Description

BACKGROUND OF THE INVENTION

The present invention generally relates to an automated synthesis apparatus for compounds and a method of controlling the automated synthesis apparatus, and more particularly, to an automated synthesis apparatus for compounds and a method of controlling the automated synthesis apparatus capable of fully automatically synthesizing, with a computer control by programs many derivatives of specific compound structure of various optional compound synthesis.

In pharmaceutical research, one specific compound is required to be synthesized in large numbers respectively from various optional compounds so as to investigate the relationship between chemical structures and biological activity.

The conventional synthesizing operations are effected manually in accordance with experience rule. Most operations of quantifying the sample to supply it to a reaction vessel, of stirring the contents in the reaction vessel, of taking out reactant from the reaction vessel to move it to a purifying device, further washing the reaction vessel or the like after the manufacture completion of the products are manually effected mainly by researchers. Therefore, a lot of time and hands are required for this type of synthesizing operation which are necessary for the pharmaceutical basic researches.

An automation is demanded for this type of synthesizing operation. Conventionally automated reaction apparatuses, of a batch type, or the like are provided to meet the demand. But automated apparatuses for purifying, isolating products followed by a series of synthesis procedure are hardly provided. In order to make the reactions optimum in the above described automated reaction apparatus, analyzing arts of HPLC or the like for requiring the measurement of comparatively long time period have to be used.

Therefore, the present applicant provides an automated synthesis apparatus capable of automatically processing, as a series, the formation and isolation of the compounds of a wide range from samples such as raw materials · regents · solvents or the like. The automated synthesis apparatus (such as disclosed in Japanese Laid-Open Patent Application Tokuheisho No. 2-2870, corresponding to EP-A-0 332 452) is composed of a synthesis processing apparatus I and a control apparatus II as shown in Fig. 17. The synthesis processing apparatus I is provided with a series of units composed of a sample supply unit 1, a reaction unit 2, a purifying unit 3, a heat & cold medium circulating unit 4, a washing solvent supply unit 5, an exhaust gas - exhaust water unit 6. Although not shown, a reaction tracing (reaction analysis) unit or the like may be additionally provided. Each unit of the above described synthesis processing apparatus I is connected, through an interface 9, with the computer 8 of the automated control apparatus II. Reference numeral 10 is a main power source.

Each of the above described units is controlled, operated in accordance with the program stored and inputted in the computer 8. In each service unit composed of the heating & cooling medium circulating unit 4, a washing solvent supplying unit 5 and the exhaust gas - exhaust water unit 6, the materials, reagents, catalysts, solvents and so on are fed to the reaction unit 2 from the sample supply unit 1 while the ambient conditions of the reaction unit 2, the purifying unit 3 are being adjusted. The reaction processing such as heating, cooling, concentrating, PH adjusting and so on is effected in the reaction unit 2. A product produced through the reaction processing in the purifying unit 3 is purified by an HPLC and/or a CPC or the like so as to automatically obtain products.

A target compound to be produced by the above described automated synthesis apparatus is various in a wide range and the synthesizing procedures are different in accordance with the target compounds. Namely, a series of synthesizing procedure programs are different for each specific target compound, and individual synthesizing procedure program is required in accordance of the specific target compounds.

Synthesizing procedure programs for automatically controlling the synthesis processing apparatus I as a series in accordance with the individual target compounds is very hard to make. For example, the sample supply unit 1 is provided with a plurality of volumetric tubes and liquid level boundary sensors for quantifying the raw materials, reagents, the solvents, and many flow lines for transferring to the next step the raw materials, the reagents, the solvents from each of the liquid storing containers and many electromagnetic valves for switching flow passages interposed in each flow line. The reaction unit 2 is provided with a plurality of reaction vessels for raw materials to be fed from the above described sample supply unit, a separatory funnel where the reaction vessels and the tunnel contents (reaction mixture) can be circulated, a vessel for PH adjusting use where the reaction vessels and the reaction mixture can be circulated, and also, the reagent can be fed from the above described sample supply unit 1.

The components of each unit are extremely many, and are complicated in construction. The whole automated synthesis processing apparatus is provided with about one hundred fifty valves, about thirty relays, about twenty sensors. Further, flow lines which relate these elements organically are very complicated.

When a synthesizing procedure program for synthesizing one specific target compound, a sub-program (unit operation procedure) with the operation conditions of many electromagnetic valves, relays, sensors being arranged in order is required to be made even if one unit of operation procedure for feeding materials to the specific reaction vessel from, for example, a specific liquid storing container is made. The number of the unit operation procedures necessary to a final stage for separately taking the target compound finally from a first stage of starting the material supply is as many as about one hundred.

As the construction of an apparatus which is hardware is extremely complicated, and the making of the soft program for driving, controlling the hardware is complicated, the program maker has to be familiar with the knowledge of the hardware of the synthesis processing apparatus and program. Otherwise, the program is impossible to make in reality. As the whole construction of the program is hard to understand in the changing operation, the searching of the changed locations is difficult to effect, which is likely to cause errors. Even if the automation of the apparatus is made possible, it is very difficult to make programs of automatically controlling the apparatus in accordance with the target compound, which takes more time.

The above described problem is based on special reasons that compounds to be synthesized, formed by the automated synthesis apparatus cannot be formed with the use of a single or few synthesizing procedure programs, and different programs are required respectively in accordance with the each target compound, namely, the specification of the target compound.

The conventional programming method is too complicated and troublesome because of the above described various reasons, because a synthesizing person has to operate the automated processing apparatus easily by the sufficient use of the various functions of the automated synthesis apparatus having various properties.

The conventional program has a defect of inferior flexibility incapable of stopping operation even when the reaction processing operation is desired to be stopped in a case where, for example, the reaction is completed earlier than the reaction setting time, which is understood with the naked eyes, with the operation control of the synthesis processing apparatus being effected as the made program sets.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been developed with a view to substantially eliminating the above discussed drawbacks inherent in the prior art, and has for its essential object to provide an improved automated synthesis apparatus and a method of controlling the automated synthesis apparatus.

Another important object of the present invention is to provide an automated synthesis apparatus and a method of controlling the apparatus, where the programs of the synthesizing route the synthesizing person desires, namely, a series of operation programs from the stage of the raw feeding operation to the final stage of isolation, separate-taking of the final products is made easily and quickly so that the automated synthesis apparatus may exhibit sufficiently the its original performance so as to cope with various syntheses.

In order to achieve the above described demands in accordance with the present invention, a unit operation procedure to be made necessary in the making of a series of synthesizing procedure programs, for example, a unit operation procedure for effecting the volumetric supply to a specific reaction vessel of the reaction unit from the specific liquid storing container out of the sample supply unit or a unit operation procedure composed of unit operation and so on for carrying the content liquid to another specific reaction vessel from the specific reaction vessel are all programmed in advance and are stored in a retaining means such as floppy or the like. When a series of automated synthesis procedure programs of the specific target compound are made, the above described unit operating procedures are selected when necessary. The programs can be made quickly with extreme efficiency simply with the combination of the data names of the unit operation procedures.

The present invention is characterized in that various synthesizing procedure programs can be made easily with the use of the above described unit operation procedures, and also, that when the synthesizing procedure programs made are loaded, executed with the programs for automated synthesis control use, an interrupting operations of the interrupt program may be effected with the manual operation of the keys of the computer, the execution stop of the above described synthesizing procedure program, the earlier start of the next step, and so on may be changed so as to retain the flexibility in the program execution.

The present invention is to provide an automated synthesis apparatus having various advantages in that a correct driving operation is effected with the above described synthesizing procedure programs, various operations necessary in the synthesizing operation of the various target compounds can be combined, accuracy is provided, loss is less in the respective operations, and so on.

Concretely, the present invention is to provide an automated synthesis apparatus composed of a synthesis processing apparatus provided with a means for moving the contents to the other containers and circulating them to the containers from at least one container selected from the respective kinds of liquid storing containers including a plurality of reaction vessels, a means for reacting the contents within one reaction vessel selected, a means for automatically effecting analyses by an analyzer with at least one portion of the contents taken out of the above described reaction vessel, a means for separating, purifying specific materials, with a separate purifier, from the contents of the above described reaction vessel, a means for restoring each of the above described means into an initial condition, and a control apparatus provided with storing means where many unit operating procedures necessary for operating each means of the above described synthesis processing apparatus are stored in advance, compile means where a procedure for the synthesizing of specific target compounds is selected from many unit operation procedures stored, the synthesis procedure program made with the operation order of the selected unit operation procedure being set is stored, organize means where the

above described unit operation procedure is loaded in accordance with the operation order of the above described synthesizing procedure program so as to couple a series of unit operation procedures for the synthesis processing, programs for automated synthesis control use for operating the above described selected means are stored in accordance with the coupled unit operation procedures, a computer for effecting the operation control of each means of the above described synthesis processing apparatus with the program for the above described automated synthesis control use.

The means for moving the contents to the other containers from one container in the above described automated processing apparatus and for circulating them to the container is provided with flow lines communicated mutually with among the respective means and among the components of the respective means, opening, closing valve means, volumetric devices, sensors interposed in the flow lines, with the opening, closing valve means, the volumetric devices and sensors being connected with the above described control apparatus. The moving means includes a unit which is adapted to compulsorily move the contents with pressures or to make the contents to move effect to drop spontaneously.

The above described reaction means is composed of either of a temperature means for controlling the reaction temperature of the contents, a stirring means for stirring the contents, a dropping means for dropping the contents to add dropwise, a time means for controlling the reaction time of the contents, a drying means for drying the contents, a means of extracting the specific reaction mixture from the contents.

The above described analyzing means is a meter for measuring the characteristics of the reaction mixture, including an HPLC apparatus. The above described separating, purifying means also includes an HPLC apparatus. The above described restoring means includes a washing means for washing each described means.

The synthesis processing apparatus in accordance with the present invention is provided with a sample supply unit, a reaction vessel unit, an extraction/dehydration unit, a PH adjusting unit, a reaction tracing unit for analyzing, a purifying unit including a fraction collector, a temperature control unit, washing. Each of the above described means is included in the above described units.

The above described sample supply unit is provided with a plurality of liquid storing containers for storing liquids such as raw materials, reagents, solvents, PH adjusting liquids and so on, a means for automatically feeding the above described liquids from a storing cell to these liquid storing containers, a volumetric tube for determining volumetrically the above described liquid from the above described liquid storing container, and a transportation confirming sensor, a flow line for circulating from each of the above described liquid storing container to the next step, and an electromagnetic valve for opening, closing flow passages interposed in each flow line.

The above described reaction vessel unit, an extraction/dehydrating unit, a PH adjusting unit and a reaction tracing unit for analytical use compose a reaction unit in a broad sense. The reaction unit is provided with a plurality of reaction vessels and PH adjusting vessels, flow lines adapted to feed the liquid of an optional liquid storing container from among liquid storing containers provided in the above described sample feeding unit with respect to each of these vessels, flow lines provided for their mutually free circulating operations among the above described plurality of reaction vessels and among these reaction vessels and the PH adjusting vessels, extraction/ separation funnels and dehydrating tubes provided for their mutually free circulating operations through the flow lines among the above described respective vessels, tracing HPLC for reaction liquid analyzing use connected through the above described reaction vessels and flow lines, and electromagnetic valves for opening, closing the flow passages interposed in each of the above described flow lines.

The above described purifying unit is provided with a purifying HPLC connected through the respective reaction vessels and flow lines provided in the above described reaction units, and with a fraction collector connected with the purifier so as to feed optional purified products collected by the fraction collector and the optional purified products are also able to transfer to the reaction vessels of the above described reaction units through the flow lines.

The above described temperature control unit is provided with a means for circulating hot or cold media to heat or cool the above described reaction vessels and a heater for heating the reaction vessels. The above described washing unit is provided with a means for moving the washing liquid to the above described reaction vessel, volumetric unit.

The above described reaction vessel is provided in its outer peripheral portion with a jacket so as to effect a heating or cooling operation. The above described hot · cold media are adapted to be circulated to space between the vessel and the jacket. Stirring blades and so on are provided within the vessel so as to stir the reaction liquid within the vessel. An opening portion connected with a pressure reducing means, a thermoelectric couple to be operated as a concentration sensor are mounted in the upper opening portion of the vessel. The reaction mixture is concentrated by heating under reduced pressure. The existence of the vapor from the vessel is detected by the thermoelectric couple so as to detect the extent of the concentration.

A reflux condenser may be provided with in communication with the upper portion of the above described reaction vessel so that the vapor is liquefied to drip into the vessel. Also, the stirring operation may be effected with bubbling through the introduction of air, inert gases or the like into the reaction vessel. The reaction vessel may be placed in an oil bath provided with heating means such as heater or the like. Filters and transportation confirming photosensors may be desirably provided near the dehydrating tubes and valves, liquid and gas take-out and introduction portions of the flow lines. A plurality of storing vessels where solutions are temporarily stored for the repeated extraction may be desirably provided on the extraction apparatus.

In the above described purifying unit, a selecting operation can be effected, if necessary, from CPC, electriophoresis apparatus, centrifugal chromatography, recrystallizing apparatus or the like, in addition to an HPLC apparatus as described hereinabove. For example, it is desirable that two types of purifying apparatuses like the HPLC and the CPC should be provided with so that the reaction mixture may be supplied selectively or continuously to HPLC and CPC.

The present invention provides a controlling method of an automated synthesis apparatus comprising steps of automatically controlling a synthesis processing apparatus provided with a means for transferring the contents to the other container and circulating them to the container from at least one container selected from the respective kinds of liquid storing containers including a plurality of reaction vessels, a means for reacting the contents within one reaction vessel selected, a means for automatically analyzing with a selected analyzer one portion of the contents taken out of the above described reaction vessel, a means for separating, purifying specific materials, with a separating purifier, from the contents of the above described reaction vessel, a means for restoring each of the above described means into an initial condition, making in advance the unit operation procedures necessary for operating the above described respective means to keep them stored in the retaining means, selecting a unit operation procedure necessary for a specific synthesis processing from the above described stored unit operation procedures, making a synthesis procedure program for deciding the operation order of the above described selected unit operation procedure, loading the above described synthesis procedure program with an automated synthesis controlling program so as to load the above described unit operation procedure in accordance with the operation order of the synthesis procedure program, automatically operating the above described selected means sequentially with the output of the computer in accordance with the operation order of a series of coupled unit operation procedure loaded.

The correction & addition of the unit operation procedure for composing the synthesis procedure program and/or change in the operation order can be made with the use of synthesis procedure program for synthesizing the other specific target compound stored with the retaining means so as to make the synthesis procedure program for synthesizing the above described specific target compound being made in advance.

The above described unit operation procedures for operating the above described respective means are composed of unit operation procedures to be enumerated hereinafter.

The unit operation procedure for operating a means for transferring the contents to the other container from the above described one liquid storing container and circulating the contents to the container comprises a procedure of feeding a required amount to one specific reaction vessel of the reaction unit from one specific liquid storing container of the sample supply unit, a procedure of feeding the whole amount of samples to one specific reaction vessel from one specific liquid storing container of the sample supply unit, a procedure of transporting the contents of one specific reaction vessel to other one specific reaction vessel, a procedure for extraction/dehydration of transporting to the extraction/separation funnels the contents from one specific reaction vessel to transport the upper layer liquid to the other one specific reaction vessel, a procedure for extraction/dehydration of transporting the contents from one specific reaction vessel to the extraction/separation funnels to transport the lower layer liquid to other one specific reaction vessel, a procedure of transporting the contents from one specific reaction vessel to the PH adjusting vessel, a procedure of transporting the contents to one specific reaction vessel from the PH adjusting vessel, a procedure of transporting the contents to one specific reaction vessel from a fraction tube, a procedure of transporting the contents from one specific reaction vessel to the container of the purifying unit, a procedure of transporting the contents to the extraction/separation funnels from one specific reaction vessel, a procedure of wasting the contents from the extraction/separation funnels, a procedure of transporting the contents of the storing container of the extraction/dehydration unit to the extraction/separation funnels for wasting them, a procedure of transporting the contents of the extraction/separation funnels to the storing container, a procedure of transporting the contents of the extraction/separation funnels by half to two specific reaction vessels, a procedure of transporting the contents of the extraction/separation funnels to one specific reaction vessel, a procedure of transporting the contents of one specific reaction vessel to the storing container of the analytical reaction tracing unit, a procedure of transporting the washing liquid to one specific reaction vessel through one specific quantifier device.

The unit operation procedure of operating a means for reacting the contents of the selected specific reaction vessel comprises a procedure for bubbling in (or within) one specific reaction vessel, a procedure for starting the cooling of one specific reaction vessel, a procedure of completing the cooling of one specific reaction vessel, a procedure of effecting by optional number the cooling of one specific reaction vessel, a procedure of effecting by optional number the concentration of one specific reaction vessel, a procedure of starting the stirring of one specific reaction vessel, a procedure of completing the stirring of one specific reaction vessel.

The unit operation procedure for operating a means for automatically analyzing with an analyzer with one portion of the reactant taken out form the above described reaction vessel being selected comprises a procedure of turning on an analyzing HPLC switch, a procedure turning off the analyzing HPLC switch, a procedure for sampling the samples of one specific reaction vessel to effect the analyzing operation with HPLC after dilution.

The unit operation procedure for operating a means for separating, purifying by a separating, purifying device a specific material from the contents within the above described reaction vessel comprises a procedure of selecting the column for chromatography to stand by a detector, a procedure of resetting a column for chromatography and a detector, a procedure of purifying samples to the HPLC from the storing container so as to effect the chromatographic operation.

A unit operation procedure for operating a means for restoring the above described respective means into the initial conditions includes a procedure for transporting a washing solvent to one specific reaction vessel through one specific volumetric device, a procedure for drying one specific reaction vessel, a procedure for drying flow lines.

The unit operation procedures include a start procedure for inputting, setting the conditions for the synthesis, a sub-operation procedure for exclusive extraction use.

The synthesis procedure program for automated synthesis controlling use of the above described specific target compound is normally made by inputting of program names (synthesis procedure data names), selecting of the start procedure for inputting the conditions of the synthesis, thereafter selecting of the above described unit operation procedure, sequential inputting of the names of the unit operation procedures selected in accordance with the operation order so as to effect the combining operation.

Also, an interrupt program is interrupted during the execution in accordance with the above described synthesis procedure program by the described automated synthesis controlling program so that the driving operation of the synthesis processing apparatus in accordance with the interrupt program may be effected. The interrupt program includes a program for changing the time setting of reaction, concentration with the time setting the synthesis procedure program, a program adapted so that the analysis start and completion can be effected in an optional time period of earlier time and so on, a program of re-setting the conditions at the purification time, a program adapted to change so that the completion judgment of the reaction may be effected by the automated analysis of the reaction condition, instead of the time setting. The interruption of the above described interrupt program is adapted to be easily effected by the key operation of the computer at a program execution time based on the synthesis procedure program.

As described hereinabove, in the present invention, a synthesis processing apparatus capable of automatically effecting a series of synthesis processing is provided so that a program (synthesis processing procedure) necessary for an automated synthesis operation of the specific target compound with the synthesis processing apparatus may be made extremely easily. The synthesis of compounds in wide range may be effected without assistance in a shorter time with the efficient use of the present synthesis processing apparatus.

In the present invention, the synthesis program can be easily made, preserved till a plurality of reactions from the single reaction even without knowledge of the program language at the program making time of the synthesis processing procedure. Further, the correction, addition and so on of the programs can be easily effected. The synthesis processing program may be easily made even when a synthesizing person is not familiar with the knowledge of the apparatus (hardware) and the programming (software).

As the interruption of the interrupt program by the manual operation may be effected at the execution time of the synthesis procedure program, the step may be advanced to the next one with the reaction processing operation determined with the program being stopped when the reaction has been completed before a time set with the program with the progressing condition of the reaction being observed on the CRT provided in the automated control apparatus or the reaction situation in the reaction vessel being observed by an operator himself. The synthesis processing apparatus is not operated only as set with the program. As the interruption by the manual operation is adapted to be applied upon the control operation by the synthesis procedure program, the synthesis processing operation can be performed with more flexibility and rationality.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with the preferred embodiment thereof with reference to the accompanying drawings, in which;

Fig. 1 is a block diagram of a whole automated synthesis apparatus of the present invention;
Fig. 2 is a block diagram showing one side portion of a synthesis processing apparatus in the automated synthesis apparatus of the present invention;
Fig. 3 is a block diagram showing the other side portion of the synthesis processing apparatus in the automated synthesis apparatus of the present invention;
Fig. 4 is a block diagram of a sample supply unit in the above described automated synthesis apparatus;
Fig. 5 is a block diagram of a reaction flask unit in the above described automated synthesis apparatus;
Fig. 6 is a block diagram of a PH adjusting unit in the above described automated synthesis apparatus;
Fig. 7 is a block diagram of an extracting/drying unit in the above described automated synthesis apparatus;
Fig. 8 is a block diagram of an analytical reaction tracing unit in the above described automated synthesis apparatus;
Fig. 9 is a block diagram of a purifying unit in the above described automated synthesis apparatus;
Fig. 10 is a block diagram of a temperature control unit in the above described automated synthesis apparatus;
Fig. 11 is a block diagram of a washing unit in the above described automated synthesis apparatus;
Fig. 12 is a block diagram of a washing unit in the above described automated synthesis apparatus;
Fig. 13 is a flow chart of a program for making synthesis procedure data;
Fig. 14 is a flow chart of a correcting program for synthesis procedure data;

Fig. 15 is a flow chart of an automated synthesis controlling program;
Fig. 16 is a flow chart of the other embodiment of an automated synthesis controlling program; and
Fig. 17 is a block diagram of the conventional automated synthesis apparatus.

DETAILED DESCRIPTION OF THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring now to the drawings, there is shown in Fig. 1, an automated synthesis apparatus, according to one preferred embodiment of the present invention, which is composed of a synthesis processing apparatus (I) and a control apparatus (II). The synthesis processing apparatus (I) is provided with a sample supply unit 11 including raw materials, reagents, solvents, a reaction flask unit 12, a PH adjusting unit 13, an extracting/dehydrating unit 14, an analytical reaction tracing unit 15, a purifying unit 16, a temperature control unit 17, a washing unit 18. The above described reaction flask unit 12, a PH adjusting unit 13, an extracting/dehydrating unit 14, an analytical reaction tracing unit 15 constitute a reaction unit in a broad sense.

The above described control apparatus (II) is provided with a computer (hereinafter referred to as CPU), a program 19 (concretely floppy, hard disk, IC card, magnetic tape, CD and so on for storing, retaining the program) to be inputted to the CPU, a display (hereinafter referred to as a CRT) connected with the CPU, an output portion 21, an input portion 22, an A/D converting portion 23 for connecting the printer 20, the CPU with each unit of the above described synthesis processing apparatus (I).

The above described synthesis processing apparatus (I) drives each of the above described units in accordance with the stored, inputted programs into the CPU of the above described control apparatus (II), mainly feeds samples to the reaction flask unit 12 from the sample supply unit 11, adjusting the surrounding conditions of the reaction unit, the purifying unit with each service unit composed of a temperature control unit 17, a washing unit 18, effecting the reaction processing operation with the reaction unit, purifying the reaction mixture with the purifying unit 16 so as to automatically form the products.

The whole construction of the above described synthesis processing apparatus (I) is shown in Fig. 2, Fig. 3. The apparatus will be described sequentially hereinafter with reference to Fig. 4 and its sequential showing the construction of the respective units. Fig. 2 and Fig. 3 show the whole block diagram divided in two with the coupling portion of a flow line shown with solid lines of the upper end and the lower end being shown with (a) and (a'), (b) and (b'). Many flow lines grasped between the flow lines of both the upper, lower ends are to be coupled as the positional conformity with the combination of the flow lines of above described both the upper, lower ends.

In the drawing, the flow lines are shown with solid lines. The marks A through W and ① through ⑫ described at the tip ends of the flow lines are coupled to the tip ends of the flow lines with corresponding marks A through W, the ① through ⑫ being described to them. Electromagnetic valves for opening, closing the flow passages interposed in the flow lines are shown with the small ○ signs. In the electromagnetic valve of the small ○ sign in a portion of a three-way valve, the flow line side with an arrow sign is a common side, a flow line side with the small ● sign being attached is a steady-state closed, a flow line side with the small ● sign being not attached is a steady-state open, the flow line on the arrow mark side and a flow line with the small ○ sign being not attached show a condition where the fluid flows. Therefore, when an electromagnetic valve is turned on, the side of the ● mark opens, and the other closes so as to change the flow passage. When the electromagnetic valve of the ○ mark is a two-way valve, only the opening, closing operations are effected. The electromagnetic valve with a small ○ being not attached to it is a steady-state closed, and the electromagnetic valve with a small ○ being attached to it is a steady-state open.

The above described ○ mark electromagnetic valves show S1 through S145. Operating switches for pumps except for the electromagnetic valves are also shown with S8 and so on. The electromagnetic valves are shown as switches S1 through S145 for opening, closing the flow passages. The electromagnetic valves of the small ○ mark to be opened, closed with the same switches are shown with the same numerals. Photosensors for transportation confirming use are shown with PS1 through PS21. Volumetric devices are shown with MT1 and MT2.

A sample supply unit 11 of raw materials & reagents, solvents and so on shown fully in Fig. 4 quantifies with a predetermined amount (in the present embodiment, 10m1 unit) with the use of volumetric tubes MT1, MT2 and photosensors PS8, PS9 coupled to each flow line from the selected liquid storing containers RS1 through RS6 so as to transport it to the selected reaction flasks RF1 through RF3 described later. Also, the whole amount is adapted to be transported, with the use of the photosensors PS12 through PS14 to the reaction flasks RF1 through RF3 coupled through the flow lines from the selected liquid storing containers RR1 through RR9. At the transportation time, the transporting speed is adapted to be changed, depending upon the reaction conditions acid or alkali solution is adapted to be transferred to a PH adjusting flask PH, to be described later, connected from the selected liquid storing containers RS7 through RS8.

In the above described sample supply unit 11, as shown, the above described respective liquid storing containers RS1 through RS8, RR1 through RR9 are connected with raw material storing cells through flow lines composed of tubes, and are connected through lines with the reaction flasks RF1 through RF3 and a PH adjusting flask PH.

The volumetric tubes MT1, MT2 interposed in the above described flow lines, and photosensors PS8 and PS9, for detecting the gas-liquid boundary level, flow into, first, the flow lines samples to be fed from the liquid storing containers. When a photosensor detects that the capacity of the samples to be fed to the volumetric tube has reached 10m1, a switch of the magnetic valve interposed in the above described flow line is operated to open, close the flow passage so that the volumetric samples are adapted to be fed to a specific reaction flask of the reaction unit. On the liquid storing containers RR1 through RR9 side where the volumetric tubes are not interposed, the whole amount of liquids is adapted to be fed to the reaction flask while the whole amount of liquids is being detected with the photosensor.

The raw materials are adapted to be automatically fed from the raw material storing cells (not shown) to each of the above described liquid storing containers. The respective liquid storing containers are connected with raw material storing cells through feeding lines, and branch lines connected through electromagnetic valves with the common raw material suction lines are connected with each of the above described liquid storing containers. The above described lines of raw material suction are connected with the vacuum pump 110 so as to drive the vacuum pump 110. The switch of the above described electromagnetic valve corresponding to either of the liquid storing containers RS1 through RS8 to feed the materials is operated to automatically feed the raw materials to the liquid storing containers from the raw material storing cells into the liquid storing containers under reduced pressure.

The materials from the respective storing containers to the reaction flasks are adapted to be fed to the optional flasks with the suction the flow lines under reduced pressure, as described later, after the quantifying operation. A plurality of liquid storing containers to be set in the sample supply unit 11 are respectively connected with the flow lines so that an optional feeding operation may be effected even with respect to any flask to a plurality of flasks to be set in the reaction flask unit 12 to be described later.

All the above described liquid storing containers RS1 through RS8, RR1 through RR9 and volumetric tubes MT1, MT2 are adapted to effect washing operations alternatively with water and methanol. As shown, flow lines connected with the washing unit 18 are provided and flow passage opening, closing electromagnetic valves are interposed even in the flow lines. All the above described flow lines are provided as a closed system.

The reaction flask unit 12 is composed of construction shown in Fig. 5. The reaction flask unit 12 is a center of a synthesis processing apparatus, is coupled to all the other units, with the mutual flask being coupled among them. The reaction flask unit 12 is provided with three reaction flasks RF1 through RF3. The reaction is effected by stirring, heating, refluxing, cooling and also the concentration can be effected within these reaction flasks.

The above described three reaction flasks RF1 through RF3 are adapted to directly feed raw materials, reagents, solvents and so on through flow lines from the liquid storing containers of the sample supply unit 11. The mutual circulation is effected, as described later, among the three reaction flasks RF1, RF2, RF3 so that the reaction liquid may be transferred.

The above described first reaction flask RF1 and the second reaction flask RF2 are the same in construction with a circulating jacket 30 of a hot or a cold medium and an outer stirrer 31 being set on the outer periphery of the flask. A reflux condenser 32 is mounted on the reaction flasks RF1, RF2 with the reflux condenser being communicated with the interior thereof. The third reaction flask RF3 is used when it is desired to be heated at higher temperatures than the above described first, second reaction flasks RF1, RF2 or when the temperature is desired to be optionally changed. The reaction flask RF3 is placed in an oil bath 33 with a heater 34 being set in the oil bath 33. Optional heating, controlling operations can be effected up to about 200°C with the use of the heater 34. A reflux condenser cooling tube 32 and an outer stirrer 31 are set even in the reaction flask RF3. When the reaction is made to effect at comparatively low temperatures or the reaction temperature is not necessary to be optionally be changed, the reaction flasks RF1, RF2 are used. When comparatively high temperatures or reaction temperatures are necessary to be optionally changed, the reaction flask RF3 may be used.

In order to increase the efficiency of the mixed stirring, the reaction flasks RF1, RF2, RF3 are connected with a compressor 116 through flow lines, and are communicated with a vacuum pump 110 through flow lines. A bubbling stirring operation is adapted to be effected through air or inert gasses such as air or nitrogen, argon, helium or the like, if necessary, into the reaction flasks RE1, RF2, RF3. The bubbling stirring operation may be used jointly when the mixed liquid within the reaction flask is hard to be easily mixed, stirred with an outer stirring apparatus 31 only.

Even in the above described reaction flask unit 12, many flow-passage opening, closing electromagnetic valves shown with O signs are provided in the respective flow lines as shown. Photosensors PS15 through PS17 for confirming the transportation of the reaction mixture to each reaction flask, line filters FL1 though FL3 for removing insoluble materials, concentration sensors CS1 and CS2 are interposed.

A PH adjusting unit 13 for composing one portion of the reaction unit in a broad sense is of construction shown in Fig. 6. Acid solution is added from the liquid storing container RS7 of the sample supply unit 11 or alkali solution is added from RS8, and respectively so as to adjust to the desired PH.

The above described PH adjusting unit 13 is provided with a PH adjusting flask PH with PH electrode 40 being built in being provided with in parallel to the reaction flasks RF1 through RF3 can be mutually circulated by the introduction lines from the respective reaction flasks to the PH adjusting flask, by the introduction lines from the PH adjusting flasks to the respective reaction flasks so that the reaction liquid after the PH compensation may be changed in flowing to the optional reaction flask. Therefore, any electromagnetic valves are interposed in the above described flow lines as described.

An extracting/dehydrating unit 14 shown in Fig. 7 also constitutes one portion of the reaction unit in a broad sense so that the liquid mixture of the selected reaction flasks RF1 through RF3 is transferred into a separatory funnel SF to extract. Then, the liquid of the upper layer or the lower layer is separated by the difference of the electric conductivity resistance so as to collect in the storing containers SR3, SR4. The re-extracting operation is effected, the washing operation is effected with the washing liquid/extraction liquid from the RS1 through RS6 if necessary, the dehydrating operation is effected through dehydrating tubes DT1 through DT5 so as to transport the extraction liquid to the selected reaction flask.

The above described separatory funnel SF is connected selectively through the reaction flasks RF1 through RF3 and guiding flow lines so as to introduce the reaction mixture within the required reaction flasks RF1 through RF3 into the separatory funnel SF. The lower end outlet of the separatory funnel SF is connected with the dehydrating tubes DT1 through DT5 through the flow lines with a liquid-liquid boundary sensor (LL) and a PS19 being mounted on it with an organic layer separated by the above described separatory funnel SF being fed to the dehydrating tube. In order to effect the bubbling stirring operation within the separatory funnel SF, the vacuum pump 110 is connected through flow lines so as to reduce the pressure in the separatory funnel SF. Storing bottles SR0, SR1 for temporarily storing an extracting mother liquid, an extraction liquid are connected with a separatory funnel SF through flow lines.

A plurality of dehydrating tubes DT1 through DT5 are disposed in parallel so as to be selectively communicated with the connection flow lines of the separatory funnel SF on the inlet side, and to be selectively connected again with feed lines connecting with the respective reaction flasks RF1 through RF3 on the outlet side. Dehydrating agents such as anhydrous sodium sulfate and so on are filled into each dehydrating tubes so as to dehydrate, dry the flowing organic layer. A glass filter is mounted in an exit portion so as to remove the insolvable materials. Also, the water layer is adapted to be transported to the reaction flasks RF1 through RF3 with the use of the by-pass disposed in parallel.

As shown in the above described extracting/dehydrating unit 14, many flow passage opening, closing electromagnetic valves are interposed in the flow lines for mutually connecting the separatory funnel SF, dehydrating tubes DT1 through DT5, reaction flasks RF1 through RF3, and also, photosensors FS19 and PS20, rotary valves RV4 and RV5 to be operated with switches S145 are provided, the reaction flasks and extracting/dehydrating units are adapted to mutually circulate liquid by the operations of the switches and the rotary valves, so that the extracting operation can be effected repeatedly by the necessary number.

The analytical reaction tracing unit 15 is constructed as shown in Fig. 8, and the unit also constitutes one portion of the reaction unit in a broad sense. The reaction solution of a given amount (for example, 0.1m1) is sampled with the use of a photosensor PS7 from the selected reaction flask, is diluted with the solvent from the liquid storing container RS6 of the sample supply unit 11. Thereafter, 0.02m1 is separately taken out with the use of the photosensor PS6 out of it, is charged on the analyzing HPLC to be operated with a switch S8 with the use of the selected developing solvent SO1 or SO2 so as to effect an analyzing operation. The obtained analytical results with a chromatographic chart are displayed on the CRT and the results are printed out. The reaction proceeding condition is judged in accordance with the analytical results so as to judge whether the reaction is continuously carried out or not.

In the above described analytical reaction tracing unit 15, the reaction mixture fed from the selected flask is diluted to an optional concentration, thereafter is stored, many flow passage opening, closing electromagnetic valves are provided in the connection lines, among a storing bottle SR2 for storing the diluted liquid, the above described HPLC pump HP1, developing solvent feeding portions SO1, SO2, six-way rotary valve RV1 where a given amount of sample is put into a sample loop from the storing bottle SR2, a column Col.1 and an infrared absorption detector DE1, sensors PS3, PS6, PS7, further the reaction flask and the reaction tracing unit 15 and the flow lines within the unit 15.

The purifying unit 16 transports the whole contents of the selected reaction flask to a temporarily storing container SR1, charges it on the HP2 of the purifying HPLC with construction shown in Fig. 9, purifies with a column chromatographic method under determined purifying conditions (selection of the column to be used from two types of purifying columns, selection of the solvent to be used from two types of developing solvents or switching by time, purifying time and so on). The purified outflowing liquid is collected in a large-sized fraction collector FC.

The reaction mixture is adapted to be directly fed to the purifying unit 16 even from either of the reaction flasks RF1, RF2, RF3 by the flow passage opening, closing electromagnetic valves provided in the flow lines and in the respective flow lines. The construction of the present purifying HPLC is almost similar to that of the tracing HPLC, and is provided with a storing cell SR1 for storing the liquid from the reaction flask, columns Col.2, Col.3, developing solvent feeding cells SO3, SO4, an HPLC pump HP2, a transportation pump TP for putting the reaction mixture into the sample loop, six-way rotary valves RV2, RV3 sensors PS1, PS2, PS4, PS5, PS11, an infrared absorption detector DE2.

The eluate effluent from above described columns Col.2, Col.3 measured the infrared absorption by the detector DE2, thereafter takes out, collects refined products in many containers disposed in the fraction collector FC through flow lines into the fraction collector FC. Flow lines are provided so that the required products may be taken out from the fraction collector FC so as to feed into optional reaction flasks RF1, RF2, RF3. Many flow-passage opening, closing electromagnetic valves and sensors PS10 are provided as shown in the flow lines.

The reaction mixture is adapted to be fed to a purifying HPLC even from either of the reaction flasks RF1, RF2, RF3. After the purifying operation by the HPLC, the obtained liquid gathered by the fraction collector FC can be fed to either of the reaction flasks RF1, RF2, RF3.

The temperature control unit 17 is of construction shown in Fig. 10. Cold temperature media are made to circulate into the reaction flasks RF1, RF2 of a jacket type and the PH adjusting flask PH through flow lines shown in the shown tip end signs (1) through 12 so as to control the contents at temperature within the range of -40°C through 90°C. The reaction flask RF3 of the oil bath type effects the control operation with the use of a heater from a room temperature to about 200°C. The cold media are being circulated into reflux condensers of the respective reaction flasks.

The washing unit 18 is of construction shown in Fig. 11 and Fig. 12. The washing liquids within the washing liquid stores SO5, SO6 are guided into vacuum pump 110 into the reaction flask, flow lines and so on used for synthesizing. The bubbling operation is effected by a compressor 116 to effect a washing operation and then drying operation is carried out. The washing waste liquid is collected into a waste liquid store, and is wasted after the washing, drying operation. By this operation, the next synthesis preparation is got ready.

In the drawing, M1 - M8 show manual switches, CP1 - CP2 are liquid transporting pumps, LL is a liquid - liquid boundary.

The synthesis processing apparatus (I) composed of the above described construction outputs to a control apparatus (II) the detection signals of the set sensors PS1 through PS21. Operating switches (hereinafter referred to as switches S1 - S145 including both of them) for the above described flow-passage opening, closing electromagnetic valve, the other pumps, an so on are operated in accordance with the synthesis procedure program inputted to the CUP of the control apparatus (II). The apparatus is automatically operated so as to effect an processing operation from a first step of feeding the material into a reaction flask to a final step of the washing of the apparatus after the synthesis completion.

Then, a manufacturing step of the above described synthesis procedure will be described.

The synthesis procedure is made by the CUP in accordance with the order shown in a synthesis procedure data making operation program shown in Fig. 13. "Synthesis procedure data name" composed of title and so on of a product which is an object is inputted. In a first embodiment of a synthesis procedure to be shown in, for example, Table 1 to be described, the "synthesis procedure data name", namely, the program name is inputted as "PHGL-Z2". The synthesis procedure shows to synthesis N-(carbobenzyloxy)-D-phenylalanine composed of a chemical reaction formula shown in a chemical formula 1.

Then, the operation name of "unit operation procedure" to be performed at the first step is inputted. The "unit operation procedure" is composed of a sub-program (subroutine), is a procedure program for setting the operation of the above described electromagnetic valve switches and so on for effecting the unit operation of the synthesis with the use of the above described synthesis processing apparatus. The "unit operation procedure" is approximately 150 in type as described later with one unit operation being registered in one "unit operation name" as the "unit operation procedure". For example, an operation of feeding the material of the given amount to the first reaction flask RF1 of the reaction flask unit 12 from the liquid storing container RS1 of the sample supply unit 11 is registered in the "unit operation name" of "RS1 - RF1". The "unit operation procedure" to be inputted at first is a procedure for inputting, setting the conditions of the synthesis registered under the register name of the "START - 1" to be normally described later.

The above described unit operation procedure is adapted to optionally load under the "unit operation name" with the use of the retaining means, with the storing operation being effected under the tile of the "unit operation name" on the retaining means composed of a floppy, hard disk, IC card, magnetic tape, CD and so on.

The "unit operation procedure" registered, stored in the above described retaining means in advance is selected if necessary so as to effect an inputting operation with the "unit operation name." As shown in Fig. 13, after the inputting operation, the registration of the inputted "unit operation name" is confirmed. If the registration is effected, the similar operation is effected sequentially, the "unit operation name" is inputted in accordance with the operation sequence, continues till the input of the "unit operation name" of the final step is completed. If the inputted "unit operation name" is not registered, the "unit operation name" is inputted, the unit operation procedure is inputted so as to register it in the retaining means, thereafter the first operation is continued.

After the last "unit operation name" is inputted, the inputted "unit operation name" is printed in order as shown in Fig. 13. Then, the order of the unit operation procedure is registered with the title of the "synthesis procedure data name" on the retaining means so as to complete the making of the synthesis procedure program.

The synthesis procedure program made in the above described step is shown in Table 1 described hereinafter in the first embodiment. The subroutine No. in the right column corresponds to the subroutine order shown in Table 2. The respective subroutines are registered in advance in the "unit operation name" as shown hereinabove. Namely, the synthesis procedure program is made by the subsequent inputting of the "unit operation name" until No. 1 - No. 45 shown

in Table 2. Chemical Formula 1 is a chemical formula of compounds considered an object of the synthesis as described hereinabove, and is desired to be described or accompanied on a form with synthesis procedures being printed on it.

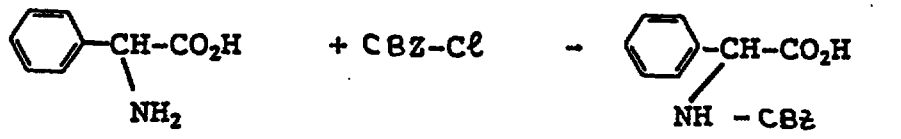
(Table 1)

Program name PHGL - Z2	
Operations	Subroutines No 1
1 input reaction conditions	1
2 (1) 1.8g (12mM)/N-NaOH 12ml (12mM) is put into a reaction flask.	manual
3 CBZ-Cl 2.1g(12mM)/THF 20ml and N-NaOH 12ml are added dropwise with stirring for fifteen minutes at 0°C.	2, 3, 4, 5, 6
4 Further cooling at 0°C, stirring operations are continued for thirty minutes.	7
5 THF is removed at 40°C.	8
6 Washing with AcOEt(30ml) twice	9, 10, 11, 12, 13
7 AcOEt 30ml is added and the mixture is adjusted to PH2 by adding N-HCl with stirring.	14, 15, 16, 17
8 The mixture is extracted with AcOEt, and then dried through the anhydrous sodium sulfate column.	18, 19, 20, 21
9 After removal of AcDAt, white crystals (2) are obtained in a yield of 2.61g (76.3%)	manual
10 washing of the apparatus	22, 23, 45

(Table 2)

Subroutine Order					
No.	operation	No.	operation	No.	operation
1	START - 1	2	F1 - STR - ON	3	COOL - 1 - ON
4	R51 - RF1	5	COOL - 1 - OF	6	F1 - STA - OF
7	HF1 - RC - 1	8	RF1 - CONCI	9	F1 - STH - ON
10	RS2 - RF1	11	F1 - STR - OF	12	AR1 - BUBB
13	AR1 - L - RF2	14	RS2 - RF2	15	RF2 - PH
16	PH ADJ	17	PH - RF2	18	RS2 - AF3
19	RF3 - PH	20	PH - AF2	21	RF2 - X - RF3
22	ALARM	23	WASH	24	PS WASH
25	SR1 - SF - DR	26	RF1 - SF	27	SF - SR1
28	SR1 - SF - DR	29	RF2 - SF	30	SF - F3 - F2
31	RF2 - SF	32	SF DRAIN	33	RF3 - SF
34	SF DRAIN	35	F1 - STR - ON	36	RF1 DRY
37	F1 - STR - OF	38	F2 - STR - ON	39	RF2 DRY
40	F2 - STR - 0F	41	F3 - STR - PM	42	RF3 DRY
43	F3 - STR - 0F	44	FINISH	45	END

(Chemical Formula 1)



1.8g(12mM) 2.1g(12mM) 2.6g(76.3%)

(1) (2)

The above described respective synthesis procedures are made in a step showing in the above described Fig. 13, and as shown in a synthesis procedure data correcting program of Fig. 14, are made in a step shown in the above described Fig. 13, can be made by the correction of the synthesis procedure data to be stored, recorded on the retaining means composed of a floppy and so on. When a synthesis procedure program approximate to the registered synthesis procedure program is made, the registered synthesis procedure program is called with a synthesis procedure data name so as to replace the different unit operation procedure with correction, or/and a unit operation procedure necessary for the desired location is inserted and the order of the unit operation procedures is replaced. By such correction, another synthesis procedure many be made with better efficiency.

The program for driving, controlling the synthesis processing apparatus is stored in the retaining means as the automated synthesis controlling program shown in Fig. 15 with the use of a synthesis procedure program made in a step shown in the above described Fig. 13 or Fig. 14. When a particular target compound is synthesized in accordance with the synthesis procedure program, first an automated synthesis controlling program is inputted into the computer CPU so as to input the "synthesis procedure data name" of the synthesis procedure program in accordance with the instructions of the program so that the synthesis procedure program is read from the retaining means with the synthesis procedure program being stored in it. The unit operation procedure name is read from the synthesis procedure program so as to read the respective unit operation procedures from the retaining means with the unit operation procedure being stored. The unit operation procedure is coupled in accordance with the operation order set with the synthesis procedure program. The electromagnetic valve switch and so on of the synthesis processing apparatus (I) is sequentially operated and is driven through an I/O interface, an A/D interface and so on in accordance with the unit operation procedure.

The automated synthesis controlling program shown in Fig. 15 set so that the synthesis processing apparatus may be driven in accordance with the above described synthesis procedure program is to operate the synthesis processing apparatus as set in the synthesis procedure program. The automated synthesis controlling program shown in Fig. 16 shows a modified embodiment of an automated synthesis controlling program where an interrupt program can be executed by the manual key operation of the computer during the execution of the synthesis procedure program.

The automated synthetic controlling program shown in Fig. 16 makes it possible to interrupt the various types of interrupt programs during the execution of the synthesis procedure program as shown. The interrupting operation includes an operation of changing the setting of the reaction, concentration time, into an optional time, by key operations from the set time by the synthesis procedure program, an operation of changing the analysis starting and completing time from the set time of the synthesis procedure program to an optional time, an operation of changing the conditions of the purifying time into a set conditions by the program so as to effect re-setting operation, and so on. The illustrated interrupt program is only an example illustration, and is not restricted to the described operation.

Concretely, the time setting of the above described reaction, concentration inputs, sets the synthesis procedure program with the unit operation procedure of the "START-1" at the making time of the synthesis procedure program. When the program is executed so as to effect the actual synthesis processing, there is a case where the reaction, concentration time is obliged to be reduced or extended by the condition of the reaction, concentration. In this case, the time set in program at first by the manual key operation is changed, shortened or extended so that the setting operation may be effected again.

The interruption of the above described analysis start and completion samples one portion of the reaction liquid for an optional time by the key operation during the reaction to measure using the HPLC so that the progressing condition of the reaction may be investigated. The analysis is adapted to be completed at this time point by the key operation.

The re-setting of the conditions at the purifying time is adapted to re-set the conditions of the purifying set by the synthesis procedure program before the synthesis processing starts, the conditions of the purifying by the key operation when, for example, the conditions have been judged to be desired to be other conditions in accordance with the reaction conditions.

Although it is not described in Fig. 16, the completion judgment of the reaction is effected automatically by the automatic analysis of the reaction liquid so as to stop the reaction processing operation by the completion judgment of the reaction so that such an interrupt program to be advanced to the next step may be interrupted.

As the reaction processing operation is set in time in the synthesis procedure program, there is a case where the reaction continues even if the reaction is completed in reality, and if the reaction is not really complete on the other hand, there is an inconvenience of completing the reaction processing as in the program. In such a case, when an operator can watch the reaction conditions, the reaction can be completed by the above described key operation. When the reaction processing operation is effected in a manless condition at night or the so, the reaction processing operation can be stopped automatically in accordance with the judgement by the automated operation of the completion judgment of the above described reaction, and the step can move to the next step.

The completion judgment of the above described reaction is to automatically judge whether the reaction continues further by the analytic results of the reaction liquid, or the reaction stops to move to the next step. For example, the following three methods are provided as a judgment means.

1) The size of the peak of the raw material is inputted in advance. If the peak of the raw material is confirmed to have been reduced by 90 % or more as a result of the analysis, the reaction processing operation is stopped.
2) When the remaining ratio of the raw material is the same through the comparison with the previous analysis result, the reaction processing operation is stopped.
3) The size of the peak of the product is inputted in advance. If the peak of the product is confirmed to have been reached by 90% or more as the analysis result, the reaction is stopped.

As described above, when the synthesis processing is executed in accordance with the synthesis procedure program, it is fundamental that the synthesis processing apparatus I is controlled, driven in accordance with the automated synthesis controlling program shown in Fig. 15. In the synthesizing of compounds where elements difficult to predict (the reaction time is difficult to predict correct or the like) are many, synthesis processing can be effected reasonably with better efficiency when the synthesis processing apparatus I is driven and controlled with the use of the automated synthesis controlling program which can be interrupted with the manual operation shown in Fig. 16.

The "unit operation procedure" as a basic unit for constituting the above described "synthesis procedure program" will be described hereinafter. As shown hereinabove, the "unit operation procedure" is composed of one unit of operation procedure of "sample is fed to one specific reaction flask of the reaction flask unit 12 from one specific liquid storing container of the sample supply unit 11," "solution in one specific reaction flask is cooled" or the like as described hereinabove. In the present invention, the subroutine program is made in advance about approximately 150 types of unit operation procedures to be enumerated hereinafter so as to give them "unit operation names" for storing them in the retaining means.

The contents of the unit operation procedures and their "unit operation names" are shown in Table 3 given hereinafter. The concrete operation contents are given later.

(Table 3)

Unit Operation Names	Operation Contents
RS1 - RF1	A reagent in RS1 is quantified in 10ml units followed by transferring it to RF1.
RS1 - RS2	" RS1 " RF2.
RS1 - RF3	" RS1 " RF3.
RS2 - RF1	" RS2 " RF1.
RS2 - RF2	" RS2 " RF2.
RS2 - RF3	" RS2 " RF3.
RS3 - RF1	" RS3 " RF1.
RS3 - RF2	" RS3 " RF2.
RS3 - RF3	" RS3 " RF3.
RS4 - RF1	" RS4 " RF1.
RS4 - RF2	" RS4 " RF2.
RS4 - RF3	" RS4 " RF3.
RS5 - RF1	" RS5 " RF1.
RS5 - RF2	" RS5 " RF2.

RS5 - RF3	"	RS5	"	RF3.	
RS6 - RF1	"	RS6	"	RF1.	
RS6 - RF2	"	RS6	"	RF2.	
RS6 - RF3	"	RS6	"	RF3 .	

RR1 - RF1 Total amount of a reagent in RR1 is transported to RF1. (Dropwise addition in the case of RC-1)

RR2 - RF1	"	RR2	"	RF1.	(	"	RC - 2	)
RR3 - FR1	"	RR3	"	RF1.	(	"	RC - 3	)
RR4 - FR1	"	RR4	"	RF2.	(	"	RC - 1	)
RR5 - RF1	"	RR5	"	RF2.	(	"	RC - 2	)
RR6 - RF2	"	RR6	"	RF2.	(	"	RC - 3	)
RR7 - RF2	"	RR7	"	RF3.	(	"	RC - 1	)
RR8 - RF3	"	RR8	"	RF3.	(	"	RC - 2	)
RR9 - RF3	"	RR9	"	RF3.	(	"	RC - 3	)

RF1 - RF2	The solution in RF1 is transported to RF2.			
RF1 - RF3	"	"	"	RF3.
RF2 - RF1	"	RF2	"	RF1.
RF2 - RF3	"	"	"	RF3.
RF3 - RF1	"	RF3	"	RF1.
RF3 - RF2	"	"	"	RF2.

HPLC A sample from SR3 is charged to HPLC to carry out chromato graphy.

RF1 - BUBB	Bubbling in RF1.
RF2 - BUBB	" .
RF3 - BUBB	" .
PH - BUBB	" .
COOL - 1 - ON	Cooling start of RF1
COOL - 1 - OF	Cooling completion of RF1
C00L - 2 - ON	Cooling start of RF2
COOL - 2 - OF	Cooling completion of RF2
RF1 - RC - 1	First cooling reaction in RF1
RF1 - RC - 2	Second cooling reaction in RF1
RF1 - RC - 3	Third cooling reaction in RF1
RF1 - RH - 1	First heating reaction in RF1 (Room reaction when the temperature setting is RT)
RF1 - RH - 2	Second heating reaction in RF1 (Room reaction when the temperature setting is RT)
RF1 - RH - 3	Third heating reaction in RF1 (Room reaction when the temperature setting is RT)
RF2 - RC - 1	First cooling reaction in RF2

RF2 - RC - 2	Second cooling reaction in RF2
RF2 - RC - 3	Third cooling reaction in RF2
RF2 - RH - 1	First heating reaction in RF2 (Room temperature reaction when the temperature setting is RT)
RF2 - RH - 2	Second heating reaction in RF2 (Room temperature reaction when the temperature setting is RT)
RF2 - RH - 3	Third heating reaction in RF2 (Room temperature reaction when the temperature setting is RT)
---	---
RF3 - REA - 1	First reaction in RF3
RF3 - REA - 2	Second reaction in RF3
RF3 - REA - 3	Third reaction in RF3
---	---
RF1 - CONC1	First concentration in RF1
RF1 - CONC2	Second concentration in RF1
RF1 - CONC3	Third concentration in RF1
RF2 - CONC1	First concentration in RF1
RF2 - CONC2	Second concentration in RF2
RF2 - CONC3	Third concentration in RF2
RF3 - CONC1	First concentration in RF3
RF3 - CONC2	Second concentration in RF3
RF3 - CONC3	Third concentration in RF3

RF1 - X - RF2	The reaction mixture in RF1 is extracted, dried to transport upper layer liquid to RF2.
RF1 - X - RF3	The reaction mixture in RF1 is extracted, dried to transport upper layer liquid to RF3.
RF2 - X - RF1	The reaction mixture in RF2 is extracted, dried to transport upper layer liquid to RF1.
RF2 - X - RF3	The reaction mixture in RF2 is extracted, dried to transport upper layer liquid to RF3.
RF2 - X - RF1	The reaction mixture in RF3 is extracted, dried to transport upper layer liquid to RF1.
RF3 - X - RF2	The reaction mixture in RF3 is extracted, dried to transport upper layer liquid to FR2.
F1 - XL - F2	The reaction mixture in RF1 is extracted, dried to transport lower layer liquid to RF2.
F1 - XL - F3	The reaction mixture in RF1 is extracted, dried to transport lower layer liquid to FR3.
F2 - XL - F1	The reaction mixture in RF2 is dried, dried to transport lower layer liquid to RF1.
F2 - XL - F3	The reaction mixture in RF2 is extracted, dried to transport lower layer liquid to RF3.
F3 - XL - F1	The reaction mixture in RF3 is extracted, dried to transport lower layer liquid to RF1.
F3 - XL - F2	The reaction mixture in RF3 is extracted,

	dried to transport lower layer liquid to RF2.
RF1 - L - RF2	A solution in RF1 is extracted, washed to transport lower layer liquid to RF2.
DE - CO ON	Selection of the column for chromatography and stand by a detector.
DE - CO OF	Selection of the column for chromatography and reset a detector.
RF1 - PH	A solution in RF1 is transported to PH.
RF2 - PH	" RF2 "
RF3 - PH	" RF3 "
PH - RF1	A solution in PH is transported to RF1.
PH - RF2	" " RF2.
PH - RF3	" " RF3.
PH ADJ	PH adjustment
FRACT - RF1	A liquid is transported from fraction tube to RF1.
FRACT - RF2	" RF2.
FRACT - RF3	" RF3.
FRACT - RFM	A liquid is transported from fraction tube to desired flask

RF1 - SR3	A solution in RF1 is transported to SR3.
RF2 - SR3	" RF2 "
RF3 - SR3	" RF3 "
RF1 - SF	A solution in RF1 is transported to SF
RF2 - SF	RF2 "
RF3 - SF	RF3 "
SF DRAIN	A solution in SF is wasted.
SR1 - SF - DR	A solution in SR1 is transported to SF and wasted.
SR0 - SF - DR	A solution in SR0 is transported to SF and wasted.
SR3 DRAIN	" SR3 "
SR2 DRAIN	" SR2 "
SR - SR0	A solution in SF is transported to SR0.
SF - SR1	A solution in SF is transported to SR1.
SF - F1 - F2	A solution in SF is transported by half to RF1, RF2.
SF - F1 - R3	A solution in SF is transported by half to RF1, RF3.
SF - F2 - F3	A solution in SF is transported by half to RF2, RF3.

SF - RF3	A solution in SF is transported to RF1.
SF - RF2	A solution in SF is transported to RF2.
SF - RF3	A solution in SF is transported to RF3.
RF1 - SR2	A solution in RF1 is transported to SR2.
RF2 - SR2	" RF2 "
RF3 - SR2	" RF3 "
RF1 DRY	Drying of RF1.
RF2 DRY	" RF2.
RF3 DRY	" RF3.
MR WASH	Washing of MT1, MT2, RR1 - RR9. Washing liquid remains in RF1, RF2, RF3.
START - 1	First subroutine program of reaction three times, concentration three times.
START - 2	Transportation from the flask is also included in the above described program.
WS - RF1	Solvent for washing use is transported to RF1 through PS1.
WS - RF2	Solvent for washing use is transported to RF2 through PS1.

WS - RF3	Solvent for washing use is transported to RF3 through PS1.
F1 - STR - ON	Stirring of RF1 starts.
F1 - STR - OF	" ends.
R2 - STR - ON	Stirring of RF2 starts.
F2 - STR - OF	" ends.
F3 - STR - ON	Stirring of RF3 starts.
F3 - STR - OF	" ends.
A - LC ON	Switch on the analytical HPLC
A - LC OF	" off
PURY	A reaction mixture in SR3 is purified with HPLC.
ANAL1	A reaction mixture in RF1 is sampled to analyze with HPLC after dilution.
ANAL2	A reaction mixture in RF2 is sampled to analyze with HPLC after dilution.
ANAL3	A reaction mixture in RF3 is sampled to analyze with HPLC after dilution.
MATU	Allowed to stand for five minutes.
ALARM	input-wait with alarm ringing, moves next

```
                    with F1 KEY
FINISH              final picture plane
WASH DELETE         washing picture plane
DELETE              subroutine erasure
```

Exclusive extraction subroutines are enumerated in Table 4 given hereinafter.

(Table 4)

Unit Operation Names	Operation Contents.
ESF - SR0	A solution is transported from SF to SR0
ESF - SR1	A solution is transported from SF to SR1
ESEP - SR0	Allowed to stand for five minutes, lower layer is transported to SR0.
ESEP - SR1	Allowed to stand for five minutes, lower layer is transported to SR1.
ESF - DT - F1	A solution in SR is transported to RF1 through a drying tube.
ESF - DT - F2	A solution in SF is transported to RF2 through a drying tube.
ESF - DT - F3	A solution in SF is transported to RF3 through a drying tube.
ESF - F1	A solution in SF is transported to RF1.
ESF - F2	A solution in SF is transported to RF1.
ESF - F3	A solution in SF is transported to RF3.
EF1 - SF	A solution in RF1 is transported to SF.
EF2 - SF	A solution in RF2 is transported to SF.
EF3 - SF	A solution in RF3 is transported to SF.
EXSLCT	A solvent for extraction are quantified and transported to RF1, RF2, RF3.
EWSSLCT	A solution for washing are quantified and transported to RF1, RF2, RF3.
ESF - RUBB	Bubbling in SF.
ESR1 - SF	A solution in SR1 is transported to SF.
ESR0 - SF	A solution in SR0 is transported SF.
ESF DR	A solution in SR is wasted.
ESR1 SR	A solution in SR1 is transported to SF, and wasted.
ESR0 DR	A solution in SR0 is transported to SF and wasted.
EXT - START	Number of extraction operation times is calculated. In the extraction operation, it is arranged at the head.
EDT SLCT	A drying tube is set.
EDT RST	A drying tube is reset.

The program contents of each of the above described unit operation procedures will be described hereinafter in detail. All the specifications of the respective electromagnetic valves are displayed as switches S1, S100 and so on for operating all the electromagnetic valves.

[RS1 - RF1] Reagents of RS1 are quantified in a given amount (10ml in the present embodiment) and are transported to RF1.

The titles of the synthesis unit operations to be performed are displayed on the CRT. The switches S118, 35, 55, 114, 116 are turned on for a given time period so as to start the transportation of the solution of the RS1, with an air compressing pump, to the quantifying tube MT1. Switches S114, 116 are turned off to stop the air compressing pump. When the liquid level detector of the photosensor PS8 detects the liquid level, it follows that the required amount (10ml in the present embodiment) has been quantified so as to output the signal. The output signal is received to turn off the switches S118, 35 to stop the transportation of the MT1 from the RS1. Thereafter, the switch S61 is turned on so as to transport the quantified reagent from the MT1 to RF1. The switches S67, 86, 110 are on for the required time period so as to completely transport the reagents, which remains on the flow line, to RF1 by the pressure reducing pump. The switches S110, 67, 86, 55, 61 are turned off so as to turn off all the electromagnetic valves.

Unit operations for transporting to either of the reaction flasks RF1-RF3 with 10ml the reagent of the liquid storing containers RS1-RS6 of the sample supply unit 11, "RS1-RF2", "RS1-RF3", "RS2-RF1", "RS2-RF2", "RS2-RF3","RS3-RF1", "RS3-RF2", "RS4-RF3", "RS5-RF1", "RS5-RF2", "RS5-RF3", "RS6-RF1", "RS6-RF2", "RS6-RF3" are omitted in description as the unit operation procedure of the above described "RS1-RF1" is the same in operation, with the switches, photosensors, volumetric tubes are different from their correspondences.

[RR1-RF1] All amount of the reagent in the RR1 is transported to the RF1.

The titles of the synthesis unit operation to be performed are displayed on the CRT. The switches S118, 53, 43, 85 are on for the required time period so as to start the transportation of RR1 from the RR1. During this period, the transportation start of the solution is confirmed with a photosensor PS12. After the transportation start signal has been confirmed, the switches S67, 86, 110 are on for the required time period, all the solution which remains on the line with the use of the reducing pump is transported to the RF1. The transportation completion of the solution is confirmed by the photosensor PS12. After the confirmation of the transportation completion signal, switches S110, 86, 67, 118, 53, 43, 85 are turned off to turn off all the electromagnetic valves.

The operations of the unit operations "RR2-FR1", "RR3-RF1", " RR4-RF2", "RR5-RF2", "RR6-RF2", "RR7-RF3", "RR8-RF3", "RR9-RF3" for transporting all amount of the reagent in the liquid storing containers of the sample supply unit 11 to the reaction flasks RF1-RF3 are omitted in description as the operation of the above described "RR1-RF1" is the same in operation with the switches, photosensors are different from their correspondences.

[RF1-RF2] The solution is transported from the RF1 to the RF2.

The titles of the synthesis unit operations to be performed are displayed on CRT. The switches S84, 68, 127, 93, 73, 92, 110 are on for the required time period so as to start the transportation of the solution from the RF1 to the RF2 with the use of the pressure reducing pump. During this period, the transportation start and completion of the solution are confirmed by the photosensor PS15. After the confirmation of the transportation start and the completion signal, the switches S84, 68, 127, 93, 73, 110 are turned off so as to turn off all the electromagnetic valves.

The operations of the other unit operations "RF1-RF3", "RF2-RF1", "RF2-RF3", "RF3-RF1", "RF3-RF2" for transporting the solution between the flasks of the reaction flask unit 12, the above described "RF1-RF2" is the same in operation are the same in operation as the "RF1-RF2", with the switches and the photosensors being different from the correspondences.

[HPLC] A reaction mixture of SR3 is charged into the HPLC to carry out chromato graphy.

The titles of the syntheses unit operations to be performed are displayed on the CRT.

The switch S21 is on for the required time period so as to switch the injection rotary valve RV2 to the LOAD. After the switch S16 has been turned on, the switches S3, 2 are turned on. Then the piston of the syringe pump is pulled by the required amount so as to slowly introduce the solution of SR3 into the loop of the injection rotary valve. The photosensor PS5 detects the solution so as to repeat the pulling operation of the piston until it runs out. The photosensor PS5 detects the solution and the computer receives the gone signal. The switch S21 is on for the given time period so as to switch the RV2 to an INJECTION from the LOAD for starting the HPLC. The analog output of the detector is converted into digital output so as to successively display the chromatogram on the CRT. The purification is effected by a peak division method. The detection method of the peak is calculated with the size of the slope. The switch S27 is turned on to effect a collecting operation at the fraction collector. At the peak split division completion time, the switch S27 is tuned off so as to switch the outflow liquid to the waste line. Then, the switch S34 is turned on to keep the tube of the fraction collector, by one stroke portion, transported as the preparation of the next peak division. Two types of developing solvents (SO3, SO4) can be used. To change the developing solvents can be effected by the on, off of the switch S30. If the HPLC purification is completed, the chromatographic chart on the CRT is printed out and the data are registered in the floppy disc. After the purification is completed, the switches S3, 2 are turned off. The picture plane on the CRT is restored to the origin. A position of the piston of the syringe pump is pushed back with the switch S3 being turned on as far as the

initial position. All the switches S are turned off with the switches S3, 16 being turned off.

[RF1 - RUBB] Air is bubbled to the RF1 to effect stirring, washing operations.

The titles of the synthesis unit operations to be performed are displayed on the CRT. Switches S87, 84, 67, 86, 110 are on for the given time period. Air is taken in from the outside with the use of the pressure reducing pump, is fed into the solution of the RF1 to effect the bubbling operation. The switches S87, 84, 67, 86, 110 are turned off.

The unit operations "RF2-RUBB", "RF3-RUBB" and "PH-BUBB" of the stirring, washing of the other reaction flask and the PH flask are omitted in description as the operation is the same with the operation of the above described "RF1-RUBB", only with the switches being changed into the correspondences.

[COOL - 1 - ON] Cooling start of the RF1

The titles of the synthesis unit operations to be performed are displayed on the CRT. The switches S109, 105 are on for the given time period. The cold media of the cooling cells are circulated into the RF1 jacket so as to cool the inner solution.

[COOL - 1 - OFF] Cooling completion of the RF1

The titles of the synthesis unit operations for to be performed are displayed on the CRT. The switches S109, 105 are turned off so as to stop the cooling operation.

The unit operation of the cooling start of the RF2 of "COOL - 2 - ON", the operation of the unit operation of the cooling completion of the RF2 of the "COOL - 2 - OFF" are the same in operation only with the above described RF1 and the switches being different. The description thereof is omitted.

[RF1 - RC - 1] The first cooling reaction is effected in the RF1.

The titles of the synthesis unit operations to be performed are displayed on the CRT. The cold media are circuited into the jacket of the RF1, with the switches S109, 105, 100 being on, to rotate a stirrer for stirring the inner solution. When the set completion time has come with the time lapse being displayed, the switches S109, 105, 100 are turned off so as to complete the first cooling reaction. The progressive condition of a temporary change reaction can be confirmed with the analyzing HPLC in the analysis start setting time, the unit operation of the [ANAL-1]. The cooling reaction is carried out even during the analyzing operation.

The unit operation for effecting the second cooling reaction in the RF1 of the "RF1-RC-2", the unit operation for effecting the third cooling reaction in the RF1 of the "RF1-RC-3" are omitted in description, as they are the same in operation as the above described "RF1-RC-2". The unit operation for performing the first cooling reaction on the RF2 of the "RF2-RC-1", the unit operation for performing the second cooling reaction in the RF2 of the "RF2-RC-2", the unit operation for performing the third cooling reaction in the RF2 of the [RF2-RC-3] are the same in operation as the unit operation of the first, second, third cooling reaction to be performed in the above described RF1 only with the switches being changed to the correspondences. The description thereof is omitted.

[RF1-RH-1] The first heating reaction is effected in the RF1.

The titles of the synthesis unit operations to be performed are displayed on the CRT. Hot media are circulated into the jackets of the RF1 with the switches S106, 105, 106, 109, 104, 100 being turned on. The stirrer is rotated to stir the inner solution. When the temperature setting of the reaction is at room temperature, only the stirring operation is effected with the switch S100 only being turned on. When the set completion time has come with the time lapse being displayed, the switches S106, 105, 106, 109, 104, 100 are tuned off so as to complete the first heating reaction. When the temperature setting of the reaction is at room temperature, only the switch S100 is turned off. The progress condition of the temporary change reaction can be confirmed by the analytical HPLC in the analysis start setting time, the unit operation of the [ANAL-1]. The heating reaction is effected even during the analyzing operation.

The unit operation for effecting the second heating reaction in the RF1 of the "RF1-RH-2", the unit operation for effecting the third heating reaction in the RF1 of the "RF1-RH-3" are the same in operation as the unit operation for performing the first heating reaction in the RF1. The description thereof is omitted. The unit operation for effecting the first heating reaction in the RF2 of the "RF2-RH-1", the unit operation for effecting the second heating reaction in the RF2 of the "RF2-RH-2", the unit operation for the third heating reaction in the "RF2-RH-3" are the same in operation as the first, second, third unit operations in the RF1, only with the switches being changed to the correspondences. The description thereof is omitted.

[RF3-REA-1] The first heating reaction is effected in the RF3.

The titles of the synthesis unit operations to be effected are displayed on the CRT. A set temperature is instructed to a temperature controller from computers so as to effect a heating operation to a set temperature with a heater of the oil bath of the RF3 with the switches S1, 103, 108 being on for rotating the stirrer so as to stir the inner solution. When the set completion time has come with a time lapse being displayed, switches S1, 103, 108 are turned off so as to complete the first heating reaction. The progress condition of the temporary change reaction in the analysis start setting time, the unit operation of the [ANAL-3] can be confirmed with the analytical HPLC. The heating reaction is effected even during the analytical operation.

The unit operation for effecting the second heating reaction in the RF3 of the "RF3-REA-2", the unit operation for effecting the third heating reaction in the RF3 of the "RF3-REA-3" are the same as the unit operation for effecting the

first heating reaction in the above described RF3. The description thereof is omitted.

[RF1-CONC1] The first concentration is effected in the RF1.

The titles of the synthesis unit operations to be effected are displayed on the CRT. Air is taken in from the outside with the use of the pressure reducing pump while the hot media are being circuited into the jacket of the RF1 and being stirred with the switches S84, 87, 67, 86, 110, 104, 109, 105, 100 being on so as to effect the bubbling operation so as to concentrate the contents. The concentration completion setting time with the time lapse being displayed, the concentration sensor (temperature change of the inner solution is analyzed to detect the completion time of the concentration) are judged so as to turn off the switches S84, 87, 67, 86, 110, 104, 109, 105, 100 for completing the first concentration.

The unit operation for effecting the second concentration in the RF1 of the "RF1-CONC2", the unit operation for effecting the third concentration in the RF1 of the "RF1-CONC3" are the same in operation as the unit operation for effecting the first concentration in the RF1. The description thereof is omitted. The unit operation for effecting the first, second and third concentration are the same in operation as the unit operation of the concentration in the above described RF1 only with the switches being changed to the correspondences.

[RF3-CONC1] The first concentration is effected in the RF3.

The titles of the synthesis unit operations to be effected are displayed on the CRT. A set temperature is instructed to the temperature controller from the computer. While the heating, stirring operations are being effected with the use of the heater of the oil bath of the RF3 with the switches S79, 97, 96, 110, 95, 102, 1 being on, air is taken in from the outside with the use of the pressure reducing pump so as to effect the bubbling operation for concentrating the contents. The concentration completion setting time, the switches S79, 97, 96, 110, 95, 102, 1 are turned off with the time lapse being displayed so as to complete the first concentration.

The unit operation for effecting the second concentration in the RF3 of "RF3-CONC2", the unit operation for effecting the third concentration in the RF3 of the "RF3-CONC3" are the same in operation as the unit operation for effecting the first concentration in the above described RF3. The description thereof is omitted.

[RF1-X-RF3] The solution of the RF1 is extracted, washed and is transported to the RF3 while extracted upper layer liquid is being dried.

The titles of the synthesis unit operation to effecting are displayed on the CRT. How many times the extracting operation has been effected is judged to turn on, off the switch S145 in accordance of the number of the extractions for setting the dehydration tubes. The switches S84, 70, 131, 110, 100 are on for the required time period. The inner solution of the RF1 is transported to the separatory funnel SF with the use of a pressure reducing pump during the stirring operation of the RF1. The switches S84, 70, 131, 110, 100 are turned off. After the inner solution of the SF has been still placed for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During this period, the change in the electric conductivity in the boundary level of the solution is detected by the computer so as to turn off the switches S115, 134 for transporting only the lower layer to the SR1. The switches S115, 134, 110, 135 are on for the required time period so as to transport the upper layer of the SF to the SR0. During this period, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 110, 135 are turned off so as to complete the transportation of the SR0 from the SF. The switches S130, 131, 110 are turned on to transport the extraction mother liquor of the SR1 to the SF. The capacity set from the set extraction solvent is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner liquid of the RF1 to the separately funnel SF with the use of the pressure reducing pump while the RF1 is being stirred. During this operation, the transportation of the solution is confirmed by the photosensor RS15. The switches S84, 70, 131, 110, 100 are turned off. The switches S110, 131, 134 are on for the required time period so as to feed air to the SF with the use of the pressure producing pump to extract the bubbling operation. The switches S110, 131, 134 are turned off. After the inner solution of the SF has been stood for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During this operation, the change in the conductivity in the boundary level of the solution is detected by the computer to turn off the switches S115, 134 for transporting the lower layer only to the SR1. The switches S130, 131, 110, 135 are on for the required time period so as to transport the extraction liquid of the SR0 to the SF. Switches S130, 131, 110, 135 are turned off. The capacity set from the set extraction liquid washing solvent is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner liquid of the RF1 to the separatory funnel of the SF with a pressure reducing pump while the RF1 is being stirred. During this operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off. The switches S110, 131, 134 are on for the required time period, the air is fed to the SF with the use of the reducing pump so as to effect the washing operation with the bubbling. The switches S110, 131, 134 are turned off. After the inner solution of the SF has been stood for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During this period, the change in the electric conductivity in the boundary level of the solution is detected by the computer to turn of the switches S115, 134 for transporting the lower layer only to the SR1. The switches S115, 134, 136, 80, 94, 79, 141, 142 are turned on. The pressure reducing pump of the switch S110 is intermittently turned on, off repeatedly for the required time period, so that the extraction liquid is made to pass a little quantity by a little quantity through either of the selected dehydration tube DT1 through DT5 so as to dry the extraction liquid and

is transported to the RF3. During this operation, the transportation of the solution is confirmed by the photosensor PS19. Switches S115, 134, 136, 80, 94, 79, 95, 141, 142 are turned off. The capacity set from the set extraction liquid washing solvent is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner solution of the RF1 to the separately funnel of the SF with the use of the pressure reducing pump while the RF1 is being stirred. During this operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S115, 134, 136, 80, 94, 79, 95, 141, 142 are turned on. The pressure reducing pump of the switch S110 is repeatedly turned on, off intermittently for the required time period so as to pass the extraction liquid a small amount and a small amount through either of the selected hydration tubes DT1 through DT5 to dry the extraction liquid and is transported to the RF3. During the operation, the transportation of the solution is confirmed by the photosensor PS19. The witches S115, 134, 136, 80, 94, 79, 95, 141, 142 are turned off. The switches S130, 131, 110 are on for the required time period to transport to the SF the extraction mother liquor of the SR1 with the use of the pressure reducing pump. After the switches S130, 131 are turned off, the switches S115, 134, 137 are on for the required time period, the extraction mother liquor is transported from the SF to the drain tank and is wasted. The switches S115, 134, 137, 110 are turned off. How many times the extraction operation has been effected is judged. The switch S145 is turned on off in accordance with the number of the extractions so as to set the dehydration tube in the initial position.

The operations of the unit operation procedures of the "RF1-X-RF2", "RF2-X-RF1", "RF2-X-RF1", "RF2-X-RF3", "RF3-X-RF1" and "RF3-X-RF2" are similar to the procedure of the above described "RF1-X-RF3" only with switches, photosensors and so on to be used being changed. The description thereof is omitted.

[F1-XL-F2] The solution of the RF1 is extracted, washed and is transported to the RF2 while the lower extracted layer liquid is being dried.

The titles of the synthesis unit operations to be effected are displayed on the CRT. How often the extracting operation have been effected is judged so as to turn on, off with the valve switch S145 in accordance with the number of the extractions so as to set the dehydration tube. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner solution of the RF1 to the separatory liquid funnel of the SF with the pressure reducing pump while the RF1 is being stirred. During the operation, the transportation of the solution is confirmed with the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off. After the inner solution of the SF has been still placed for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During this operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer to turn off the switches S115, 134 so as to transport the lower layer only to the SR1. The capacity set from the set extraction solvent is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period, the inner solution of the RF1 is transported to the separatory funnel of SF with the use of the pressure reducing pump while the RF1 is being stirred. During this operation, the transportation of the liquid is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off. The switches S110, 131, 134 are on for the required time period so as to feed air to the SF with the use of the pressure reducing pump so as to effect the washing with the bubbling. The switches S110, 131, 134 are turned off. After the inner solution of the SF has been stood for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During the operation, the change in the electric conductivity on the boundary level of the solution is detected so as to turn off the switches S115, 134 for transporting the lower layer only to the SR1. The washing liquid of the SF is wasted to the drain tank with the switches S115, 134, 137, 110 being on for the required time period. The switches S130, 131, 110 are on for the required time period so as to transport the extraction liquid of the SR1 to the SF. Switches S115, 134, 136, 78, 93, 73, 92, 141 are turned on so as to turn on, off the reducing pump of the switch S110 intermittently for the required time period for passing the extraction liquid a small amount by a small amount through either of the selected dehydration tubes DT1 through DT5 so as to dry the extraction liquid, transport it to the RF2. During this operation, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned off. The capacity set from the set extraction solvent is quantified, is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period to transport the inner solution of the RF1 to the separatory funnel with the use of the reducing pump while the RF1 is being stirred. During the operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned on so as to repeatedly turn on, off the pressure reducing pump of the switch S110 intermittently for the required time period for passing the extraction liquid a small amount by a small amount through either of the selected dehydration tubes DT1 through DT5 for drying the extracted liquid to transport it to the RF2. During this period, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 136, 78, 93, 73, 92, 141 are tuned off. The switches S130, 131, 110, 135 are on for the required time period so as to transport the extraction mother liquor of the SR0 to the SF with the use of the reducing pump. After the switches S130, 131, 135 have been turned off, the switches S115, 134, 137 are on for the required time period. The extraction mother liquor is transported to the drain tank form the SF to waste it. Switches S115, 134, 137, 110 are turned off. How often the extraction operations have been effected is judged, and the switch S145 is tuned on, off in accordance with the number of the extractions so as to set the dehydration tubes in the initial position.

The operations of the unit operation procedures of the "F1-XL-F3", "F2-XL-F1", "F2-XL-F3", "F3-XL-F1" and "F3-XL-F2" are the same as the operation of the unit operation procedure of the above described "F1-XL-F2" only with the switches and photosensors and so on being changed to the correspondences. The description thereof is omitted.

[DE-CO ON] The preparation of the purification operation is effected with the selection of the column for chromatography and the power supply of the detector being on.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switch S31 is turned on in advance so as to turn on the power supply of the detector to stabilize it. If the set column for chromatography is in the Col. 3 for the given time, the switch S22 is on for the required time period so as to switch to the Col. 3 from the initial set Col. 2 to turn off the change-over switch S22.

[DE-CO OF] The initial setting of the column for chromatography and the power supply of the detector are turned off.

The titles of the synthesis unit operations to be effected are displayed on the CRT. Switch S31 is turned off to turn off the detector. If the set column for chromagraphy is in Col. 3, the switch S22 is on for the required time period so as to switch to the Col. 2 from the initial set Col. 3 to turn off the switch S22.

[RF2-PH] The solution of the RF2 is transported to the PH.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S90, 74, 129, 126, 124, 110 are on for the required time period so as to transport the solution of the RF2 to the PH with the use of the reducing pump. The switches S90, 74, 129, 126, 124, 110 are tuned off.

The operations of the unit operations of the "RF1-PH", "RF3-PH" of the transportation procedure of the solution to the PH from the other reaction flasks RF1, RF3 are also the same as the above described "RF2-PH" only with the switches being changed to their respective corresponding switches. The description thereof is omitted.

[PH-RF2] The solution of the PH is transported to the RF2.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S125, 127, 93, 73, 92, 110 are on for the required time period, the solution of the PH is transported to RF2 with the use of the reducing pump. The switches S125, 127, 93, 73, 92, 110 are turned off.

The operations of the unit operation procedures of the "PH-RF3" and "RH-RF1" for transporting the PH solution to the other reaction flask are also the same as the above described "PH-RF2" only with the switches being respectively changed into corresponding switches. The description thereof is omitted.

[PH ADJ] The PH of the solution is adjusted.

The titles of the synthesis unit operations to be effected are titled on the CRT. The switches S107, 109, 144 are turned on to turn on the power supply of the PH measuring apparatus and also, the cold media are circuited to the jacket of the PH flask to effect the cooling operation. After the given time period, the computer calculates the value of the PH of the present solution from the AD output of the PH measuring apparatus. When the set PH value is lower than the measured value, the switches S122, 143, 42, 118, 114, 116 are turned on to add a constant amount of acid solution of the RS7 while being stirred. After the switches S122, 143, 42, 118, 114, 116 are turned off, the PH is measured so as to compare the value with the set value. When the set PH value is higher than the measured value, the constant amount of alkali solution of the RS8 is added during the stirring operation with switches S123, 143, 42, 118, 114, 116 being turned on. After the switches S123, 143, 42, 118, 114, 116 are turned off, the PH is measured so as to compare the value with the set value.

[FRACT-RF1] The solution is transported to the RF1 from the separate tubes of the fraction collector specified by the computer.

The titles of the synthesis unit operation to be effected are displayed on the CRT. The switch S33 is turned on for the given time period, the separate tubes are set in the initial position. The switch S33 is turned off. The switch S34 is repeatedly turned on, off by the number specified in the purifying step so as to move, set the separate tubes of the object till the position of the suction nozzle. The switch S32 is turned on to effect the suction so as to lower the nozzle to the bottom of the separate tube. After the given time period, the switches S29, 26, 25, 89, 67, 86, 71, 110, 72 are turned on to start the transportation of the solution to the RF1 from the separate tube with the use of the reducing pump. From the given time period, the transportation of the solution is confirmed with the photosensor PS10. When the transportation has been completed, the signal is outputted to the computer. The signal is received to turn off the switches S32, 29, 26, 25, 89, 67, 86, 71, 110, 72.

The actions of the unit operations "FRACT-RF2" and "FRACT-RF3" for transporting to the other reaction flasks RF2, RF3 from the fraction collector are also the same as the above described "FRACT-RF1" only with the operating switches, the detecting photosensors being different. The description thereof is omitted.

[FRACT-RFM] The solution from the separate tube of the optionally specified fraction collector is transported to an optional flask.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The number of the separate tubes to be transported is inputted. Then, the flask names RF1, RF2, RF3 of the transfer destination are inputted. The switch S33 is on for the required time period so as to set the separate tubes in the initial positions. The switch S33 is turned off. The switch S34 is repeatedly tuned, off by the inputted number to move, set the separate tubes of the object till the

position of the suction nozzle. If the transportation destination is RF1, the switch S32 is turned on so as to lower the suction nozzle to the bottom of the separate tube. The required time switches S29, 26, 25, 89, 67, 86, 71, 110, 72 are turned on so as to start the transportation of the solution to the RF1 from the separate tubes with the use of the reducing pump. The transportation of the solution by the photosensor PS10 is confirmed from after the required time period so as to output to the computer the signal when the transportation has been completed. The signals are received to turn off the switches S32, 29, 26, 25, 89, 67, 86, 71, 110, 72. Even when the transfer destination is RF2 or RF3, the same can be said only with the switches being changed into the corresponding switches.

[RF2-SR3] The solution of the RF2 is transported to the SR3.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S76, 75, 17, 15, 110, 101, 90 are turned on for the required time period so as to transport the solution of the RF2 to the SR3 with the use of the reduction pump. During the operation, the transportation of the solution is confirmed with the photosensor PS16. The switches S76, 75, 17, 15, 110, 101, 90 are turned off.

The "RF3-SR3" and "RF1-SR3" for transporting to the SR3 the solution from the other reaction flask are also the same in operation only with the switches being changed to the corresponding switches. The description thereof is omitted.

[RF1-SF] The solution of the RF1 is transported to the SF.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S84, 70, 131, 110 are on for the required time period so as to transport the solution of the RF1 to the SF with the use of the reducing pump. During the operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110 are turned off.

The operations of the "RF2-SF" and "RF3-SF" for transporting the solution of the other reaction flask to the SF are also the same only with the switches and the photosensors being changed to the correspondences. The description thereof is omitted.

[SF DRAIN] The solution of the SF is transported to the drain tank to waste.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S134, 137, 110, 115 are on for the required time period so as to transport the solution of the SF to the drain tank with the use of the reducing pump. The switches S134, 137, 110, 115 are turned off.

The operations of the unit operations "SR3 DRAIN" and "SR2 DRAIN" for transferring, wasting the solutions of the SR3, SR2 to the drain tank are also the same as the described "SF DRAIN" only with the switches being changed to the correspondences. The description thereof is omitted.

[SR1-SF-DR] After the solution of the SR1 has been transported to the SF, it is transported, wasted to the drain tank.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches 130, 131, 110 are on for the required time period so as to transport the solution of the SR1 to the SF with the use of the reducing pump. The switches S130, 131, 110 are turned off, the switches S134, 137, 110, 115 are on for the required time period. The solution is transported, wasted from the SF to the drain tank. The switches S134, 137, 110, 115 are turned off.

After the solution of the SR0 in the "SR0-SF-DR" has been transported to the SF, the operation of transporting it to the drain tank to waste it is the same as the above described "SR1-SF-DR" only the switches being changed to the corresponding switches. The description thereof is omitted.

[SF-SR0] The solution of the SF is transported to the SR0.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S115, 134, 138, 110, 135 are on for the required time period so as to transport the solution of the SF to the SR0 with the use of the reducing pump. The witches S115, 134, 110, 135 are turned off.

[SF-SR1] The operation of transporting to the SR1 the solution of the SF is similar to the above described "SF-SR0" only the switches being changed into the corresponding switches. The description thereof is omitted.

[SF-F1-F2] The solution of the SF is divided by half to transport to the RF1, the RF2.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S134, 136, 67, 115, 72, 86, 110, 89 are on for the required time period, and the solution of the SF is transported to the RF1 without passing it through a drying tube by the use of the reducing pump. After the switches S134, 136, 67, 115, 72, 86, 110, 89 have been continuously turned off, the switches S134, 136, 73, 141, 142, 115, 78, 92, 110, 93 are on for the required time period so as to transport the solution of the SF to the RF2 without passing it through the drying tube. Switches S134, 136, 73, 141, 142, 115, 78, 92, 110, 93 are turned off. The operation is repeated by the required time.

The operation of transporting the solution of the SF in the "SF-F1-F3" by half to the RF1, RF3, and the operation of dividing by half the solution of the SF in the "SF-F2-F3" to transport it are the same as the above described "SF-F1-F2" only with the switches being changed to the corresponding switches. The description thereof is omitted.

[SF-RF1] The solution of the SF is transported to the RF1.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S115, 134, 136, 72, 89, 67, 86, 110 are on for the required time period so as to transport the solution of the SF to the RF1 without passing it through the drying tube with the use of the reducing pump. The switches S115, 134, 136, 72, 89, 67, 86, 110 are turned off.

The operation of the transporting the solution of SF in the "SF-RF2" to the RF2, and the operation of transporting the solution of the SF in the "SF-RF3" to the RF3 are the same as the above described "SF-RF1" only with the switches being changed to the corresponding switches. The description thereof is omitted.

[RF1-SR2] The flow line of the photosensor PS7 and the SR2 are washed with the solution of the RF1.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S84, 12, 11, 110 are on for the required time period so as to transport the solution of the RF1 to the drain tank through the flow line of the photosensor PS7 with the use of the reducing pump. The switches S12, 11 are turned off. The switches S4, 14, 13 are on for the required time period. The entire amount of the solution the remaining RF1 is transported to the SR2. After the switches S4, 14, 13 have been turned off, the switches S11, 12 are on for the required time so as to waste the solution remaining in the flow line of the photosensor PS7. The switches S84, 12, 11, 110 are turned off.

The operation of washing the flow lines and the SR2 of the photosensor PS7 with the solution of the RF2 in the "RF2-SR2" and the operation of washing the flow lines and the SR2 of the photosensor PS7 with the solution of the RF3 in the "RF3-SR2" are the same as the above described RF1-SR2" only with the switches being changed to the corresponding switches. The description thereof is omitted.

"RF1 DRY" The flask of the RF1 is dried.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S61, 63, 85, 89, 72, 71, 25, 28, 100, 67, 110, 86 are on for the required time period so as to transport, dry with the use of the reducing pump the liquid within the tube coupled to the flask of the RF1 completely into the flask. After the switches S61, 63, 85, 89, 72, 71, 25, 28 are tuned off, the switches S87, 84, 106, 109, 107 are on for the required time period so as to circulate the hot media into the jacket to blow in air from the outside, heating for drying the RF1. The switches S87, 84, 67, 86, 110, 107, 106, 109, 100 are turned off.

The operation of drying the flask of the RF2 in the "RF2 DRY" and the operation of drying the flask of the RF3 in the "RF3 DRY" are the same in operation as the above described "F1 DRY" only with the switches are changed into the corresponding switches. The description thereof is omitted.

[MR WASH] The MT1, MT2, RR1-RR9 are washed with the use of the washing liquid in the S05, S06. The washed liquids are transported to the RF1, the RF2, the RF3.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S112, 114, 61, 86, 110, 67 are on for the required time period so as to guide the washing liquid in the S06 to a volumetric device of the MT1 by the use of the reducing pump, and further is transported to RF1. After the switch S112 has been turned off, the switch S111 is on for the required time period. The washing liquid in the S05, in addition to the washing operation of the S06, is flowed so as to effect the washing operation. The feeding operation of the washing liquid from the S05 is stopped with the switch S111 being turned off to transport to the MT1 the washing liquid remaining on the flow line for the required time period so as to feed air instead to dry the flow line. The switches S114, 61, 86, 110, 67 are turned off. The switches S112, 114, 57, 63, 86, 110, 67 are on for the required time period so as to guide the washing liquid in the S06 to the volumetric device of the MT2 with the use of the reducing pump for further transporting it to the RF1. After the switch S112 has been turned off, the switch S111 is on for the required time period. Followed by washing of the S06, the washing liquid in the S05 is flowed to effect the washing operation. The feeding operation of the washing liquid from the S05 with the switch S111 being turned off so as to transport to the MT1 the washing liquid remaining in the flow line for the required time period. Then, air is fed to dry the flow line. The switches S114, 57, 63, 86, 110, 67 are turned off. The switches S111, 113, 58, 43, 52, 110 are on for the required time period so as to transport to the RR1 the washing liquid of the S05. After the switch S43 has been turned off, the switch S44 is on for the required time period so as to transport the washing liquid of the S05 to the RR2. After the switch S44 has been turned off, the switch S45 is on for the required time period, the washing liquid of the S05 is transported to the RR3. The switch S111 is turned off to transport to the RR3 the washing liquid remaining on the line of the RR3 from the S05 for the required time period so as to feed the air to dry the line. The switches S111, 113, 58, 45, 52, 110 are turned off. The switches S111, 113, 59, 46, 52, 110 are on for the required time period so as to transport the washing liquid of the S05 to the RR4. After the switch S46 is turned off, the switch S47 is on for twenty seconds to transport the washing liquid of the S05 to the RR5. After the switch S47 has been turned off, the switch S48 is on for the required time period so as to transport the washing liquid of the S05 to the RR6. The switch S111 is turned off so as to transport to the RR6 the washing liquid remaining in the line of the RR6 from the S05 for the required time period for feeding the air to dry the line. The switches S111, 113, 58, 48, 52, 110 are turned off. The switches S111, 113, 60, 49, 52, 110 are on for the required time period so as to feed to the RR6 the washing liquid from the S05. The switch S49 is turned off to turn on the switch S50 for the required time period to transport the washing liquid to the RR7. The switch S50 is turned off to turn on the switch S51 for the required time period for transporting the washing liquid to the RR9. The switch S51 is turned off to transport to the RR6 the solution remaining in the line for the required time period to feed the air to dry the line. The switches S113, 111, 114, 118, 53, 51, 81, 79, 95, 110 are turned on for the required time period so as to the RF3 the washing liquid from the RR9. The switch S111 is on for the required time period to dry the line, thereafter the switch S51 is turned off to turn on the switch S50 for the required time period. After the solution of the RR8 has been transported to the RF3, the switch S111 is off for the required time period so as to dry the line. The switch S50 is turned off so as to turn on the switches S111, 49 for the required

time period. After the solution of the RR7 has been transported to the RF3, the switch S111 has been off for the required time period so as to dry the line. The switches S114, 118, 53, 49, 81, 79, 95, 110 are turned off. The switches S111, 114, 118, 53, 48, 88, 73, 92, 110 are on for the required time period, the washing liquid is transported to the RF2 from the RR6. The switch S111 is off for the required time period so as to dry the lines. After the drying operation of the lines, the switch S48 is turned off, the switch S47 is on for the required time period. After the solution of the RR5 is transported to the RF2, the switch S111 is off for the required time period so as to dry the lines. The switch S47 is turned off so as to turn on the switches S111, 46 for the required time period. After the solution of the RR4 has been transported to the RF2, the switch S111 is off for the required time period to dry the lines. The switches S114, 118, 53, 46, 88, 73, 92, 110 are turned off. The switches S111, 114, 118, 53, 45, 85, 67, 86, 110 are on for the required time period so as to transport the washing liquid from the RR36 to the RF1. The switch S111 is off for the required time period to dry the lines. After the switch S45 is turned off to turn on the switch S44 for the required time period. After the solution of the RR2 has been transported to the RF1, the switch S111 is off for the required time period so as to dry the lines. The switch S44 is turned off to have the switches S111, 43 on for the required time period. The solution of the RR1 has been transported to the RF1, the switch S111 is off for the required time period to as to dry the lines. The switches 114, 118, 53, 43, 85, 67, 86, 110 are turned off.

[START-1] The conditions of the synthesis are inputted, set.

The reaction name of the synthesis to be effected the reaction time, the reaction temperature, the concentration time, the names of the reagents and the amount, a PH adjusting value, a column name to be used for purification, the name and switching time of the purifying solvents, purifying completion time, the tube number of the fraction collector, the flow speed of the purification on HPLC, extraction solvent name, the name of the washing solvent, the number of the drying tube, name of the developing solvent to be used for HPLC analysis and so on are sequentially inputted in accordance with the plane face of CRT.

[START-2] The conditions of the synthesis is inputted, set.

The next items are added to the above described conditions. Transportation is effected to the reaction flask set from the tube of the reaction collector automatically selected during the purification.

[WS-RF1] The washing solvent is passed through the volumetric tube of the MT1 and is transported to the RF1.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S112, 114, 61, 86, 110, 67 are on for the required time period so as to guide the solvent of the S06 to the RF1 through the MTI. After the switch S112 has been turned off, the switch S111 is turned on for the required time period. At this time, the solvent of the S05 is guided to the same line. The switch S111 is turned off so as to stop the feeding operation of the solvent of the S05. All the solvents remaining in the line for the required time period is transported to the RF1 while the air is being fed so as to effect the drying operation. The switches S114, 61, 86, 110, 67 are turned off.

The operation of passing the washing solvent of the "WS-RF2" through the volumetric tube of the MT1 to transport it to the RF2 and the operation of the passing the washing solvent of the "WS-RF3" through the volumetric tube of the MT1 to transport it to the RF3 are the same as the operation of the above described "WS-RF1" only with the switches are changed to the corresponding switches. The description thereof is omitted.

[F1-STR-ON] The stirring operation of the RF1 starts.

That titles of the synthesis unit operations to be effected are displayed on the CRT. The power of the stirrer is turned on with the switch S100 being on. The stirring operation of the RE1 starts.

[F1-STR-OF] The stirring operation of the RF1 is stopped.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switch S100 is turned off to cut the power of the stirrer so as to stop the stirring of the RF1.

The operation for starting the stirring operation of the RF2 in the "F2-STR-ON", the operation for stopping the stirring of the RF2 in "F2-STR-OFF", the operation for starting the stirring of the RF3 in the "F3-STR-ON" and the operation for stopping the stirring of the RF3 in the "R3-STR-OFF" are the same as the operations of the above described "F1-STA-ON" and "F1-STR-OFF" only with the switches being changed to the corresponding switches. The description thereof is omitted.

The power of the analytical HPLC in the "A-LC ON" is turned on to select the developing solvents of the S01, S02.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The S8 is on, the power supply of the analytical HPLC is turned on so as to effect the stabilizing operation so as to provide the analysis start. If the selected solvent is S02, the switch S9 is turned on.

[A-LC OFF] The power of the analytical HPLC is turned off to effect the initial setting of the developing solvent.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switch S8 is turned off so as to turn off the power of the analytical HPLC. If the selected solvent is S02, the switch S9 is turned off.

The reaction liquid of the RF1 in the "ANAL1" is partially sampled so as to effect a diluting operation using the solvent in the RS6. One portion thereof is charged on the analytical HPLC to effect a chromatographic operation for investigating the reaction conditions.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switch S100 is turned off to stop the stirring operation so as to have the switches S87, 84, 67, 86, 110 on for the required time period. Air is guided

to the RF1 with the use of the reducing pump to effect a bubbling operation. The switches S87, 84, 67, 86, 110 are tuned off. After the required time period, the switches S84, 12, 110, 11 are turned on to suck the reaction liquid of the RF1 into the line of the photosensor PS7. After the photosensor PS7 has detected the reaction liquid, the signal is fed to the computer. By the confirmation of the signal, the sampling of the reaction liquid has been completed. After the switches S11, 110 are turned off, the switches S4, 5, 118, 114, 116, 40, 55 are turned on for the required time period so as to start feeding to the MT1 the solvent of the RS6 with the use of the compressed air pump. The photosensor PS8 detects the liquid level to quantify the given amount of the solvent in the PS6. Then, the S118, 40 are turned off to turn on the switches S54, 14, 13, 110 for the required time period. The sampled solution is diluted while the solvent quantified by the MT1 is being transported to the flask of the RS2. The switches S54, 14, 13, 110, 55, 4, 5 are tuned off. The switches S67, 86, 110, 10 are on for the required time period so as to return to the RF1 the reaction liquid remaining on the line of the photosensor PS7. After the switches S110, 86, 67, 12, 84, 10 have been turned off, the switch S100 is turned on so as to resume the stirring operation of the RF1. The S20 is on for the required time period so as to switch the analytical sample injector RV1 to the LOAD. After the switch S20 has been turned off, the switches S11, 110 are turned on so as to guide the diluted sample of the RS2 to the line of the photosensor PS6. After the photosensor PS6 has detected the liquid, the switches S11, 110 are turned off to stop the transportation. The switch S20 is on for the required time period to switch the RV1 to the INJECTION. The switch S20 is turned off so as to change the CRT picture plane to the chart of the analytical HPLC. The output of the analytic detector is calculated so as to display the chromatographic chart. After the lapse of the required time, the chromatography is completed so as to print out the chromatographic chart. The CRT picture plane is restored to the former state to have the switches S11, 110 on for the required time period to transport, waste the drain tank the diluted sample remaining in the SR2. The switches S11, 110 are turned off.

The operation of partially sampling the reaction liquid of the RF2 in the "ANAL2", diluting with the use of the RS6 solvent, charging on the analytical HPLC one portion thereof to effect the chromatography, investigating the reaction condition, and partially sampling the reaction liquid of the RF3 in the "ANALS3", diluting it with the use of the solvent of the RS6, charging one portion on the analytical HPLC to effect the chromatography, investigating the reaction condition are the same as the above described "ANAL1", only with the switches, photosensors and so on being changed into the corresponding switches, the photosensors and so on. The description thereof is omitted.

[F2-L-F2] The solution of the RF2 is extracted, washed so as to transport the lower extracted liquid layer to the RF2.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches 76, 90, 131, 132, 110, 101 are on for the required time period so as to transport the separatory funnel of the SF the inner solution of the RF2. During this operation, the transportation of the solution is confirmed by the photosensor PS16. The switches 76, 90, 131, 132, 110 are turned off. The switch S115 is on for the required time period. After standing, the switch S134 is turned on so as to start the transportation of the SF solution to the SRI. During this period, the change in the electric conductivity on the boundary level of the solution is detected by the computer so as to have the switches S137, 110 on for the required time period for transporting, wasting the upper layer only to the drain tank. After the switches S137, 115, 134 has been turned off, the switches S131, 139, 119 are on for the required time period so as to transport the solution of the SR1 to the SF. The switches S110, 131, 119, 130 are turned off. After the extraction solvent set by the unit operation in the "RS6-RF2" has been quantified, the switches S79, 90, 131, 132, 110, 101 are turned off. The switches S134, 131, 110 are on for the required time period so as to start the transportation of the SF solution to the SR1. During this operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer so as to have the switches S137, 110 on for the required time period so as to transport the upper layer only to the rain tank to waste it. After the switches S137, 115, 134 have been turned off, the switches S131, 130, 119 are on for the required time period so as to transport the SR1 solution to the SF. The switches S110, 131, 119, 130 are turned off. The switches S134, 136, 141, 142, 78, 93, 73, 92, 110, 115 are on for the required time period so as to transport the solution to the RF2 from the SF.

[RF1-L-RF2] The solution of the RF1 is extracted, washed so as to transport the lower extracted liquid layer to the RF2.

The titles of the synthesis unit operations to be effected are displayed on the CRT. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport to the separatory funnel of the SF the inner solution of the RF1 with the use of the reducing pump while the RF1 is being stirred. During this period, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off. After the inner solution of the SF has been placed for the required time period, the switches S115, 134 are turned on so as to start the transportation of the solution of the SF to the SR1. During this operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer so as to turn off the switches S115, 134 for transporting the lower layer only to the SR1. The capacity set from the set extraction solvents is quantified so as to transport it to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner solution of the RF1 to the separatory funnel of the SF with the use of the reducing pump while the RF1 is being stirred. During this period, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are tuned off. The switches S110, 131, 134 are on for the required time period so as to feed the air to the SF with the use of the reducing pump for effecting the extracting with the bubbling. The switches S110, 131, 134 are turned off. After the inner solution of the SF

has been still placed for the required time period, the switches 115, 134 are turned on so as to start the transportation the solution of the SF to the SR1. During the operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer so as to turn off the switches S115, 134 for transporting the lower layer only to the SR1. The switches S115, 134, 138, 110, 135 are on for the required time period so as to transport the extraction mother liquor to the SR0 from the SF. The switches S115, 134, 138, 110, 135 are turned off. The switches S130, 131, 110 are on for the required time period so as to transport the extracted liquid from the SR1 to the SF. The capacity set from the set extracted liquid washing solvent is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport to the separatory funnel of the SF the inner liquid of the RF1 with the use of the reducing pump, while the RF1 is being stirred. During the period, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off. The switches S110, 131, 134 are on for the required time period so as to feed air into the SF with the use of the reducing pump for effecting the washing operation with the bubbling. The switches S110, 131, 134 are turned off. After the inner solution of the SF has been placed for the required time period, the switches S115, 134 are turned on so as to start the transportation of the SF solution to the SR1. During this operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer to turn off the switches S115, 134 for transporting the lower layer only to the SR1. The switches S115, 134, 137, 110 are on for the required time period so as to waste the SF washing liquid into the drain tank. The switches S130, 131, 110 are on for the required time period so as to transport the extraction liquid of the SR1 to the SF. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned on so as to repeatedly turn on, off the reducing pump of the switch S110 intermittently for the required time period. The extracted liquid is passed through either of the selected dehydrating tubes DT1 through DT5 a small amount by a small mount to dehydrate the extracted liquid and is transported to the RF2. During this operation, the transportation of the liquid is confirmed by the photosensor PS19. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned off. The capacity set from the set extraction solvents is quantified and is transported to the RF1. The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport the inner solution of the RF1 to the separatory funnel of the SF with the use of the reducing pump while the RF1 is being stirred. During this operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned on so as to repeatedly turn on, off intermittently the reducing pump of the switch S110 for the required time period so as to pass either of the selected dehydrating tubes DT1 through DT5 a small amount by a small amount. The extracted liquid is dehydrated, and is transported to the RF2. During this period, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 136, 78, 93, 73, 92, 141 are turned off. The switches S130, 131, 110, 135 are on for the required time period so as to transport the extraction mother liquor of the SR0 to the SF with the use of the reducing pump. The switches S130, 131, 135 are turned off and thereafter, the switches S115, 134, 137 are on for the required time period so as to transport the extraction mother liquor to the drain tank from the SF to waste. The switches S115, 134, 137, 110 are turned off.

[ESF-SR0] Exclusive extraction unit operation. The solution is transported from the SF to the SR0.

The switches S115, 134, 138, 110, 135 are on for the required time period so as to transport the solution with the use of the reducing pump from the SF to the SR0.

[ESF-SR1] Exclusive extraction unit operation. The solution is transported from the SF to the SR1.

The switches S115, 134, 138, 110 are on for the required time period so as to transport the solution with the use of the reducing pump from the SF to the SR1. The switches S115, 134, 138, 110 are turned off.

[ESEP-SR0] Exclusive extraction unit operation. Only the lower layer of the solution separated into two layers from the SF is transported to the SR0.

After the solution has been stood for the required time period, the switches S115, 134, 135 are turned on so as to start the transportation of the SF solution to the SR0. During the operation, change in the electric conductivity on the boundary level of the solution is detected by the computer to turn off the switches S115, 134, 135 for transporting the lower layer only to the SR0.

[ESEP-SR1] Exclusive extraction unit operation. Only the lower layer of the solution separated from the SF into two layers are transported to the SR1.

After the solution has been stood for the required time period, the switches S115, 134 are turned on to start the transportation the SF solution to the SR1. During the operation, the change in the electric conductivity on the boundary level of the solution is detected by the computer to turn off the switches S115, 134 so as to transport the lower layer only to the SR1.

[ESF-DT-F1] Exclusive extraction unit operation. The solution is transported to the RF1 through the dehydration tube DT from the SF, being dehydrating.

Switches S115, 134, 136, 72, 89, 67, 86 are on so as to repeatedly turn on, off the reducing pump by operating the switch S110 intermittently for the required time period for dehydrating the extracted liquid through the passing of the SF extracted liquid a small amount by a small amount through either of the selected dehydrating tubes DT1 through DT5 for transporting it to the RF1. During this operation, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 136, 72, 89, 67, 86 are tuned off.

The operation of transporting the solution to the RF2 through the dehydrating tube DT from the SF in the "ESF-DT-F2" while the solution is being dehydrated, the operation for transporting the solution while dehydrating the solution through the dehydrating tube DT from the SF in the "ESF-DT-F3" are the same as the above described "EST-DT-RF1" only with the switches and photosensors being changed into the corresponding switches and photosensors. The description thereof is omitted.

[ESF-F1] Exclusive extraction unit operation. The solution of the SF is transported to the RF1 without passing through the dehydrating tubes DT.

The switches S115, 134, 136, 72, 89, 67, 86, 110 are turned on so as to transport the solution of the SF to the RF1 with the use of the reducing pump. During this operation, the transportation of the solution is confirmed by the photosensor PS19. The switches S115, 134, 136, 72, 89, 67, 86, 110 are turned off.

The operation for transporting the solution of the SF in the "ESF-F2" to the RF2 without passing through the dehydrating tubes DT, and the operation for transporting to the RF3 the solution of the SF in the "ESF-F3" without passing through the dehydrating tubes DT are the same as in the above described "EST-F1" only with the switches and the photosensors are changed into the correspondences. The description thereof is omitted.

[EF1-SF] Exclusive extraction unit operation. The solution of the RF1 is transported to the SF.

The switches S84, 70, 131, 110, 100 are on for the required time period so as to transport to the SF the solution of the RF1 with the use of the reducing pump. During this operation, the transportation of the solution is confirmed by the photosensor PS15. The switches S84, 70, 131, 110, 100 are turned off.

The operation for transporting the solution of the RF2 in the "EF2-SF" to the SF and the operation for transporting to the SF the solution of the RF3 in the "EF3-SF" are the same as in the above described "EF1-SF" only with the switches and the photosensors being changed to the correspondences. The description thereof is omitted.

[EXSLCT] Exclusive extraction unit operation. The extraction solvents are selected, quantified and are guided to the reaction flask.

The set extraction solvents (RS1, RS2, RS3, RS4, RS5, RS6) are selected to quantify the set amount for transporting the extraction solvent to the set reaction flasks (RF1, RF2, RF3).

[EWSSLCT] Exclusive extraction unit operation. The extraction solvents are selected, quantified and are guided to the reaction flask.

The set extraction solvents (RS1, RS2, RS3, RS4, RS5, RS6) are selected to quantify the set amount for transporting the washing solvent to the set reaction flasks (RF1, RF2, RF3).

[ESF-BUBB] Exclusive extraction unit operation. Air is blown into the SF so as to bubble the solution.

The switches S110, 131, 134 are on for the required time period so as to blow the air into the SF with the use of the reducing pump. The solution is stirred, extracted by the bubbling operation. The switches S110, 131, 134 are turned off.

[ESR1-SF] Exclusive extraction unit operation. The solution of the SR1 is transported to the SF.

The switches S130, 131, 110 are on for the required time period so as to transport the solution of the SR1 to the SF with the use of the reducing pump. The switches S130, 131, 110 are turned off.

[ESR0-SF] Exclusive extraction unit operation. The solution of the SR0 is transported to the SF.

The switches S130, 131, 110, 135 are on for the required time period so as to transport the solution of the SR0 to the SF with the use of the reducing pump. The switches S130, 131, 110, 135 are tuned off.

[ESF DR] Exclusive extraction unit operation. The solution of the SF is transported to the drain tank and is wasted. The switches S115, 134, 137, 110 are on for the required time period so as to transport to the drain tank the solution of the SF with the use of the reducing pump to waste. The switches S115, 134, 137, 110 are turned off.

[ESR1 DR] Exclusive extraction unit operation. The solution of the SR1 is transported to the SF and thereafter, is transported to the drain tank to waste.

The switches S130, 131, 110 are on for the required time period to transport the solution of the SR1 to the SF. After the switches S130, 131, 110 have been turned off, the switches S115, 134, 137, 110 are on for the required time period so as to transport the solution of the SF to the drain tank, and is wasted. The switches S115, 134, 137, 110 are turned off.

[ESR0 DR] Exclusive extraction unit operation. The solution of the SR0 is transported to the SF and thereafter, is further transported to the drain tank to waste.

The switches S130, 131, 110, 135 are on for the required time period so as to transport the solution of the SR0 to the SF. After the switches S130, 131, 110, 135 have been turned off, the switches S115, 134, 137, 110 are on for the required time period so as to transport the solution of the SF to the drain tank and is wasted. The switches S115, 134, 137, 110 are tuned off.

[EXT-START] Exclusive extraction unit operation. The titles of the extraction operations are displayed on the CRT, and the number of the extraction operations are counted.

[EDT SLCT] Exclusive extraction unit operation. Dehydrating tubes are set.

An switching operation is effected to the lines of the specified dehydrating tubes. Or the number of the dehydrating operations effected is calculated so as to repeatedly turn on, off the switch S145 by the number. The next new dehydrating tube used is selected so as to effect the switching operation to the line.

[EDT RST] Exclusive extraction unit operation. The lines of the dehydrating tubes are returned to the initial posi-

tions. The lines of the dehydrating tubes to be used at the present time are calculated so as to turn on and off the switch S145 by the number thereof for switching the lines of the dehydrating tubes to the initial positions.

The unit operation procedure is composed of the above enumerated contents. As described hereinabove, the synthesis procedure program is made through inputting of the "unit operation names" of these unit procedure procedures in accordance with the operation sequence. In a case where the synthesis processing apparatus (I) is operated with an automated synthesis controlling program shown in Fig. 16 with the insertion of the above described interruption program being allowed when the synthesis of the particular target compound is effected in accordance with the synthesis procedure program, the operation of the synthesis processing apparatus can be instructed with manual key operations in the optional locations of the operation contents of the above described respective unit operation procedures.

In a case where the moving start of the solution cannot be confirmed by the photosensor within the required time period when reagent is transported to the reaction flask from the liquid storing container of the sample supply unit in, for example, the "RR1-RF1", the instructions can not be displayed on the CRT with the key operations. In the "RF1-RC-1", cold media are circulated into the jacket. While the inner solution of the reaction flask is stirred by stirring of the stirrer, the switch is turned off by the key operation so that the stirring reaction can be completed.

The synthesis processing operation in the above described first embodiment will be described hereinafter.

In the first embodiment, in accordance with the synthesis procedure program shown in the above described Table 1, the synthesis processing apparatus (I) is controlled by the order of the unit operation procedure (subroutine) shown in Table 2 so as to synthesize N-(carbobenzyloxy)-D-phenylalanine shown in a chemical formula 1 as described hereinabove. The operation of the synthesis processing apparatus couples the above described operation contents of the unit operation procedure shown in the Table 2 in the numerical order, and is described hereinafter roughly.

In a first step, the reaction conditions are sequentially inputted in accordance with the picture plane of the CRT in accordance with the unit operation procedure of the "START-1". Namely, reaction time, reaction temperatures, concentration time, names and amounts of the reagents, PH adjustment values, names of columns to be used for purification and so on are inputted.

At a second step, 1.8g (12mM)/N-NaOH 12ml (12mM) is inputted manually into the first reaction flask RF1.

At a third step, No. 2 through No. 6 of the unit operation procedures are sequentially effected. Namely, an external stirrer 31 of the first reaction flask RF1 of the "F1-STR-ON" is operated so as to start the stirring of the first reaction flask. Then, the cold media are circulated into the jacket 30 of the first reaction flask RF1 with the "COOL-1-ON" so as to start the cooling operation. The above described solution within the first reaction flask RF1 is cooled, stirred at 0°C by the stirring and cooling operations. CBZ-C1 2.1g(12mM)/THF 20ml and N-NaOH 12m1 are dripped to the above described first reaction flask RF1 for fifteen minutes from the liquid storing containers RR1, RR5 in accordance with the operation procedure of the "RR1-RF1". After the dropping operation, the cooling of the first reaction flask RF1 is stopped by the "COOL-1-OF" and the stirring of the RF1 is stopped with the "F1-STR-OF".

At a fourth step, the unit operation procedure of the "RF1-RC-1" of No. 7 is effected so as to effect the first cooling reacting operation at the first reaction flask RF1 and the cooling stirring operation at 0°C is continued for thirty minutes. Concretely, the cold media are circulated to the jacket of the first reaction flask RF1 and the solution within the first reaction flask is stirred by the rotation of the external stirrer so as to continue it for thirty minutes.

At a fifth step, the unit operation procedure of the "FR1-CONC1" of No. 8 is effected so as to effect the first concentration operation of the solution in the RF1 so that the solvent THF is runs out at 40°C. Concretely, the hot media are stirred by the rotation of the external stirrer into the jacket of the first reaction flask RF1 while the hot media are being circulated. In this condition, air is brought from the output with the use of the reducing pump and the contents are concentrated with the first reaction flask interiors being bubbling.

At a sixth step, the unit operation procedures of the No. 9 through No. 13 are effected, the stirring operation of the RF1 is started in the "F1-STR-ON", reagent 10ml of the liquid storing container RS2 is transported to the RF1 in the "RS2-RF1". Thereafter, the stirring operation of the RF1 is stopped in the "F1-STR-OF", the RF1 is being bubbled in the "RF1-BUBB", the solution of the RF1 in the "RF1-L-RF2" is extracted, washed, the lower extracted liquid layer is transported, and the washing operation is effected twice with AcOEt 30ml.

At a seventh step, the unit operation procedures of the No. 14 through No. 17 are effected, the reagent AcOEt (10ml) in the liquid storing container RS2 is transported to the reaction flask RF2 three times in the "RS2-RF2", and the AcOEt of the 30ml is added to the solution of the second reaction flask RF2. Then, the solution of the second reaction flask RF2 is transported to the PH adjusting flask in the "RF2-PH", is adjusted into the PH2 with N-HC1 in the "PH ADJ" in the PH adjusting flask, the PH-adjusted solution in "PH-RF2" is transported to the second reaction flask RF2 again.

At an eighth step, the unit operating procedures of the No. 18 through No. 21 are effected, the extraction solution (AcOEt) of the liquid storing container RS2 is transported with the "RS2-RF3" to the third reaction flask RF3. The extracted liquid of the third reaction flask transported is transported to the PH adjusting flask with "RF3-PH". Furthermore, the extracted liquid of the PH adjusting flask is transported to the second reaction flask RF2 with the "PH-RF2". The extracted liquid within the second reaction flask is extracted, dehydrated with the "RF2-X-RF3" so as to transport the upper liquid to the RF3.

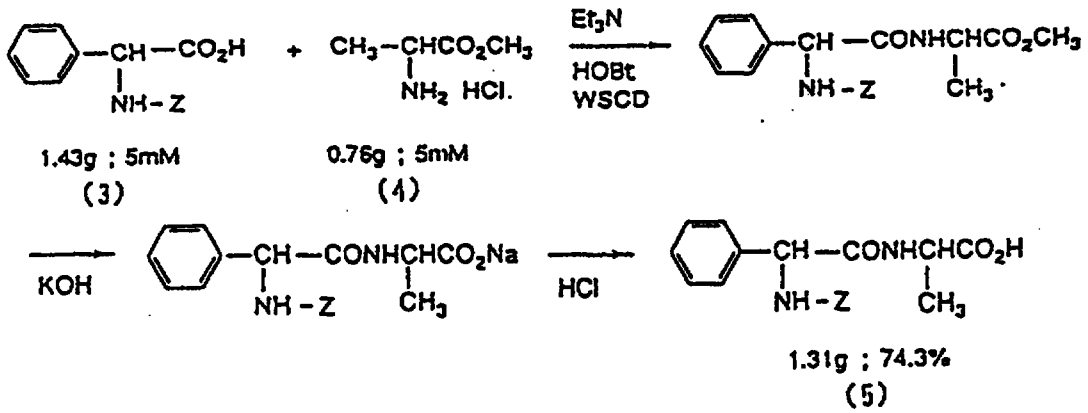
Concretely, the reaction mixture of the second reaction flask RF2 is transferred to the separatory funnel SF with the use of the reducing pump. After standing in the separatory funnel SF for the required time period, only the lower layer is transported to the storing container SR1 so as to transport the upper layer to the storing container SR0. The extraction mother liquor of the storing container SR1 is transported to the separatory funnel SF. The capacity set from the set extraction solvent is quantified, is transported to the second reaction flask RF2, and is transported to the separatory funnel with the use of the reducing pump, while being stirred within the second reaction flask. The air is fed to the SF with the use of the reducing pump so as to effect an extracting operation with the bubbling. After standing the inner solution in the SF after the required time period, the lower layer only is transported to the SR1. The extracted liquid is passed a small amount by a small amount through either of the selected dehydrating tubes DT1 through DT5 so as to dehydrate the extracted liquid for transporting it to the third reaction flask RF3.

At a ninth step, the AcOEt is manually removed out so as to obtain 2.61g(76.3%) white crystals of the chemical formula (2). Concretely, the extracted liquid is taken out from the RF2, is concentrated so as to obtain white crystals as residues.

At a tenth step, the unit operation procedures of the No. 22 through No. 45 are effected so as to wash the apparatus. Concretely, in the "ALARM", an alarm goes off to effect the input wait. The step advances to the next step by the key operations so as to have the washing picture plane in the next "WASH" for washing the MT1, MT2, MT3 in the "MR WASH". Then, in the "SR1-SF-DR", the solution of the storing container SR1 is transported to the separatory funnel SF and is wasted. In the "RF1-SF", the solution of the first reaction flask RF1 is transported to the separatory funnel SF, the solution transported to the separatory funnel are transported to the storing container SR1 in the "SF-SR1", the solution transferred to the SR1 in the "SR1-SF-DR" is transported to the SF, is wasted. Similarly, the solution of the second reaction flask is also processed. In the "RF2-SF", the solution of the second reaction flask RF2 is transported to the separatory funnel SF. In the "SF-F2-F3", the solution transported to the separatory funnel SF is transported by half to the second reaction flask RF2 and the third reaction flask RF3. In the "RF2-SF", the solution transported to the second reaction flask RF2 is transported to the separatory funnel SF. In the "SF DRAIN", the solution transported to the separatory SF is wasted. Similarly, in the "RF3-SF", the solution transported to the third reaction flask RF3 is transported to the separatory funnel SF. In the "SF DRAIN", the solution transported to the separatory liquid funnel SF is wasted. Then, in the "F1-STR-ON", the stirring of the first reaction flask RF1 starts and in the "RF1 DRY", the drying of the first reaction flask RF1 is effected. Thereafter, in the "F1-STR-OF", the stirring of the first reaction flask RF1 is stopped. Similarly, in the "F2-STR-ON", the stirring of the second reaction flask RF2 starts. In the "RF2 DRY", the RF2 is dried. In the "F2-STR-OF", the stirring of the RF2 is stopped. Similarly, even in the third reaction flask, the stirring of the RF3 starts in the "RF3-STR-ON". In the "RF3 DRY", the RF3 is dried, in the "F3-STR-OF", the drying of the RF3 is stopped. In the "FINISH", the picture plane becomes an ended one.

In the second embodiment, as shown in Table 5, the synthesis procedure data name (program name) synthesizes N-carbobenzyloxy)-D-phenylalanyl-L-alanine as shown in the chemical formula 2 in the "AA-CON4". The synthesis procedures are sequentially effected, in accordance with the unit operation procedure (subroutine) shown in Table 6, in a procedures shown in Table 3. The detailed operation description is omitted, because the operation contents of the unit operation procedures shown in Table 6 are described hereinabove.

(Chemical Formula 2)



(Table 5)

Program Name AA-Con4

No.	Operations	Subroutine No.
1	Input reaction conditions	1
2	(3), 1.43g(5mM) is dissolved in $CHCl_3$ (20ml), is put into RF1. (4) 0.76g(5mM) is added to it.	manual
3	Et_3N [0.5g(5mM)/CHCl3, 10ml] is added. while stirring under a cooling operation.	2, 3, 4
4	HOBt [0.8g(6mM)/DMF 10ml] is added.	5
5	Stirring operation under cooling for	6

	five minutes	
6	Water-Soluble Carboiimide (WSCD) [1.7g(5.5mM)/CHCl3,10ml] is added.	7
7	Stirring under cooling for thirty minutes	8,9,10
8	Stirring at room temperature for ninety minutes	11
9	Under cooling, 0.5N-HCl (30ml) is added and stirred.	12,13,14,15
10	A $CHCl_3$ layer is separately obtained, washed, thereafter is dried.	16,17,18
11	M-$NaHCO_3$ (20ml) is added, stirred.	19,20,21,22
12	$CHCl_3$ is separately obtained, washed, thereafter is dried.	23
13	DMF (10ml) is added, $CHCl_3$ is removed at 40°C.	24,25
14	N-KOH (7.5ml) is added with stirring under cooling.	26--32
15	Stirring at room temperature for ninety minutes	33,34,35,36
16	Water (20ml) and AcOEt (30ml) are added, stirred.	37,38,39
17	The water layer is separately obtained, is washed again with AcOEt.	40,41
18	$CHCl_3$ (40ml) is added, while being stirred under cooling, thereafter N-HCl (8ml) is	42--50

	added to acidity.	
19	RF1 and the separatory funnel are washed for the next operation.	51--55
20	The $CHCl_3$ layer separately obtained runs washed with water.	56,57
21	Synthesizing is completed. When $CHCl_3$ solution is taken out from the reaction flask (RF1), is concentrated to obtain white crystals 1.31g(74.3%) of (5).	manual
22	Washing of all synthesis lines	58--86

Order of Subroutines

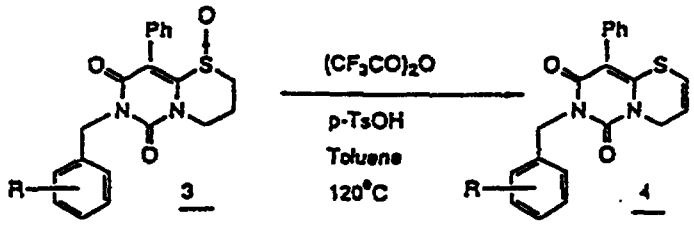
(Table 6)

1	START-1	2	F1-STR-ON	3	COOL-1-ON
4	RR1-RF1	5	RR2-RF1	6	MATU
7	RR3-RF1	8	F1-STR-OF	9	COOL-1-OF
10	RF1-RC-1	11	RF1-RH-2	12	F1-STR-ON
13	COOL-1-ON	14	RS4-RF1	15	MATU
16	F1-STR-OF	17	COOL-1-OF	18	F1-XL-F3
19	F3-STR-ON	20	RS1-RF3	21	F3-STR-OF
22	RF3-BUBB	23	F3-XL-F2	24	RS5-RF2
25	RF2-CONC1	26	DELETE	27	DELETE
28	DELETE	29	DELETE	30	F2-STR-ON
31	COOL-2-ON	32	RR4-RF2	33	COOL-2-OF
34	F2-STR-OF	35	RF2-BUBB	36	RF2-RH-3
37	F2-STR-ON	38	RS2-RF2	39	RS6-RF2
40	F2-STR-OF	41	F2-L-F2	42	COOL-2-ON
43	F2-STR-ON	44	RS3-RF2	45	RS9-RF2
46	RR6-RF2	47	COOL-2-OF	48	DELETE
49	RF2-BUBB	50	RF2-BUBB	51	WS-RF1
52	RF1-BUBB	53	RF1-SF	54	SF-SR1
56	SR1-SF-DR	56	F2-STR-OF	57	F2-XL-F1
58	ALARM	59	WASH	60	PS WASH
61	RF1-BUBB	62	RF2-BUBB	63	RF3-BUBB
64	RF1-SF	66	SF-SR1	66	SR1-SF-DR
67	RF2-SF	68	SF-F1-F2	69	RF1-SF
70	RF2-SF	71	SF-F3-F2	72	RF2-SF
73	SF DRAIN	74	RF3-SF	76	SF DRAIN
76	F1-STR-ON	77	RF1 DRY	78	F1-STR-OF
79	F2-STR-ON	80	RF2 DRY	81	F2-STR-OF
82	F3-STR-ON	83	RF3 DRY	84	F3-STR-OF
85	FINISH	86	END		

In a third embodiment, as shown in Table 7, the program name synthesizes 7-(m-methoxyl benzyl)-9-phenylpyrimid (6, 1-b)(1,3)thiazine-6,8(7H)dion-1-oxide as shown in the chemical formula 3 with the "NAKA-1". The synthesis proce-

dures are sequentially effected, in accordance with the subroutine shown in Table 8, in the order shown in Table 7.

(Chemical Formula 3)



(Table 7)

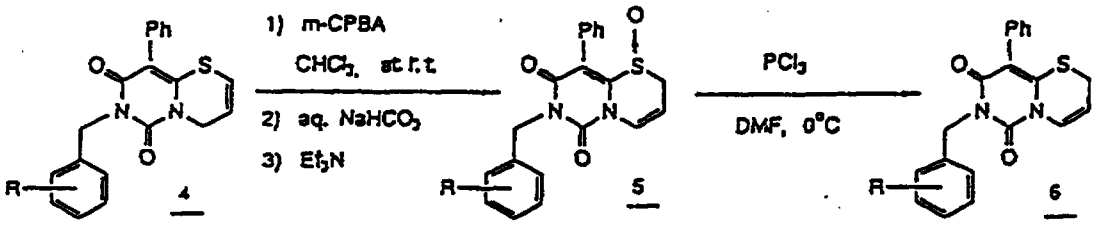
Program Name NAKA- 1		
No.	Operations	Subroutines
1	Input reaction conditions	1
2	3 (1mmol) is put into a reaction flask.	manual
3	Toluene (20ml) is added, stirred.	2,3
4	The toluene solution (5ml) of trifluoroacetic anhydride (2.1g, 10mmol) is added.	4,5
5	p-toluene sulfonic acid (40mg) is added.	manual
6	Refluxing at 130°C overnight.	6--8
7	Toluene is removed out under reduced pressure.	9
8	The resulting residue is effected to cool with stirring.	10,11
9	Separation using a separatory funnel is effected after addition of chloroform (30ml) and water (20ml). After drying (Na_2SO_4) of organic layers, solvent is removed out under reduced pressure.	12--17
10	The crude product is dissolved in chloroform (10ml) so as to effect a purification operation with silica gel column chromatography (AcOEt-n-Hexane 1:4).	18--25
11	Washing of the apparatus	26--43

(Table 8)

Order of Subroutines					
1	START-1	2	RR8-RF3	3	F3-STR-ON
4	RR9-RF3	5	F3-STR-OF	6	A-LC ON
7	RF3-REA-1	8	A-LC OF	9	RF3-CONC1
10	F3-STR-ON	11	MATU	12	RS3-RF3
13	RS2-RF3	14	F3-STR-OF	15	RF3-BUBB
16	F3-XL-F2	17	RF2-CONC2	18	F2-STR-ON
19	RS4-RF2	20	F2-STR-OF	21	RF2-BUBB
22	DE-CO ON	23	RF2-SR3	24	HPLC
25	DE-CO OF	26	WASH	27	PS WASH
28	RF1-BUBB	29	RF2-BUBB	30	RF3-BUBB
31	RF3-SF	32	SF-F3-F2	33	RF3-SR2
34	SR2 DRAIN	35	RF2-SR3	36	SR3 DRAIN
37	RF1-SF	38	SF DRAIN	39	RF1 DRY
40	RF2 DRY	41	RF3 DRY	42	FINISH
43	END				

In a fourth embodiment, as shown in Table 9, the program name synthesizes 7-(m-methoxylbenzyl)-9-phenyl-2H-pyrimid (6, 1-b)(1,3)-thizine-6, 8(7H)-dione as shown in the chemical formula 4 with the "NAKA-3". The synthesis procedures are sequentially effected, in accordance with the subroutines of Table 10, in the order shown in Table 7.

(Chemical Formula 4)



(Table 9)

Program Name NAKA-3		
No.	Operations	Subroutines
1)	Input reaction conditions	1
2)	4 (1mmol) is put into a reaction flask.	manual
3)	Chloroform (20ml) is added, with stirring under cooling.	2-4
4)	Chloroform solution (5ml) of m-CPBA(196mg, 1.1mmol) is added.	5-7
5)	Stirring at room temperature for 2 hours	8-10
6)	Washing operation is effected with aq. $NaHCO_3$(30ml). The organic layers are dried (Na_2SO_4).	11-16
7)	Chloroform solution (5ml) of Et_3N(0.05ml) is added with stirring at room temperature. 8) Solvents are removed out under reduce pressure.	17-22 23
9)	Residues are dissolved in DMF(5ml).	24,25
10)	Washing of other reaction containers	26-30
11)	DMF solution (5ml) of PCl_3(412mg,3mmol) is added with stirred for thirty minutes to the reaction solution of the 9).	31-37
12)	Aqueous $NaHCO_3$(30ml) is added, an extraction operation is effected with AcOEt(30ml). After organic layers are dried (Na_2SO_4), solvents are removed out under reduced pressured.	38-44
13)	Crude products dissolved in chloroform (20ml) are purified with silica gel column chromatography (AcOEt-n-Hexane 1:4 through 1:2).	45-52
14)	Washing of the apparatus	53-84

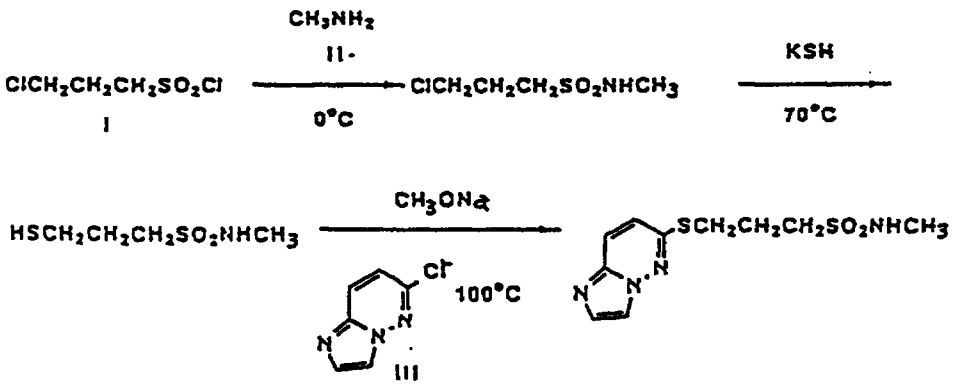
(Table 10)

Order of Subroutines					
1	START-1	2	COOL-2-ON	3	F2-STR-ON
4	RS4-RF2	5	RR6-RF2	6	F2-STR-OF
7	COOL-2-OF	8	A-LC ON	9	RF2-RH-1
10	A-LC OF	11	F2-STR-ON	12	DELETE
13	RS2-RF2	14	F2-STR-OF	15	RF2-BUBB
16	F2-XL-F1	17	F1-STR-ON	18	RR2-RF1
19	A-LC ON	20	ALARM	21	A-LC OF
22	F1-STR-OF	23	RF1-CONC1	24	F1-STR-ON
25	RR1-RF1	26	WS-RF2	27	RF2-BUBB
28	RF2-SF	29	SF DRAIN	30	RF2 DRY
31	COOL-1-ON	32	RR5-RF1	33	COOL-1-OF
34	F1-STR-OF	35	A-LC ON	36	RF1-RC-2
37	A-LC OF	38	F1-STR-ON	39	RS2-RF1
40	RS6-RF1	41	F1-STR-OF	42	RF1-BUBB
43	RF1-X-RF2	44	RF2-CONC2	45	F2-STR-ON
46	RS4-RF2	47	F2-STR-OF	48	RF2-BUBB
49	DE-CO ON	50	RF2-SR3	51	HPLC
52	DE-CO OF	53	WASH	54	PS WASH
55	RF1-BUBB	56	RF2-BUBB	57	RF3-BUBB
58	RF1-SR2	59	SR2 DRAIN	60	RF2-SR3
61	SR3 DRAIN	62	RF3-SF	63	SF-F1-F2
64	RF1-SF	65	RF2-SF	66	SF-SR1
67	SR1-SF-DR	68	WS-RF2	69	WS-RF3
70	RF2-SR2	71	SR2 DRAIN	72	RF3-SR2
73	SR2 DRAIN	74	F1-STR-ON	75	RF1 DRY
76	F1-STR-OF	77	F2-STR-ON	78	RF2 DRY
79	F2-STR-OF	80	F3-STR-ON	81	RF3 DRY
82	F3-STR-OF	83	FINISH	84	END

In a fifth embodiment, as shown in Table 11, the program names synthesizes 6-[3-(N-(methylsulfamoyl) propylthio]-imidazo(1, 2-b)pyridazine as shown in the chemical formula 5 with the "AA-SERIES". The synthesis procedures are

sequentially effected, in accordance with the subroutines of Table 12, in the order shown in Table 11.

(Chemical Formula 5)



(Table 11)

Program Name AA-SERIES

No.	Operations	Subroutines
1	Input reaction conditions	1
2	The solution of I [2.655g(15mmol)/ether 15ml] is putted into the vessel under stirring.	2,3
3	II [0.930g(30mmol)/ether 15ml] is added dropwise under cooling at 0°C.	4,5,6,7,8
4	Thirty minutes Stirring is effected at 0°C for 30 minutes.	9

5	Water (30ml) is added with stirring.	10,11,12
6	Organic layers are separated and water layers are extracted with ethyl acetate (30ml). The combined organic layers are washed with water (30ml). An drying operation is effected with anhydrous sodium sulfate.	13
7	Organic layers are concentrated.	14
8	Methanol (10ml) and potassium thiosulfate [1.08g(15mmol)/ethanol 20ml] are added, and heated with stirring for one hour at 70°C.	15,16,17, 18,19
9	Sodium methylate [20ml(0.81g 15mmol)] and III [2.3g(15mmol)/methanol 20ml] are added with stirring at 100°C for ninety minutes.	20,21,22, 23,24,25
10	Concentration is effected.	26,27
11	Water (30ml) and ethyl acetate (30ml) are added, with stirring.	28,29,30
12	Organic layers are separated and water layers are extracted with ethyl acetate 30ml. The combined organic layers are washed with water (30ml). An drying operation is effected with anhydrous sodium sulfate.	31
13	Concentration is effected.	32
14	Chloroform (20ml) is added to dissolve the residues.	33,34
15	Chromatographic purification (silica gel	35,36,37

SI-60, column 20 X 500mm)is effected.

After twenty minutes, a developing solvent is changed from chloroform to chloroform : methanol (45:1). 38,39

16 Purified elute is concentrated, followed by recrystalization with methanol and ether to give the desired compound (613mg, 15%). manual

17 Washing of the apparatus 40--65

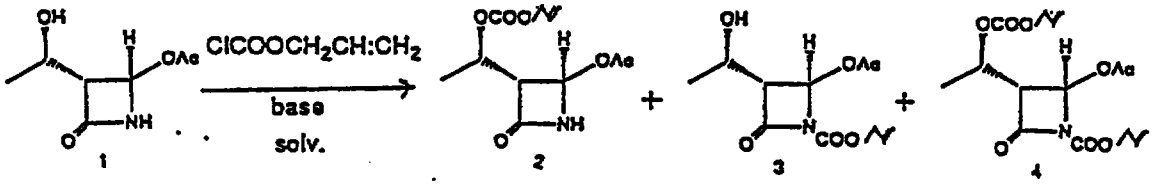
18 Completion 66

(Table 12)

Order of Subroutines					
1	START-1	2	F1-STR-ON	3	RR1-RF1
4	COOL-1-ON	5	RR2-RF1	6	COOL-1-OF
7	A-LC ON	8	F1-STR-OF	9	RF1-RC-1
10	A-LC OF	11	RS1-RF1	12	RF1-BUBB
13	RF1-X-RF3	14	RF3-CONC1	15	F3-STR-ON
16	RS2-RF3	17	RR7-RF3	18	F3-STR-OF
19	RF3-REA-2	20	F3-STR-ON	21	RR8-RF3
22	RR9-RF3	23	A-LC ON	24	F3-STR-OF
25	RF3-REA-3	26	A-LC OF	27	RF3-CONC2
28	RS1-RF3	29	RS3-RF3	30	RF3-BUBB
31	RF3-X-RF2	32	RF2-CONC3	33	F2-STR-ON
34	RS4-RF2	35	RF2-SR3	36	F2-STR-OF
37	DE-CO ON	38	HPLC	39	DE-CO OF
40	WASH	41	MR WASH	42	F1-STR-ON
43	F2-STR-ON	44	F3-STR-ON	45	RF1-BUBB
46	RF2-BUBB	47	RF3-BUBB	48	RF1-SF
49	SF-F3-F2	50	RF3-SF	51	SF-SR0
52	SR0-SF-DR	53	RF2-SF	54	SF-SR1
55	SR1-SF-DR	56	WS-RF2	57	RF2-SR3
58	SR3 DRAIN	59	RF1 DRY	60	RF2 DRY
61	RF3 DRY	62	F1-STR-OF	63	F2-STR-OF
64	F3-STR-OF	65	FINISH	66	END

In a sixth embodiment, as shown in Table 13, the program names synthesizes allyloxycalbonylization of 3-(1-hydroxyethyl)-4-acetoxyazetidine-2-one, as shown in the chemical formula 6 with the "VACOS:NG1". The synthesis procedures are sequentially effected, in accordance with the subroutines of Table 14, in the order shown in Table 13.

(Chemical formula 6)



(Table 13)

Program Names VACOS:NG1

No.	Operations	Subroutines
1	Input reaction conditions.	1
2	1 (1mmol) is put into a reaction flask (RF3).	manual
3	Under stirring, reaction solvent, for instance, THF (10ml in RS2) is added.	2-3
4	Base, for instance, DMAP, Py (2mmol/THF 2.5ml in RR8) is added at room temperature.	5
5	Reaction solvent, for instance, THF (2ml in	

	RR9) is applied to wash lines.	6
6	Chloroallylester formate (2mmol/THF, 2.5ml in RR7) is added dropwise for about one hour at room temperature.	7
7	Stirring is stopped.	8
8	Stirring is effected for about 120 minutes at room temperature (RF3 first reaction).	9
9	RF1 is cooled. AcOEt (20ml in RS3) and N-HCl (10ml in RS4) is added under keeping	10-12
10	Under reduced pressure, solvent is removed at 40°C (RF3).	13
11	RF1 cooling is stopped.	14
12	AcOEt and N HCl having been cooled in RF1 is transferred to RF3.	15
13	bubbling in RF3.	16
14	Organic layer of RF3 (AcOEt layer) is washed with hydrochloric acid and transferred to RF3 without drying.	17
15	Analytical HPLC apparatus is ON.	20
16	Organic layer of RF3 (AcOEt layer) is washed with water including copper sulfate (10ml each in RR1, RR2) and is dried by Na_2SO_4 and, then, is transferred to RF2.	18,19,21
17	Under reduced, solvent is removed at	

	60°C (RF2).	22
18	Acetonitrile (10ml in RS6) is added, and solvent is again removed.	23-25
19	Acetonitrile (10ml in RS6) is added, and the solution is bubbling.	26-27
20	Second reaction in RF2 is effected. (for 2 minutes for HPLC measuring.)	28
21	Analytical HPLC apparatus is OFF.	29
22	The obtained crude products in RF2 is transferred to SR3 (under washing by Acetonitrile).	30-33
23	Apparatus is washed.	34-65

(Table 14)

Order of Subroutines					
No. 1	START-1	No. 2	F3-STR-ON	No. 3	RS2-RF3
No. 4	DELETE	No. 5	RR8-RF3	No. 6	RR9-RF3
No. 7	RR7-RF3D	No. 8	F3-STR-OF	No. 9	RF3-REA-1
No. 10	COOL-1-ON	No. 11	RS3-RF1	No. 12	RS4-RF1
No. 13	RF3-CONC1	No. 14	COOL-1-OF	No. 15	RF1-RF3
No. 16	RF3-BUBB	No. 17	F3-EA-F3	No. 18	RR1-RF1
No. 19	RF1-RF3	No. 20	A-LC ON	No. 21	F3-XW-F2
No. 22	RF2-CONC2	No. 23	RS6-RF2	No. 24	RF2-BUBB
No. 25	RF2-CONC3	No. 26	RS6-RF2	No. 27	RF2-BUBB
No. 28	RF2-RH-2	No. 29	A-LC OF	No. 30	RF2-SR3
No. 31	RS6-RF2	No. 32	RF2-BUBB	No. 33	RF2-SR3
No. 34	WASH	No. 35	RR3-RF1	No. 36	RF1-RF3
No. 37	RF3-BUBB	No. 38	RR7-WASH	No. 39	RF3-SF
No. 40	SF-SR1	No. 41	SR1-SF-DR	No. 42	RR8-WASH
No. 43	RF3-BUBB	No. 44	RF3-SF	No. 45	SF-RF2
No. 46	RF2-BUBB	No. 47	RF2-SR2	No. 48	SR2 DRAIN
No. 49	RS2-RF3	No. 50	RS2-RF3	No. 51	RF3-BUBB
No. 52	RF3-BUBB	No. 53	RF3-SF	No. 54	SF DRAIN
No. 55	RS6-RF2	No. 56	RS6-RF2	No. 57	RF2-BUBB
No. 58	RF2-BUBB	No. 59	RF2-SR2	No. 60	SR2 DRAIN
No. 61	MATU	No. 62	RF2 DRY	No. 63	RF3 DRY
No. 64	FINISH	No. 65	END		

As the synthesis processing apparatus (I) is of the above described construction in the synthesizing the target compounds in the above described respective embodiment, the advantages on the operation to be enumerated hereinafter are provided.

Firstly, the target sample is selected, when the sample is added to the reaction flask and so on from the sample supply unit, so that the volumetric amount or the entire amount can be transported to the desired reaction flask. In this case, the samples set at the desired time can be added at any time. The volumetric amount and the dropping speed are correct and reproducible. Therefore, the loss of the valuable sample can be reduced. In accordance with the temperature conditions, the transportation can be effected at a time and the slow transportation can be effected by the dropping at the cooling time.

Secondly, between the reaction flasks, between the reaction flask and the PH adjusting flask, between the reaction flask and the separatory funnel, the solution can be transported optionally even to each trap, thus making it possible to effect the various operations. As the transportation is mainly effected under reduced pressure, harmful vapor is not leaked externally. As all the flow lines are closed, there is no danger of leaking the contents.

Thirdly, at the purifying time, the whole amount of the solution of the respective reaction flasks is injected into the HPLC column so as to effect a purifying operation by the chromatographic method. At this time, a column to be used is selected from two types of columns, and the solvents to be used from two types of developing solvents are elected. Further, the types of the solvents can be switched with time. The various purifying operations in accordance with such target compounds can be effected like this. The division method of the outflowing liquid from the fraction collector is effected by the peak division so as to collect at the large-sized fraction collector. Therefore, the later processing is simplified. A step gradient method, instead of the peak division method, can be used.

At the above described purifying time, the time of the chromatography can be freely selected. If anything unusual is detected, for example, when the developing solvents have run out on the way to the chromatography, the column pressure has become abnormally high, the tube of the fraction collector has become run out, and so on, the chromatographic operation at that time can be stopped, thus preventing the chromatography from being prevented so that the samples are not be wasted. Further, as the data of the chromatography can be preserved, the arrangement is simplified. As the peak circulation can be effected, the ratio of the respective peak can be easily understood.

Fourthly, the bubbling can be effected by the air blowing into the respective reaction flasks, PH adjustment flasks, and the stirring operation can be effected with an external stirrer composed of stirrers and so on, so that the stirring performance can be improved. When necessary in accordance with the reaction, the stirring operation can be effected even at any time.

Fifthly, the cooling, heating operations of the reaction flasks, PH adjusting flasks of the jacket type can be controlled in the wide range of 90°C from -40°C. Also, in the reaction flask of an oil bath type, the controlling operation can be effected from the room temperature to 200°C. In such a wide range, the temperature can be controlled, and also, the temperature controlling operation can be correctly effected. Further, temperature rising, falling can be effected with better reproducibility, and the boiling reflux operation can be effected in terms of time during the reacting operation.

Sixthly, the concentration and drying of the solution are effected by a bubbling method within the respective reaction flasks. At this time, the end of the concentration is judged with the use of the concentration sensor in the reaction flask of the jacket type, the decomposition of the compounds by the excessive concentration can be controlled. As the concentration is effected by reduced pressure, the vapor of the solvent can be prevented from being diffused.

Seventhly, the contents of the respective reaction flasks are transported to the separatory funnels, and are extracted. Thereafter, the solution of the upper layer is separately obtained, is washed when necessary, is dehydrated through the tube and is transported to the respective reaction flask, thus resulting in no waste. As the above described separate liquid is effected with the sensor, dispersion is not caused and the reproducibility is better.

Eighthly, acid or alkali solution can be automatically selected, added while the heating, cooling operations are effected by the PH adjusting flasks, can be easily adjusted to the desired PH. If the PH adjustment can be effected if the organic solvents can coexist at the PH adjusting time.

Ninthly, at the transporting time to the respective reaction flasks from the fraction collector, the purified solution can be transported from the desired fraction tube to the desired reaction fraction collector. In this manner, the yield ratio is improved, because a plurality of reactions can be effected while being purified.

Tenthly, the solution of the separatory funnels, the respective traps are once transported to the waste liquid trap. Thereafter, it is wasted out of the system of the apparatus. As all the waste solution is collected once to the waste trap, the processing is simplified. As it is wasted each time, the speed of the transportation liquid is stable as the capacity of the waste trap is always the same.

Eleventhly, the washing liquid to be desired is transported from the two types of washing liquids to the reaction flasks while being washed through each volumetric tube the sample stock tube. Even either of water soluble, organic solvent soluble washing liquids can be washed.

Twelfthly, the analytical reaction tracing samples the solution of a fixed amount from each reaction flask so as to effect a diluting operation. Thereafter, the fixed amount is injected into an analytical HPLC so as to start the analysis. The chromatographic chart is displayed on the CRT. The results are printed out. The progress condition of the reaction can be investigated correctly at the desired time.

Thirteenthly, the conditions of the synthesis to be effected by the use of the automated synthesis apparatus are inputted. In the conditions, the apparatus is controlled, the synthesis recording notes can be simultaneously made as the conditions are printed out. As the synthesis recording notes of the similar types can be provided, the arrangement becomes simplified.

Fourteenth, when the operation control of the synthesis processing apparatus is effected by the automated synthesis controlling program which has make it possible to interrupt of the interrupt program, the predetermined program is changed in accordance with the progress situation so that the operation can be effected with a faster step. Therefore, the synthesis processing operation can be effected efficiently.

As is clear from the foregoing description, according to the automated synthesis apparatus of the present invention. Many types of products can be automatically made through the combination of the substitution values of the different materials of many types by the synthesis processing apparatus. As programs for controlling the operations of the synthesis processing apparatus can be extremely made easily, the utility of the synthesis processing apparatus can be improved.

Namely, many (approximately 150 types or so) unit operation procedures assumed necessary in the various types of synthesis processing operations are made in advance and are stored in retaining means such as floppy, hard disc, IC card, magnetic tape, CD and so on. The synthesis procedure program may be made simply by the inputting operation of only the unit operations names of the above described unit operation procedures in accordance with the operation order when the synthesis procedure program of the particular target compound is made. Therefore, the synthesis pro-

cedure program can be made easily even if the synthesizing person is not familiar with the knowledge of the hardware mechanism of the synthesis processing apparatus and the program for making the synthesis procedures.

Even when the synthesis procedure program of the target compound is made as an original from the first step, it can be easily made simply by the inputting of the unit operation names. In addition, when the synthesis procedure program similar to the synthesis procedure program made like this, it can be made more easily with application of corrections, addition and so on upon the above described synthesis procedure program. Even those who do not familiar sufficiently with the knowledge of the program can make easily the operation program of the synthesis processing operation which has approximately one hundred and fifty switches, approximately twenty sensors, and so on, thus resulting in considerable advantages. As the synthesis processing apparatus can be operated in accordance with the program by the making of the program to be desired by the synthesizing person with the advantages, the automatic synthesizing apparatus can cope with many syntheses by the sufficient exhibition of the intrinsic performance.

Easier production of the various syntheses makes it possible to produce small amount and many types under the different reaction conditions. In the automation in the conventional factory plant, the simple type may be produced in large quantities by the repetition control of the fixed reaction conditions. The epoch-making effects can be produced in the new drug development and so on. Especially, as the present apparatus is a fully automated apparatus, an operation can be effected for twenty four hours a day, compounds can be produced with better efficiency without assistance. The present apparatus is extremely high in value when many derivatives of one specific compound structure is synthesized.

In the automated synthesis control in accordance with the conventional general program, the operation of the synthesizing apparatus is effected in accordance with the time, conditions and so on set by the program. Even when the reaction has been completed earlier than the set conditions, the reaction processing can be continued, stopped until the set time is completed, thus resulting in inconveniences such as excessive concentration and so on. Even when the progressing condition of the reaction is to be watched, the analysis of the reaction condition cannot be effected by the optional supply of reaction liquid to the analysis reaction tracing unit.

In the present invention, when the synthesis processing operation is effected by the synthesis processing apparatus with the synthesis procedure program being put into the automated synthesis controlling program, the operation set by the program is stopped or the insertion of the operation except for the operation set by the program can be effected through the manual key operation in a case where the interruption of the interrupt program is allowed. For example, when an operator detected with his naked eyes the earlier completion of the reaction than the setting time of the program.

The synthesizing operation is basically effected with an automated control in accordance with the setting of the program, with an advantage that the synthesis processing operation can be effected in a manless condition at night or the like. In the synthesizing operation to be effected when the operator can watch, the manual operation is inserted at any time during the execution of the practice of the program so as to have a faster speed, rationalization of the synthesis processing operation. It is possible to effect the synthesis operation efficiently than when the operation is effected as in the program.

In the apparatus of the present invention, many stages of reactions can be coped with by the free transportation of the reaction liquid among the respective reaction flasks, so that the compounds of many types can be effected. As the reaction tracing HPLC is provided, the progressing condition of the reaction can be automatically judged, the waste of the reaction time or the like can be reduced.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art.

Claims

1. An automated synthesis apparatus comprising,

a synthesis processing apparatus including

means for shifting contents of at least one container selected from a plurality of storing containers including reaction vessels to the other container,

means for reacting the contents of reaction vessels selected,

means for analyzing with analyzers at least one portion of the contents taken out from the reaction vessels,

means for separating and purifying with purifiers at least one of materials from the contents of the reaction vessels, and

reset means for resetting each of the above means to a predefined initial state, characterized by

a synthesis control apparatus including storing means containing a plurality of unit operating procedures each for operating each means of the above described synthesis processing apparatus,

compile means for compiling at least one of said unit operation procedures selected by storing means set up operation procedures for synthesizing specific target compounds,

organize means for selecting and connecting together each means of said synthesis processing apparatus in accordance with the compiled operation procedures of the compile means to set up control procedures for operating all the selected means of the synthesis processing apparatus in sequence, and

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cedure program can be made easily even if the synthesizing person is not familiar with the knowledge of the hardware mechanism of the synthesis processing apparatus and the program for making the synthesis procedures.

Even when the synthesis procedure program of the target compound is made as an original from the first step, it can be easily made simply by the inputting of the unit operation names. In addition, when the synthesis procedure program similar to the synthesis procedure program made like this, it can be made more easily with application of corrections, addition and so on upon the above described synthesis procedure program. Even those who do not familiar sufficiently with the knowledge of the program can make easily the operation program of the synthesis processing operation which has approximately one hundred and fifty switches, approximately twenty sensors, and so on, thus resulting in considerable advantages. As the synthesis processing apparatus can be operated in accordance with the program by the making of the program to be desired by the synthesizing person with the advantages, the automatic synthesizing apparatus can cope with many syntheses by the sufficient exhibition of the intrinsic performance.

Easier production of the various syntheses makes it possible to produce small amount and many types under the different reaction conditions. In the automation in the conventional factory plant, the simple type may be produced in large quantities by the repetition control of the fixed reaction conditions. The epoch-making effects can be produced in the new drug development and so on. Especially, as the present apparatus is a fully automated apparatus, an operation can be effected for twenty four hours a day, compounds can be produced with better efficiency without assistance. The present apparatus is extremely high in value when many derivatives of one specific compound structure is synthesized.

In the automated synthesis control in accordance with the conventional general program, the operation of the synthesizing apparatus is effected in accordance with the time, conditions and so on set by the program. Even when the reaction has been completed earlier than the set conditions, the reaction processing can be continued, stopped until the set time is completed, thus resulting in inconveniences such as excessive concentration and so on. Even when the progressing condition of the reaction is to be watched, the analysis of the reaction condition cannot be effected by the optional supply of reaction liquid to the analysis reaction tracing unit.

In the present invention, when the synthesis processing operation is effected by the synthesis processing apparatus with the synthesis procedure program being put into the automated synthesis controlling program, the operation set by the program is stopped or the insertion of the operation except for the operation set by the program can be effected through the manual key operation in a case where the interruption of the interrupt program is allowed. For example, when an operator detected with his naked eyes the earlier completion of the reaction than the setting time of the program.

The synthesizing operation is basically effected with an automated control in accordance with the setting of the program, with an advantage that the synthesis processing operation can be effected in a manless condition at night or the like. In the synthesizing operation to be effected when the operator can watch, the manual operation is inserted at any time during the execution of the practice of the program so as to have a faster speed, rationalization of the synthesis processing operation. It is possible to effect the synthesis operation efficiently than when the operation is effected as in the program.

In the apparatus of the present invention, many stages of reactions can be coped with by the free transportation of the reaction liquid among the respective reaction flasks, so that the compounds of many types can be effected. As the reaction tracing HPLC is provided, the progressing condition of the reaction can be automatically judged, the waste of the reaction time or the like can be reduced.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art.

Claims

1. An automated synthesis apparatus comprising,

a synthesis processing apparatus including

means for shifting contents of at least one container selected from a plurality of storing containers including reaction vessels to the other container,

means for reacting the contents of reaction vessels selected,

means for analyzing with analyzers at least one portion of the contents taken out from the reaction vessels,

means for separating and purifying with purifiers at least one of materials from the contents of the reaction vessels, and

reset means for resetting each of the above means to a predefined initial state, characterized by

a synthesis control apparatus including storing means containing a plurality of unit operating procedures each for operating each means of the above described synthesis processing apparatus,

compile means for compiling at least one of said unit operation procedures selected by storing means set up operation procedures for synthesizing specific target compounds,

organize means for selecting and connecting together each means of said synthesis processing apparatus in accordance with the compiled operation procedures of the compile means to set up control procedures for operating all the selected means of the synthesis processing apparatus in sequence, and

operate means of a computer for actuating the control procedures to operate each means of the above described synthesis processing apparatus for synthesizing the specific target compounds.

2. The automated synthesis apparatus in accordance with claim 1, wherein the shifting means is provided for moving the contents to the other container from one container in the above described synthesis processing apparatus and for circulating them to the container within flow lines communicated mutually with among the respective means and among components of the respective means, opening, closing valve means, quantifiers, sensors interposed among the flow lines, with the opening, closing valve means, the quantifiers, and sensors being connected with the above described control apparatus.

3. The automated synthesis apparatus in claim 1 or 2, wherein the shifting means includes a device which is adapted to compulsorily move the contents with pressures or a device which is adapted to make the contents to move effect a natural drop.

4. The automated synthesis apparatus in accordance with any one of claims 1 to 3, wherein the reacting means comprises either of a temperature means for controlling the reaction temperature of the contents, a stirring means for stirring the contents, a dropping means for dropping the contents to effect an addition, a time means for controlling the reaction time of the contents, a drying means for drying the contents, a means of extracting the specific reaction mixture from the contents.

5. The automated synthesis apparatus in accordance with any one of claims 1 to 4, wherein the respective means of the synthesis processing apparatus comprises

a sample supply unit provided with a plurality of storing containers for storing raw materials, reagents, solvents, PH adjusting liquids, and so on, a means for automatically feeding the sample from storing cells to these storing containers, a volumetric tube and a sensor for quantifying the samples to be transported from the storing containers, a flow line for a flowing operation from each of the storing container to the next step, and an electromagnetic valve for opening, closing flow passages interposed in each flow line,

a reaction unit composed of combination of a reaction vessel unit, an extraction/dehydration unit, a PH adjusting unit and a reaction tracing unit for analytical use, provided with a plurality of reaction vessels and PH adjusting vessels, flow lines adapted to feed the sample of an optional storing container from among storing containers provided in the sample supply unit with respect to each of these vessels, flow lines provided for their mutual free circulating operations among the plurality of reaction vessels, and among these reaction vessels and the PH compensating vessels, extraction/separation funnels and dehydrating tubes provided for their mutual free circulating operations through the flow lines among the respective vessels, tracing HPLC for reaction liquid analyzing use connected through the respective reaction vessels and flow lines, and electromagnetic valves for opening, closing the flow passages interposed in the respective flow lines,

a purifying unit provided with a purifying HPLC connected through the respective reaction vessels and flow lines provided in the reaction units, and with a fraction collector so as to feed an optional purified products collected to the fraction collector through the flow lines to the reaction vessels of the reaction units,

a temperature control unit provided with a means for circulating hot media or cold media to heat or cool the reaction vessels and a heater for heating the reaction vessels,

a washing unit for transporting the washing liquid to the reaction vessels, quantifying devices.

6. The automated synthesis apparatus in accordance with any one of claims 1 to 5, wherein the control apparatus controls the driving of the synthesis processing apparatus in accordance with the inputted synthesis procedure program, and also, makes it possible to input an interrupt program by the manual operation at the synthesis procedure program execution time so that the driving control of the synthesis processing apparatus may be effected in accordance with the interrupt program.

7. A method for controlling automatically the operation of an automated synthesis apparatus which includes means for shifting contents of at least one container selected from a plurality of storing containers including reaction vessels to the other container, means for reacting the contents of reaction vessels selected, means for analyzing with analyzers at least one portion from the contents taken out of the reaction vessels, means for separating and purifying with purifiers at least one of materials from the contents of the reaction vessels, and means for restoring each of the means into an initial condition, said method comprising the steps of

storing in advance a plurality of operating procedures each for operating each means of the synthesis processing apparatus,

compiling at least one of unit operation procedures selected by the storing means to set up operation procedures for synthesizing specific target compounds,

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selecting from and connecting together each means of the synthesis processing apparatus in accordance with the operation procedures of compiling to set up control procedures for operating all the selected means of the synthesis processing apparatus in sequence, and

actuating the control procedure to operate each means of the synthesis processing apparatus for synthesizing the specific target compounds.

8. The controlling method in accordance with claim 7, further comprising a step of effecting the correction addition of the unit operation procedure for composing the synthesis procedure program and / or change in the operation order with the use of synthesis procedure program for synthesizing the other specific target compound stored with the retaining means so as to make the synthesis procedure program for synthesizing the specific target compound being made in advance.

9. The controlling method in accordance with claim 7, further comprising steps of, in a unit operation procedure for operating a means for moving the contents to the other container from the one storing container and circulating the contents to the container, including a procedure of feeding a required amount to one specific reaction vessel of the reaction unit from one specific storing container of the sample supply unit, a procedure of feeding the whole amount of samples to one specific reaction vessel from one specific storing container of the sample supply unit, a procedure of transporting the contents of one specific reaction vessel to other one specific reaction vessel, a procedure for extraction/dehydration of transporting to the extraction/separation funnel the contents from one specific reaction vessel to transport the upper layer liquid to the other one specific reaction vessel, a procedure for extraction/dehydration of transporting the contents from one specific reaction vessel to the extraction/separation funnels to transport the lower layer liquid to other one specific reaction vessel, a procedure of transporting the contents from one specific reaction vessel to the PH adjusting vessel, a procedure of transporting the contents to one specific reaction vessel from the PH adjusting vessel, a procedure of transporting the contents to one specific reaction vessel from a fraction tube, a procedure of transporting the contents from one specific reaction vessel to the container of the purifying unit, a procedure of transporting the contents to the extraction/separation funnel from one specific reaction vessel, a procedure of wasting the contents from the extraction/separation funnels, a procedure of transporting the contents of the storing container of the extraction/dehydration unit to the extraction/separation funnels for wasting them, a procedure of transporting the contents of the extraction/separation funnels to the storing container, a procedure of transporting the contents of the extraction/separation funnels by half to two specific reaction vessels, a procedure of transporting the contents of the extraction/separation funnels to one specific reaction vessel, a procedure of transporting the contents of one specific reaction vessel to the storing container of the analyzing reaction tracing unit, a procedure of transporting the washing liquid to one specific reaction vessel through one specific quantifier device.

10. The controlling method in accordance with claim 7, comprising steps of, in a unit operation procedure of operating a means for reacting the contents of the selected specific reaction vessel, including a procedure for bubbling one specific contents in the reaction vessel, a procedure for starting the cooling of one specific contents in the reaction vessel, a procedure of completing the cooling of one specific contents in the reaction vessel, a procedure of effecting by optional number the cooling of one specific contents in the reaction vessel, a procedure of effecting by optional number the concentration of one specific contents in the reaction vessel, a procedure of starting the stirring of one specific contents in the reaction vessel, a procedure of completing the stirring of one specific contents in the reaction vessel.

11. The controlling method in accordance with claim 7, comprising a step of, in a unit operation procedure for operating a means for automatically analyzing with an analyzer with one portion of the reactant taken out form the reaction vessel being selected, including a procedure of turning on an analyzing HPLC switch, a procedure turning off the analyzing HPLC switch, a procedure for sampling the samples of one specific reaction vessel to effect the analyzing operation with HPLC after dilution.

12. The controlling method in accordance with claim 7, comprising steps of, in a unit operation procedure for operating a means for separating, purifying by a separating, purifying device a specific material from the contents within the reaction vessel, including a procedure of selecting the chromatocolumn to stand by a detector, a procedure of resetting a chromatocolumn and a detector, a procedure of purifying samples to the HPLC from the storing container so as to effect the chromatographing operation.

13. The controlling method in accordance with claim 7, comprising a step of including, in a unit operation procedure for operating a means for restoring the respective means into the initial condition, a procedure for transporting a washing

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liquid to one specific reaction vessel through one specific quantifying device, a procedure for drying one specific reaction vessel, a procedure for drying flow lines.

14. The controlling method in accordance with claim 7, further comprising a step of including, in the unit operation procedure, a starting procedure of setting by inputting of the synthesis conditions, a sub-operation procedure for execution exclusive use.

15. The controlling method in accordance with claim 7, further comprising steps of, in the making of the synthesis procedure program, inputting of a program name, selecting of the start procedure for inputting the conditions of the synthesis, thereafter selecting the unit operation procedure, sequential inputting of the name of the unit operation procedure selected in accordance with the operation order so as to effect the combining operation.

16. The controlling method in accordance with claim 7, further comprising steps of interrupting an interrupt program while the execution in accordance with the synthesis procedure program is effected with the automatic synthesis controlling program so that the driving operation of the synthesis processing apparatus in accordance with the interruption program may be effected.

17. The controlling method in accordance with claim 16, further comprising the step of including, in the interrupt program, a program for changing the time setting of reaction, concentration into the time setting of the synthesis procedure program, a program arranged so that the analysis start and completion can be effected at an optional time with earlier time, a program of re-setting the conditions at the purification time, a program adapted to change so that the completion judgment of the reaction may be effected by the automatic analysis of the reaction condition, instead of the time setting.

18. The controlling method in accordance with claim 16, further comprising the step the interruption of the interrupt program is adapted to be effected by the key operation of the computer at a program execution time in accordance with the synthesis procedure program.

Patentansprüche

1. Automatische Synthesevorrichtung mit einer Vorrichtung zur Durchführung der Synthese, welche aufweist:
eine Einrichtung zum Überführen des Inhalts mindestens eines Behälters, der aus mehreren Vorratsbehältern unter Einschluß von Reaktionsgefäßen ausgewählt ist, in einen anderen Behälter,
eine Einrichtung zum Umsetzen des Inhalts der ausgewählten Reaktionsgefäße,
eine Einrichtung zum Analysieren mindestens eines Teils des aus den Reaktionsgefäßen entnommenen Inhalts mit Analysatoren,
eine Einrichtung zum Abtrennen mindestens eines der Stoffe aus dem Inhalt der Reaktionsgefäße und zum Reinigen mit Reinigungsvorrichtungen, und eine Rücksetzeinrichtung zum Rücksetzen jeder der vorstehenden Einrichtungen in einen vorbestimmten Ausgangszustand,
gekennzeichnet durch
eine Vorrichtung zur Synthesesteuerung, aufweisend:
eine Speichereinrichtung, die eine Vielzahl von Einheiten-Arbeitsprozeduren enthält, die jeweils zum Betreiben der Einrichtungen der vorstehend beschriebenen Vorrichtung zur Durchführung der Synthese dienen,
eine Kompilereinrichtung zum Kompilieren mindestens einer dieser Einheiten-Arbeitsprozeduren, welche von Arbeitsprozeduren zur Initialisierung der Speichereinrichtung ausgewählt wird und zur Durchführung der Synthese von spezifischen Zielverbindungen bestimmt ist,
eine Organisationseinrichtung zum Auswählen und Zusammenfügen aller Einrichtungen der Vorrichtung zur Durchführung der Synthese gemäß den kompilierten Arbeitsprozeduren der Kompilereinrichtung zur Initialisierung von Steuerprozeduren zum sequentiellen Betreiben aller ausgewählten Einrichtungen der Vorrichtung zur Durchführung der Synthese, und eine Betriebseinrichtung eines Rechners zum Auslösen der Steuerprozeduren, um jede Einrichtung der vorstehend beschriebenen Vorrichtung zur Durchführung der Synthese so zu betreiben, daß die spezifischen Zielverbindungen synthetisiert werden.

2. Synthesevorrichtung nach Anspruch 1, wobei die Überführungseinrichtung dazu vorgesehen ist, in der vorstehend beschriebenen Vorrichtung zur Durchführung der Synthese die Inhalte von einem Behälter zum anderen Behälter zu bewegen und sie zu dem Behälter über Flußleitungen umzuwälzen, die gegenseitig verbunden sind mit der jeweiligen Einrichtung und mit Komponenten derjeweiligen Einrichtung, Öffnung, Ventilschließeinrichtung, Abmeßeinrichtungen, in die Flußleitungen gesetzte Sensoren, wobei die Öffnung, Ventilschließeinrichtung, Abmeßeinrichtungen und Sensoren mit der vorstehend beschriebenen Steuervorrichtung verbunden sind.

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3. Synthesevorrichtung nach Anspruch 1 oder 2, wobei die Überführungseinrichtung eine Einrichtung umfaßt, die dazu eingerichtet ist, den Inhalt zwangsmäßig unter Druck zu bewegen, oder eine Einrichtung, die dazu eingerichtet ist, den Inhalt so zu bewegen, daß ein natürlicher Tropfen entsteht.

4. Synthesevorrichtung nach einem der Ansprüche 1 bis 3, wobei die Einrichtung zum Umsetzen auch eine Temperatureinrichtung zum Steuern der Reaktionstemperatur des Inhalts, eine Rühreinrichtung zum Rühren des Inhalts, eine Tropfeinrichtung zum Tropfen des Inhalts zum Bewirken eines Zusatzes, eine Zeiteinrichtung zum Steuern der Reaktionszeit des Inhalts, eine Trockeneinrichtung zum Trocknen des Inhalts, eine Einrichtung zum Extrahieren des spezifischen Reaktionsgemisches aus dem Inhalt aufweist.

5. Synthesevorrichtung nach einem der Ansprüche 1 bis 4, wobei die jeweilige Einrichtung der Vorrichtung für den Syntheseablauf umfaßt:
eine Probenzuführeinheit, die ausgerüstet ist mit mehreren Vorratsbehältern zum Bevorraten von Ausgangsstoffen, Reagenzien, Lösemitteln, Flüssigkeiten zur pH-Einstellung usw., einer Einrichtung zum automatischen Zuführen der Probe aus Vorratszellen zu diesen Vorratsbehältern, einem volumetrischen Rohr und einem Sensor zum Abmessen der Proben, die aus den Vorratsbehältern zu transportieren sind, einer Flußleitung zum Erzeugen eines Flusses aus jedem der Vorratsbehälter zum nächsten Schritt und einen elektromagnetischen Ventil zum Öffnen und Schließen von Flußwegen, die zwischen die Flußleitungen gesetzt sind,
eine Reaktionseinheit, die aufgebaut ist aus einer Kombination einer Reaktionsgefäßeinheit, einer Extraktions/Entwässerungs-Einheit, einer Einheit zur pH-Einstellung und einer Reaktionsverfolgungseinheit für analytische Zwecke, die ausgerüstet ist mit mehreren Reaktionsgefäßen und Gefäßen zur pH-Einstellung, Flußleitungen, die eingerichtet sind zum Zuführen der Probe eines wahlweisen Vorratsbehälters von Vorratsbehältern, die in der Probenzuführungseinheit in bezug auf diese Gefäße vorgesehen sind, Flußleitungen, die vorgesehen sind für ihre gegenseitige freie Umwälzung zwischen der Vielzahl der Reaktionsgefäße und unter diesen Reaktionsgefäßen und den Gefäßen zur pH-Kompensation, Extraktions/Abtrenn-Trichter und Entwässerungsrohre, die zu ihrer gegenseitigen freien Umwälzung durch die Flußleitungen unter den jeweiligen Gefäßen vorgesehen sind, Reaktionsverfolgungs-HPLC zum Zweck der Analyse der Reaktionsflüssigkeit, die durch die jeweiligen Reaktionsgefäße und Flußleitungen verbunden sind, und elektromagnetische Ventile zum Öffnen und Schließen der Flußwege, die zwischen die jeweiligen Flußleitungen gesetzt sind,
eine Reinigungseinheit, die ausgerüstet ist mit einer Reinigungs-HPLC, die über die jeweiligen Reaktionsgefäße und Flußleitungen verbunden sind, die in der Reaktionseinheit vorgesehen sind, und mit einem Fraktionssammler, um ein wahlweises, gereinigtes Produkt, welches vom Fraktionssammler gesammelt wurde, durch die Flußleitungen zu den Reaktionsgefäßen der Reaktionseinheit zu führen,
eine Temperatursteuereinheit, die mit einer Einrichtung zum Umwälzen eines heißen oder kalten Mediums zum Heizen oder Kühlen des Reaktionsgefäßes und einem Heizer zum Beheizen der Reaktionsgefäße ausgerüstet ist,
eine Wascheinheit zum Transportieren der Waschflüssigkeit zu den Reaktionsgefäßen, Abmessungseinrichtungen.

6. Synthesevorrichtung nach einem der Ansprüche 1 bis 5, wobei die Vorrichtung zur Synthesesteuerung den Antrieb der Vorrichtung zur Durchführung der Synthese gemäß dem eingegebenen Synthese-Prozedurenprogramm steuert und es auch ermöglicht, zum Ausführungszeitpunkt des Synthese-Prozedurenprogramms durch manuelle Betätigung ein Interrupt-Programm einzugeben, so daß die Antriebssteuerung der Vorrichtung zur Durchführung der Synthese nach Maßgabe des Interrupt-Programms bewirkt werden kann.

7. Verfahren zum automatischen Steuern des Betriebs einer automatischen Synthesevorrichtung, welche aufweist:
eine Einrichtung zum Überführen des Inhalts mindestens eines Behälters, der aus mehreren Vorratsbehältern unter Einschluß von Reaktionsgefäßen ausgewählt ist, in einen anderen Behälter, eine Einrichtung zum Umsetzen des Inhalts der ausgewählten Reaktionsgefäße, eine Einrichtung zum Analysieren mindestens eines Teils des aus den Reaktionsgefäßen entnommenen Inhalts mit Analysatoren, eine Einrichtung zum Abtrennen mindestens eines der Stoffe aus dem Inhalt der Reaktionsgefäße und zum Reinigen mit Reinigungsvorrichtungen und eine Rücksetzeinrichtung zum Rücksetzen jeder der vorstehenden Einrichtungen in einen vorbestimmten Ausgangszustand, wobei das Verfahren die folgenden Schritte umfaßt:
vorheriges Speichern von mehreren Arbeitsprozeduren, die jeweils zum Betreiben der Einrichtungen der Vorrichtung zur Durchführung der Synthese dienen,
Kompilieren mindestens einer der Einheiten-Arbeitsprozeduren, welche von Arbeitsprozeduren zur Initialisierung der Speichereinrichtung ausgewählt wird und zur Durchführung der Synthese von spezifischen Zielverbindungen bestimmt ist,
Auswählen und Zusammenfügen aller Einrichtungen der Vorrichtung zur Durchführung der Synthese gemäß den kompilierten Arbeitsprozeduren zur Initialisierung von Steuerprozeduren zum sequentiellen Betreiben aller ausgewählten Einrichtungen der Vorrichtung zur Durchführung der Synthese, und Auslösen der Steuerprozeduren, um

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jede Einrichtung der Vorrichtung zur Durchführung der Synthese so zu betreiben, daß die spezifischen Zielverbindungen synthetisiert werden.

8. Verfahren nach Anspruch 7, weiter umfassend einen Schritt zum Bewirken von Korrektur/Zusatz hinsichtlich der Einheiten-Arbeitsprozedur zum Zusammenstellen des Synthese-Prozedurenprogramms und/oder einer Änderung in der Arbeitsreihenfolge beim Gebrauch des in der Speichereinrichtung gespeicherten Synthese-Prozedurenprogramms zum Synthetisieren der anderen spezifischen Zielverbindungen, um so das Synthese-Prozedurenprogramm zum Synthetisieren der spezifischen Zielverbindung im voraus zu erstellen.

9. Verfahren nach Anspruch 7 mit den weiteren Schritten, daß bei einer Einheiten-Arbeitsprozedur zum Betreiben einer Einrichtung zum Bewegen des Inhalts von einem Lagerbehälter zum anderen Behälter und zum Umwälzen des Inhalts zu dem Behälter eingeschlossen sind:
eine Prozedur zum Zuführen einer erforderlichen Menge zu einem speziellen Reaktionsgefäß der Reaktionseinheit von dem jeweiligen Vorratsbehälter der Probenzuführeinheit, eine Prozedur zum Zuführen der Gesamtmenge der Proben von einem speziellen Lagerbehälter der Probenzuführeinheit zu einem speziellen Reaktionsgefäß, eine Prozedur zum Transportieren des Inhalts eines speziellen Reaktionsgefäßes zu einem anderen speziellen Reaktionsgefäß, eine Prozedur zum Extrahieren/Entwässern und zum Transportieren des Inhalts von einem speziellen Reaktionsgefäß zu dem Extraktions/Abtrenn-Trichter, wobei die obere Flüssigkeitsschicht zu dem anderen speziellen Reaktionsgefäß transportiert wird, eine Prozedur zum Extrahieren/Entwässern und zum Transportieren des Inhalts von einem speziellen Reaktionsgefäß zu dem Extraktions/Abtrenn-Trichter, wobei die untere Flüssigkeitsschicht zu dem anderen speziellen Reaktionsgefäß transportiert wird, eine Prozedur zum Transportieren des Inhalts von einem speziellen Reaktionsgefäß zu dem Gefäß zur pH-Einstellung, eine Prozedur zum Transportieren des Inhalts von dem Gefäß zur pH-Einstellung zu einem speziellen Reaktionsgefäß, eine Prozedur zum Transportieren des Inhalts von einem Trennrohr zu einem speziellen Reaktionsgefäß, eine Prozedur zum Transportieren des Inhalts von einem speziellen Reaktionsgefäß zum Behälter der Reinigungseinheit, eine Prozedur zum Transportieren des Inhalts von einem speziellen Reaktionsgefäß zu dem Extraktions/Abtrenn-Trichter, eine Prozedur zum Beseitigen des aus dem Extraktions/Abtrenn-Trichter kommenden Inhalts, eine Prozedur zum Transportieren des Inhalts des Vorratsbehälters der Extraktions/Entwässerungs-Einheit zu dem Extraktions/Abtrenn-Trichter, um diesen zu beseitigen, eine Prozedur zum Transportieren des Inhalts des Extraktions/Abtrenn-Trichters zu dem Vorratsbehälter, eine Prozedur zum Transportieren des Inhalts des Extraktions/Abtrenn-Trichters zur Hälfte zu zwei speziellen Reaktionsgefäßen, eine Prozedur zum Transportieren des Inhalts des Extraktions/Abtrenn-Trichters zu einem speziellen Reaktionsgefäß, eine Prozedur zum Transportieren des Inhalts eines speziellen Reaktionsgefäßes zu einem Vorratsbehälter der Einheit für Analyse und Reaktionsverfolgung, eine Prozedur zum Transportieren der Waschflüssigkeit durch eine spezielle Abmeßeinrichtung zum einem speziellen Reaktionsgefäß.

10. Verfahren nach Anspruch 7 mit den Schritten, daß bei einer Einheiten-Arbeitsprozedur zum Betreiben einer Einrichtung zum Umsetzen des Inhalts des ausgewählten speziellen Reaktionsgefäßes eingeschlossen sind: eine Prozedur zum Einperlen eines speziellen Inhalts in das Reaktionsgefäß, eine Prozedur zum Starten der Kühlung eines speziellen Inhalts in dem Reaktionsgefäß, eine Prozedur zum Beendigung der Kühlung eines speziellen Inhalts in dem Reaktionsgefäß, eine Prozedur, bei der eine wahlweise Anzahl von Kühlvorgängen hinsichtlich eines speziellen Inhalts in dem Reaktionsgefäß bewirkt wird, eine Prozedur, bei der eine wahlweise Anzahl an Konzentrierungen hinsichtlich eines speziellen Inhalts in dem Reaktionsgefäß bewirkt wird, eine Prozedur zum Starten des Rührens eines speziellen Inhalts in dem Reaktionsgefäß, eine Prozedur zum Beendigen des Rührens eines speziellen Inhalts in dem Reaktionsgefäß.

11. Verfahren nach Anspruch 7 mit den Schritten, daß bei einer Einheiten-Arbeitsprozedur zum Betreiben einer Einrichtung zum automatischen Analysieren eines Teils des aus dem ausgewählten Reaktionsgefäß entnommenen Reaktanten eingeschlossen sind:
eine Prozedur zum Anschalten eines Schalters für eine analysierende HPLC, eine Prozedur zum Abschalten des Schalters für die analysierende HPLC, eine Prozedur zur Entnahme von Proben aus einem speziellen Reaktionsgefäß, um nach Verdünnung mit der HPLC die Analyse durchzuführen.

12. Verfahren nach Anspruch 7 mit den Schritten, daß bei einer Einheiten-Arbeitsprozedur zum Betreiben einer Einrichtung zum Abtrennen und Reinigen eines speziellen Materials aus dem Inhalt im Reaktionsgefäß mit Hilfe einer Abtrenn/Reinigungs-Einrichtung eingeschlossen sind:
eine Prozedur zum Auswählen der chromatographischen Säule und für Standby eines Detektors, eine Prozedur zum Zurücksetzen einer chromatografischen Säule und eines Detektors, eine Prozedur zum Reinigen von Proben zur HPLC aus dem Vorratsbehälter, um den chromatographischen Betrieb zu bewirken.

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13. Verfahren nach Anspruch 7 mit dem Schritt, daß bei einer Einheiten-Arbeitsprozedur zum Betreiben einer Einrichtung zum Rücksetzen der jeweiligen Einrichtung in den Ausgangszustand eingeschlossen sind:
eine Prozedur zum Transportieren einer Waschflüssigkeit durch eine spezielle Abmeßeinrichtung zu einem speziellen Reaktionsgefäß, eine Prozedur zum Trockenen eines speziellen Reaktionsgefäßes, eine Prozedur zum Trocknen von Flußleitungen.

14. Verfahren nach Anspruch 7, mit dem Schritt, daß die Einheiten-Arbeitsprozedur umfaßt:
eine Startprozedur zum Initialisieren der Synthesebedingungen durch Eingabe einer Sub-Arbeitsprozedur ausschließlich zur Verwendung bei der Durchführung.

15. Verfahren nach Anspruch 7, mit den weiteren Schritten, daß das Erstellen des Synthese-Prozedurenprogramms umfaßt:
das Eingeben eines Programmnames, das Auswählen der Startprozedur zum Eingeben der Bedingungen der Synthese und danach das Auswählen der Einheiten-Arbeitsprozedur, das sequentielle Eingeben des Namens der Einheiten-Arbeitsprozedur, die gemäß der Arbeitsreihenfolge ausgewählt wird, um deren Kombination zu bewirken.

16. Verfahren nach Anspruch 7 mit den weiteren Schritten, daß bei der Ausführung gemäß dem Synthese-Prozedurenprogramm mit dem Programm zur automatischen Synthesesteuerung ein Interrupt-Programm unterbrochen wird, so daß der Antrieb der Vorrichtung zur Durchführung der Synthese gemäß dem Interrupt-Programm bewirkt werden kann.

17. Verfahren nach Anspruch 16 mit dem weiteren Schritt, daß das Interrupt-Programm umfaßt:
ein Programm zum Verändern der Zeiteinstellung des Synthese-Prozedurenprogramms hinsichtlich Umsetzung/Konzentrierung, ein Programm, welches so geartet ist, daß Start und Ende der Analyse bei einer wahlweisen Zeit zur früheren Zeit bewirkt werden kann, ein Programm zum Rücksetzen der Bedingungen bezüglich der Reinigungszeit, ein Programm zur Bewirkung einer Veränderung, so daß die Beurteilung des Reaktionsabbruches anstatt durch die eingestellten Zeiten durch die automatische Analyse der Reaktionsbedingungen bewirkt werden kann.

18. Verfahren nach Anspruch 16 mit dem weiteren Schritt, daß die Unterbrechung des Interrupt-Programms so geartet ist, daß sie durch die Key-Operation des Rechners bei einer Programmausführungszeit gemäß dem Synthese-Prozedurenprogramm bewirkt wird.

Revendications

1. Appareil de synthèse automatique, comprenant :
un appareil de traitement par synthèse, comprenant :
un dispositif destiné à déplacer le contenu d'au moins un récipient choisi parmi plusieurs récipients de stockage comprenant des réacteurs, vers un autre récipient,
un dispositif de réaction du contenu des réacteurs choisis,
un dispositif destiné à analyser, avec des analyseurs, au moins une partie du contenu prélevé dans les réacteurs,
un dispositif de séparation et de purification, avec des organes de purification, d'au moins l'une des matières du contenu des réacteurs, et
un dispositif de restauration destiné à remettre chacun des dispositifs précités à un état initial prédéterminé,
caractérisé par :
un appareil de commande de synthèse qui comprend :
un dispositif de mémorisation contenant plusieurs procédures d'opération unitaire destinées chacune à la commande d'un dispositif de l'appareil précité de traitement par synthèse,
un dispositif de compilation d'au moins l'une des procédures d'opération unitaire choisie parmi les procédures d'opération de préparation du dispositif de mémorisation pour la synthèse de composés cibles spécifiques,
un dispositif d'organisation destiné à sélectionner et à connecter chaque dispositif de l'appareil de traitement par synthèse en fonction des procédures d'opération compilées par le dispositif de compilation de manière que des procédures de commande soient établies pour la commande de tous les dispositifs choisis de l'appareil de traitement par synthèse successivement, et
un dispositif d'exploitation d'un ordinateur destiné à l'exploitation des procédures de commande pour le fonctionnement de tous les dispositifs de l'appareil précité de traitement par synthèse pour la synthèse des composés cibles particuliers.

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2. Appareil de synthèse automatique selon la revendication 1, dans lequel le dispositif de déplacement est destiné à déplacer le contenu de l'autre récipient à partir d'un premier récipient dans l'appareil précité de traitement par synthèse et à le faire circuler vers le récipient par des canalisations de circulation communiquant avec les dispositifs respectifs et avec les éléments des dispositifs respectifs, des dispositifs à soupapes d'ouverture-fermeture, des dispositifs de mesure et des capteurs placés le long des canalisations de circulation, les soupapes d'ouverture-fermeture, les dispositifs de mesure et les capteurs étant connectés à l'appareil précité de commande.

3. Appareil de synthèse automatique selon la revendication 1 ou 2, dans lequel le dispositif de déplacement comprend un appareil destiné à déplacer à force le contenu sous pression ou un appareil destiné à provoquer le déplacement du contenu naturellement sous l'action de la pesanteur.

4. Appareil de synthèse automatique selon l'une quelconque des revendications 1 à 3, dans lequel le dispositif de réaction comporte un dispositif destiné à régler la température de réaction du contenu, un dispositif agitateur du contenu, un dispositif d'introduction goutte à goutte du contenu pour réaliser une addition, un dispositif de minutage qui règle le temps de réaction du contenu, un dispositif de séchage du contenu, ou un dispositif d'extraction du mélange réactionnel spécifique du contenu.

5. Appareil de synthèse automatique selon l'une quelconque des revendications 1 à 4, dans lequel les dispositifs respectifs de l'appareil de traitement par synthèse comprennent :

une unité de transmission d'échantillons associée à plusieurs récipients de stockage de matière première, de réactif, de solvant, de liquide d'ajustement de pH, etc., un dispositif destiné à transmettre automatiquement l'échantillon de cellules de stockage aux récipients de stockage, un tube volumétrique et un capteur destiné à indiquer les quantités des échantillons à transporter à partir des récipients de stockage, une canalisation de circulation de chaque récipient de stockage à l'étape suivante, et une électrovanne destinée à ouvrir et fermer des passages de circulation et placée dans chaque canalisation de circulation,

une unité réactionnelle composée d'une combinaison d'une unité à réacteurs, d'une unité d'extraction-déshydratation, d'une unité d'ajustement de pH et d'une unité de suivi de la réaction, destinée à être utilisée pour l'analyse, ayant plusieurs réacteurs et plusieurs réservoirs d'ajustement de pH, des canalisations de circulation destinées à transmettre l'échantillon d'un récipient de stockage éventuel parmi les récipients de stockage incorporés à l'unité de transmission d'échantillons par rapport à chacun des réacteurs et réservoirs, des canalisations d'alimentation utilisées dans des opérations de circulation libre entre plusieurs réacteurs et entre les réacteurs et les réservoirs de compensation de pH, des entonnoirs d'extraction-séparation et des tubes de déshydratation utilisés dans des opérations de circulation libre dans les canalisations de circulation entre les réacteurs et réservoirs respectifs, un chromatographe HPLC de suivi destiné à être utilisé pour l'analyse du liquide de la réaction dans les réacteurs respectifs et les canalisations de circulation, et des électrovannes destinées à ouvrir et fermer les passages de circulation et placée dans les canalisations respectives de circulation,

une unité de purification ayant un chromatographe HPLC de purification connecté par les réacteurs respectifs et les canalisations respectives de circulation placés dans les unités réactionnelles, et un collecteur de fractions destiné à transmettre des produits purifiés éventuels collectés par le collecteur de fractions par les canalisations de circulation vers les réacteurs des unités réactionnelles,

une unité de réglage de température ayant un dispositif destiné à faire circuler des fluides chauds ou froids pour le chauffage ou le refroidissement des réacteurs et un organe de chauffage des réacteurs, et

une unité de lavage destinée à transporter un liquide de lavage vers les réacteurs et les appareils de mesure de quantité.

6. Appareil de synthèse automatique selon l'une quelconque des revendications 1 à 5, dans lequel l'appareil de commande assure le pilotage de l'appareil de traitement par synthèse en fonction d'un programme saisi d'une procédure de synthèse et rend aussi possible la transmission d'un programme d'interruption par une opération manuelle exécutée au moment de l'exécution d'un programme de procédure de synthèse afin que la commande du pilotage de l'appareil de traitement par synthèse puisse être réalisée avec le programme d'interruption.

7. Procédé de commande automatique du fonctionnement d'un appareil de synthèse automatique qui comporte un dispositif destiné à déplacer le contenu d'au moins un récipient choisi parmi plusieurs récipients de stockage comprenant des réacteurs, vers un autre récipient, un dispositif de réaction du contenu des réacteurs choisis, un dispositif d'analyse, par des analyseurs, d'au moins une partie du contenu prélevé dans les réacteurs, un dispositif de séparation et de purification, par des organes de purification, d'au moins l'une des matières du contenu des réacteurs, et un dispositif de restauration de chacun des dispositifs à l'état initial, le procédé comprenant les étapes suivantes :

la mémorisation au préalable de plusieurs procédures d'opération destinées chacune à la commande d'un dispositif de l'appareil de traitement par synthèse,

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la compilation d'au moins l'une des procédures d'opération unitaire choisie par le dispositif de mémorisation pour la préparation des procédures d'opération utilisées pour la synthèse de composés cibles particuliers,

la sélection et la connexion des dispositifs de l'appareil de traitement par synthèse en fonction des procédures d'opération compilées pour la préparation des procédures de commande de tous les dispositifs choisis de l'appareil de traitement par synthèse successivement, et

l'exploitation de la procédure de commande pour la commande de chaque dispositif de l'appareil de traitement par synthèse pour la synthèse des composés cibles particuliers.

8. Procédé de commande selon la revendication 7, comprenant en outre une étape de correction-addition de la procédure d'opération unitaire pour la composition du programme des procédures de synthèse et/ou pour le changement de l'ordre d'opérations lors de l'utilisation du programme de procédures de synthèse pour la synthèse d'un autre composé cible particulier, conservé avec le dispositif de retenue de manière que le programme de procédure de synthèse puisse être utilisé pour la synthèse du composé cible particulier réalisé au préalable.

9. Procédé de commande selon la revendication 7, comprenant en outre, dans une procédure d'opération unitaire pour la commande d'un dispositif destiné à déplacer le contenu vers un autre récipient à partir d'un premier récipient de stockage et par circulation du contenu du récipient, une procédure de transmission d'une quantité nécessaire, à un réacteur particulier de l'unité réactionnelle, à partir d'un récipient particulier de stockage de l'unité de transmission d'échantillons, une procédure de transmission de la quantité totale des échantillons à un réacteur particulier à partir d'un récipient particulier de stockage de l'unité de transmission d'échantillons, une procédure de transport du contenu du réacteur particulier à un autre réacteur particulier, une procédure d'extraction-déshydratation et de transport à l'entonnoir d'extraction-déshydratation du contenu d'un réacteur particulier afin que la couche liquide supérieure soit transportée vers un autre réacteur particulier, une procédure d'extraction-déshydratation pour le transport du contenu d'un premier réacteur particulier aux entonnoirs d'extraction-séparation pour le transport de la couche liquide inférieure vers un autre réacteur particulier, une procédure de transport du contenu d'un réacteur particulier au réservoir d'ajustement de pH, une procédure de transport du contenu à un réacteur particulier à partir du réservoir d'ajustement de pH, une procédure de transport du contenu d'un réacteur particulier à partir d'un tube de fraction, une procédure de transport du contenu d'un réacteur particulier au récipient de purification, une procédure de transport du contenu de l'entonnoir d'extraction-séparation à partir d'un réacteur particulier, une procédure de mise au rebut du contenu des entonnoirs d'extraction-séparation, une procédure de transport du contenu du récipient de stockage de l'unité d'extraction-déshydratation vers les entonnoirs d'extraction-séparation pour leur mise au rebut, une procédure de transport du contenu des entonnoirs d'extraction-déshydratation vers le récipient de stockage, une procédure de transport du contenu des entonnoirs d'extraction-séparation par moitié à deux réacteurs particuliers, une procédure de transport du contenu des entonnoirs d'extraction-séparation à un réacteur particulier, une procédure de transport du contenu d'un réacteur particulier au récipient de stockage de l'unité de suivi de la réaction par analyse, et une procédure de transport du liquide de lavage à un réacteur particulier par un dispositif particulier de mesure de quantité.

10. Procédé de commande selon la revendication 7, comprenant, dans une procédure d'opération unitaire de commande d'un dispositif pour la réaction du contenu du réacteur particulier choisi, des procédures qui comportent une procédure de barbotage d'un contenu particulier dans le réacteur, une procédure de début du refroidissement du contenu particulier du réacteur, une procédure de fin de refroidissement du contenu particulier du réacteur, une procédure d'opération éventuelle du refroidissement d'un contenu particulier du réacteur, une procédure d'exécution éventuelle de la concentration du contenu particulier du réacteur, une procédure de début d'agitation du contenu particulier du réacteur, et une procédure de fin d'agitation du contenu particulier du réacteur.

11. Procédé de commande selon la revendication 7, comprenant, dans une procédure d'opération unitaire pour la commande d'un dispositif d'analyse automatique avec un analyseur, par utilisation d'une partie du réactif retiré du réacteur choisi, une procédure de fermeture d'un interrupteur de chromatographe HPLC d'analyse, une procédure d'ouverture de l'interrupteur du chromatographe HPLC d'analyse, et une procédure d'échantillonnage des échantillons d'un réacteur particulier pour l'exécution d'une opération d'analyse avec le chromatographe HPLC après dilution.

12. Procédé de commande selon la revendication 7, comprenant, dans une procédure d'opération unitaire destinée à la commande d'un dispositif de séparation et de purification par séparation avec un appareil de purification d'une matière particulière du contenu du réacteur, une procédure de sélection de la colonne de chromatographie placée en face d'un détecteur, une procédure de remise à l'état initial d'une colonne de chromatographie et d'un détecteur, et une procédure de purification d'échantillon transmis au chromatographe HPLC à partir du récipient de stockage afin qu'une opération de chromatographie soit exécutée.

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13. Procédé de commande selon la revendication 7, comprenant, dans une procédure d'opération unitaire destinée à la commande d'un dispositif de restauration du dispositif respectif à l'état initial, une procédure de transport d'un liquide de lavage à un réacteur particulier par un dispositif particulier de mesure de quantité, une procédure de séchage d'un réacteur particulier, et une procédure de séchage des canalisations de circulation.

14. Procédé de commande selon la revendication 7, comprenant, dans la procédure d'opération unitaire, une procédure de début de préparation par saisie des conditions de synthèse, et une procédure d'opération partielle destinée à l'exécution par mise en oeuvre exclusive.

15. Procédé de commande selon la revendication 7, comprenant en outre, lors de la préparation du programme de procédures de synthèse, la saisie d'un nom de programme, la sélection d'une procédure initiale pour la saisie des conditions de synthèse, puis la sélection de la procédure d'opération unitaire, et la saisie successive du nom de la procédure d'opération unitaire choisi en fonction de l'ordre des opérations pour l'exécution d'une opération de combinaison.

16. Procédé de commande selon la revendication 16, comprenant en outre des étapes d'interruption d'un programme d'interruption lorsque l'exécution est réalisée suivant le programme de procédures de synthèse du programme de commande de synthèse automatique de manière que l'opération de pilotage de l'appareil de traitement par synthèse puisse être réalisée en fonction du programme d'interruption.

17. Procédé de commande selon la revendication 16, comprenant en outre, dans le programme d'interruption, un programme destiné à changer le réglage du temps de réaction, la concentration pour le réglage de durée du programme de procédure de synthèse, un programme tel que le début et la fin d'analyse doivent être réalisés à un moment choisi qui peut être avancé, un programme de remise à l'état initial des conditions au temps de purification, et un programme modificateur tel que le jugement de fin de réaction peut être obtenu par analyse automatique des conditions de la réaction et non par réglage de sa durée.

18. Procédé de commande selon la revendication 16, dans lequel l'étape d'interruption du programme d'interruption est destinée à être mise en oeuvre par manoeuvre d'une touche d'un ordinateur au moment de l'exécution du programme sous la commande d'un programme de procédures de synthèse.

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