FIG. 11 is a schematic diagram of a pipetting unit according to an embodiment of the present disclosure;

FIG. 12 is a perspective view of the basic structure of a sample operating system according to an embodiment of the present disclosure;

FIG. 13 is another perspective view of the basic structure of a sample operating system according to an embodiment of the present disclosure;

FIG. 14 is a schematic diagram of a sample operating process according to an embodiment of the present disclosure;

FIG. 15 is a schematic view of a basic automated control architecture according to an embodiment of the present disclosure.

In the accompanying drawings, corresponding attachment marks indicate corresponding components. The examples described herein are used to illustrate exemplary aspects of the present disclosure, and these examples should not be construed to limit the scope of the present disclosure in any way.

Detailed Description of Drawings

The present disclosure will be described below with reference to the accompanying drawings, which illustrate several embodiments of the present disclosure. It should be understood, however, that the present disclosure can be presented in a number of different ways and is not limited to the embodiments described below; in fact, the embodiments described below are intended to make the disclosure of the present disclosure more complete and to adequately illustrate to those skilled in the art the scope of protection of the present disclosure. It should also be understood that the embodiments disclosed herein are capable of being combined in a variety of ways to provide more additional embodiments.

For descriptive purposes, the terms "up", "down", "left", "right", "vertical", "horizontal", "top", "bottom", " transverse", "longitudinal", and their derivatives are all related to the orientation in the accompanying drawings of the present disclosure. It should be understood, however, that the present disclosure may employ a variety of alternative variations unless expressly stated to the contrary. For example, a feature previously described as being "below" other features may be described as being "above" other features when the device in the accompanying drawings is turned upside down. The device may also be oriented in other ways (rotated 90 degrees or in other orientations), and the relative spatial relationships will be explained accordingly.

intermediate product, liquid replenishment can be performed again, and the replenished biological sample can be transferred from the sample operating system 3 to the incubator 1 via the transfer platform 2, and amplification culture and cryogenic sedimentation enrichment can be performed again. After completion of the centrifugal enrichment of the desired intermediate products, the products can be subjected to magnetic bead sorting. Next, DNA cleaning can be performed, e.g., by centrifugation, which can be performed in multiple rounds. Finally, DNA encapsulation is performed, thereby completing all steps of the extraction of macromolecules.

As described above, in an embodiment according to the present disclosure. The system 10 may be configured as an automated and intelligent system, and all operations of the modules in the system 10 (e.g., the incubator 1, the sample operating system 3, the transfer platform 2, etc.) may be completed automatically under the control of an automated control system. FIG. 15 illustrates an architecture of the automated control system 6 according to an embodiment of the present disclosure. As shown in FIG. 15, the automated control system 6 according to the present disclosure may comprise an industrial computer, an input/output data acquisition module, and a drive module. For data acquisition, various acquisition devices may be provided within the system 10, including but not limited to: temperature sensors, weight sensors, differential pressure sensors, photoelectric sensors, cameras, code readers, etc. Among them, the temperature sensor, the weight sensor, the differential pressure sensor, the photoelectric sensor, the camera, and the like may be arranged at appropriate locations within the system 10 as required. The drive module is used to control the operation of various components or modules within the system 10, including, but not limited to, the operation of the following components or modules: electric heating membranes, robots (transferring, pipetting, etc.), pumps (pumping, draining, etc.), solenoid valves, centrifuges, sliding table electric cylinders, drive motors (e.g., drive motors for the doors of the incubators and for the shaking beds), centrifugal fans, and the like.

With the system of the present disclosure, the following advantages can be obtained:

(1) realizing a throughput that is difficult to reach by manual operation in the research and development and production stage, and realizing a throughput increase of two orders of magnitude. Configuring a full-process intelligent scheduling system to maximize equipment and facility throughput and eliminate waiting waste in the process;

(2) Effectively avoid cross contamination of different batches of samples in the culture process during large-scale production. Continuously maintain high cleanliness of samples and environment during the production process;

(3) The whole process of anthropomorphic operation and match the molecular extraction of common process modules, high flexibility to match the needs of different process operations;

(4) Flexible process editing capabilities, and save common process flow within the system software, to achieve high-speed switching of processes in the research and development stage;

(5) Continuous collection, storage and analysis of process parameters and process results during the process to achieve online optimization of the process;

(6) Flexible adjustment of different production scales;

(7) Using high-throughput fully automated temperature-controlled incubator arrays to realize large-scale cultivation of seed bacterial fluids, and providing expansion interfaces for rapid scale-up;

(8) Realization of single day hundred/thousand/ten thousand level culture of units with different sequence design plasmid culture vectors.

Other embodiments of the present disclosure are disclosed below.

Referring to FIGS. 1-15, the present invention provides a technical solution:

An automated production system suitable for the extraction of macromolecules, comprising

(5) Centrifuge tube uncapping unit: including: loading linear module, uncapping machine working head, automatic positioning and alignment mechanism; after the robot transfers the centrifuge tube tray to the linear module, the positioning mechanism performs automatic clamping and alignment operation;

(6) Magnetic bead sorting unit: while adsorbing magnetic beads, automatically dumping the waste supernatant;

(7) Cryopreservation tube uncapping unit: including: loading linear module, uncapping machine working head, automatic positioning and alignment mechanism; after the robot transfers the centrifuge tube tray to the linear module, the positioning mechanism performs automatic clamping and alignment operation;

(8) Temperature-controlled centrifuge unit;

(9) Pipetting platform;

(10) Pipetting unit; which independently moves the pipetting unit along the Z-axis, and is installed on the SCARA robot platform; compared with the traditional X-Y-Z linear motor pipetting platform, it realizes a larger range of pipetting operations and greatly improves the flexibility in the operation process;

(11) Side view of the basic structure of the core operating system, the working table surface is optimized to achieve a near unidirectional material flow, further improving the throughput and efficiency of the production line;

1. The size of the incubator array can be adjusted to increase or decrease in number based on actual process needs;

2. Other culture methods such as bit reactor array can be replaced;

3. The core operating system can be increased in number based on actual process requirements and interfaced with a fully automated culture system;

4. Based on the actual process requirements, the types and quantities of robot units, various types of consumable uncapping units, bead handling units, centrifuge units, pumping units, pipetting units, etc., can be adjusted within the core liquid operating system;

5. Based on the actual process requirements, the internal layout of the core system is adjusted;

A complete example process of molecular extraction: as shown in Fig. 14; the core operating system is configured with a complete electrical control system to realize the automated operation of the whole process: as shown in Fig. 15.

Although embodiments of the present invention have been shown and described, it will be