

PATENT SPECIFICATION

(11)

1599618

1599618

- (21) Application No. 22150/78 (22) Filed 24 May 1978 (19)
 (31) Convention Application No. 7724342 (32) Filed 8 Aug. 1977 in
 (33) France (FR)
 (44) Complete Specification published 7 Oct. 1981
 (51) INT. CL.³ C12M 1/38 C12N 1/14
 (52) Index at acceptance
 C6F 102 AP



(54) PROCESS AND INSTALLATION FOR TREATING RESIDUAL WATER

(71) We, CHRIST FILS S.A., a French Company, of 65 Rue de Paris, 72160 Connerre, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is related to an installation for treating residual water, especially residual water resulting from the manufacture of sauerkraut, in order to transform said water into proteinic food products.

It should be noted that, as far as the treatment of residual water resulting from the manufacture of sauerkraut is concerned, by way of example, about 19.50 tons of residual water are obtained per 100 tons of cabbage.

The composition of the residual water varies from one factory to another, but generally speaking the B.O.D. (biochemical oxygen demand) needed per ton of fermented cabbage varies between 6 and 7kg. Recent research work has shown that yeasts can grow on such residual water, the average yield being 0.65kg of yeast per kilo of B.O.D.

Such a treatment of residual water not only solves pollution problems, which in the case of sauerkraut residual water are particularly difficult to overcome (as the latter has a high content of sodium chloride, a high B.O.D. value and acid pH), but also leads to the recovery of proteins which can serve as food for live-stock, as well as food for human beings at the cost of supplementary treatments.

One of the main objects of the present invention is to provide an installation which allows the industrial treatment of residual water and its transformation into proteinic food stuff, particularly in the case of residual water from sauerkraut, by promoting the development of yeasts such as *Candida utilis*.

According to this invention there is provided an installation for treating residual water from an industrial process so as to derive therefrom proteinic food products, said installation comprising in combination:

a fermentation vat having an agitator at the bottom thereof and a foam separator at

the top thereof;

respective storage vessels for residual water and for a nutritive fluid; means for supplying a mixture of said residual water and nutritive fluid to said fermentation vat, said supplying means including a static mixer connected to said vat and means including separate metering devices separately to meter the residual water and nutrient fluid to said static mixer; means for simultaneously controlling conditions within said fermentation vat affecting the growth of said proteinic food products therein, said controlling means including first means responsive to the temperature in said vat and a variable cooling circuit controlled in accordance with the response of said first responsive means second means responsive to the oxygen content in said vat and an air booster controlled in accordance with the response of said second responsive means, and third means responsive to the hydrogen ion concentration in said vat and means variably dispensing hydrogen ion concentration modifying materials into said vat in accordance with the response of said third responsive means: and means enabling discharge of fermented materials from said fermentation vat, said discharge means including a discharge conduit, a defoaming vat connected to said discharge conduit, means for transporting material from said defoaming vat to a centrifugal separator, a storage tank connected to receive the concentrated output of said separator, means for cooling the content of said storage tank, means for conveying the said cooled contents to a drum dryer, and conveyor means for transporting dried output material from said dryer.

Preferably said residual water results from the manufacture of sauerkraut and said proteinic food products are yeasts.

The invention also relates to a method of treating residual water resulting from the manufacture of sauerkraut comprising supplying the residual water, and nutritive fluid to the said respective storage vessels of an installation as described above and subsequently supplying said residual water and said nutritive fluid oxygen to the fermenta-

55

60

65

70

75

80

85

90

95

100

tion vat of said installation, adjusting the pH of the medium within the vat, growing yeast in the residual water in the vat whilst stirring the liquid in the vat and removing heat, by cooling means, so as to maintain a desired temperature, separating foam from the liquid within the vat in the defoaming vat of said installation, subsequently passing the contents of the vat to the centrifugal separator of said installation to obtain a suspension or paste containing an enhanced proportion of yeast as compared with the medium passed to the separator from the vat, and passing the suspension so obtained from the separator to the said storage tank of said installation.

Other features of the invention will become apparent from the following description, given by way of example, with reference to the single appended figure, which illustrates schematically one embodiment of the installation according to the invention.

In the embodiment described and shown, the installation comprises a fermentation vat 10 fed through a static mixer 12 and a feeding conduit 11 with a mixture introduced into said mixer by means of conduit 13 connected to a storage tank 14, said mixture containing residual water and various nutritive salts fed into the same mixer through the conduit 15 from a tank 16. Metering pumps 18 and 19 provided respectively on the conduits 13 and 15 feed the mixture to the vat or reactor 10.

The yeast growth depends particularly upon the pressure and temperature conditions, or on the oxygen concentration and the pH of the reaction medium.

The installation comprises an air booster 20 which feeds air into the fermentation vat 10 via a conduit 21, and thus ensures the supply of oxygen necessary for the growth of the yeast.

In order to control the pH of the reaction medium, a control device 22 is adapted to discharge ammonium hydroxide or phosphoric acid, as appropriate, into the vat 10 via a conduit 23.

This control device 22 is controlled by a control cabinet 24 which receives information from a pH gauge 27 provided in the fermentation vat 10.

This control cabinet also acts upon the booster 20 under the action of a gauge 26, which measures the oxygen content, and upon the flow rate of cooling fluid in a cooling device 28, comprising a cooling circuit 29 which penetrates the fermentation vat 10 in order to maintain the fermentation temperature constant, in response to information or signals received from a temperature gauge 30, which is located in the vat and connected to the control cabinet.

The Fermentation vat 10 is further equipped with an agitator, or stirrer, 31 provided in its lower portion and driven by a

motor, as well as a foam separator 32 provided in the upper portion of the vat.

The fermented mixture is discharged from the vat in the form of a suspension. (The term "suspension" is used herein to include a paste). The suspension is then passed through conduit 33 and is stocked in a defoaming vat 34. The collected suspension is then fed through conduit 35 under the action of a volumetric pump 36 to a centrifugal separator 37, in which the suspension is concentrated. The thus concentrated suspension is discharged through the conduit 38 into storage tank 39 comprising a cooling circuit 40, and then is pumped by a pump 42 through a conduit 41 onto a drum drier 43, provided with conveying means in order to fill the dry yeast into containers, bags, or barrels.

As indicated herein above, the described installation for treating residual water is particularly adapted to be used for the treatment of residual water obtained when manufacturing sauerkraut.

Provided that a few modifications and additions are made to the described installation, the latter may be used alternatively for the manufacture of vinegar by fermentating alcohol. Such an alternative use, for example in a preserve plant which, according to the seasons, manufactures sauerkraut or cans gherkins, can give rise to increased productivity of the installation and lead to its accelerated amortization.

Another object of the present invention is a process for reducing the volume of residual water from the manufacture of sauerkraut, which process is carried out in a single stage fermentation vat by transforming the organic matter carried by the effluent into a biomass adapted to be used for alimentary purposes. The yield of such a reduction is about 90 to 95%.

WHAT WE CLAIM IS:—

1. An installation for treating residual water from an industrial process so as to derive therefrom proteinic food products, said installation comprising in combination:

a fermentation vat having an agitator at the bottom thereof and a foam separator at the top thereof;

respective storage vessels for residual water and for a nutritive fluid;

means for supplying a mixture of said residual water and nutritive fluid to said fermentation vat, said supplying means including a static mixer connected to said vat and means including separate metering devices separately to meter the residual water and nutrient fluid to said static mixer;

means for simultaneously controlling conditions within said fermentation vat affecting the growth of said proteinic food products therein, said controlling means including first

tion vat of said installation, adjusting the pH of the medium within the vat, growing yeast in the residual water in the vat whilst stirring the liquid in the vat and removing heat, by cooling means, so as to maintain a desired temperature, separating foam from the liquid within the vat in the defoaming vat of said installation, subsequently passing the contents of the vat to the centrifugal separator of said installation to obtain a suspension or paste containing an enhanced proportion of yeast as compared with the medium passed to the separator from the vat, and passing the suspension so obtained from the separator to the said storage tank of said installation.

Other features of the invention will become apparent from the following description, given by way of example, with reference to the single appended figure, which illustrates schematically one embodiment of the installation according to the invention.

In the embodiment described and shown, the installation comprises a fermentation vat 10 fed through a static mixer 12 and a feeding conduit 11 with a mixture introduced into said mixer by means of conduit 13 connected to a storage tank 14, said mixture containing residual water and various nutritive salts fed into the same mixer through the conduit 15 from a tank 16. Metering pumps 18 and 19 provided respectively on the conduits 13 and 15 feed the mixture to the vat or reactor 10.

The yeast growth depends particularly upon the pressure and temperature conditions; or on the oxygen concentration and the pH of the reaction medium.

The installation comprises an air booster 20 which feeds air into the fermentation vat 10 via a conduit 21, and thus ensures the supply of oxygen necessary for the growth of the yeast.

In order to control the pH of the reaction medium, a control device 22 is adapted to discharge ammonium hydroxide or phosphoric acid, as appropriate, into the vat 10 via a conduit 23.

This control device 22 is controlled by a control cabinet 24 which receives information from a pH gauge 27 provided in the fermentation vat 10.

This control cabinet also acts upon the booster 20 under the action of a gauge 26, which measures the oxygen content, and upon the flow rate of cooling fluid in a cooling device 28, comprising a cooling circuit 29 which penetrates the fermentation vat 10 in order to maintain the fermentation temperature constant, in response to information or signals received from a temperature gauge 30, which is located in the vat and connected to the control cabinet.

The Fermentation vat 10 is further equipped with an agitator, or stirrer, 31 provided in its lower portion and driven by a

motor, as well as a foam separator 32 provided in the upper portion of the vat.

The fermented mixture is discharged from the vat in the form of a suspension. (The term "suspension" is used herein to include a paste). The suspension is then passed through conduit 33 and is stocked in a defoaming vat 34. The collected suspension is then fed through conduit 35 under the action of a volumetric pump 36 to a centrifugal separator 37, in which the suspension is concentrated. The thus concentrated suspension is discharged through the conduit 38 into storage tank 39 comprising a cooling circuit 40, and then is pumped by a pump 42 through a conduit 41 onto a drum drier 43, provided with conveying means in order to fill the dry yeast into containers, bags, or barrels.

As indicated herein above, the described installation for treating residual water is particularly adapted to be used for the treatment of residual water obtained when manufacturing sauerkraut.

Provided that a few modifications and additions are made to the described installation, the latter may be used alternatively for the manufacture of vinegar by fermenting alcohol. Such an alternative use, for example in a preserve plant which, according to the seasons, manufactures sauerkraut or cans gherkins, can give rise to increased productivity of the installation and lead to its accelerated amortization.

Another object of the present invention is a process for reducing the volume of residual water from the manufacture of sauerkraut, which process is carried out in a single stage fermentation vat by transforming the organic matter carried by the effluent into a biomass adapted to be used for alimentary purposes. The yield of such a reduction is about 90 to 95%.

WHAT WE CLAIM IS:—

1. An installation for treating residual water from an industrial process so as to derive therefrom proteinic food products, said installation comprising in combination: a fermentation vat having an agitator at the bottom thereof and a foam separator at the top thereof;

respective storage vessels for residual water and for a nutritive fluid;

means for supplying a mixture of said residual water and nutritive fluid to said fermentation vat, said supplying means including a static mixer connected to said vat and means including separate metering devices separately to meter the residual water and nutrient fluid to said static mixer;

means for simultaneously controlling conditions within said fermentation vat affecting the growth of said proteinic food products therein, said controlling means including first



means responsive to the temperature in said vat and a variable cooling circuit controlled in accordance with the response of said first responsive means, second means responsive to the oxygen content in said vat and an air booster controlled in accordance with the response of said second responsive means, and third means responsive to the hydrogen ion concentration in said vat and means variably dispensing hydrogen ion concentration modifying materials into said vat in accordance with the response of said third responsive means;

and means enabling discharge of fermented materials from said fermentation vat, said discharge means including a discharge conduit, a defoaming vat connected to said discharge conduit, means for transporting materials from said defoaming vat to a centrifugal separator, a storage tank connected to receive the concentrated output of said separator, means for cooling the contents of said storage tank, means for conveying the said cooled contents to a drum dryer, and conveyor means for transporting dried output material from said drum dryer.

2. An installation according to claim 1, in which said residual water results from the manufacture of sauerkraut and said proteinic food products are yeasts.

3. A method of treating residual water resulting from the manufacture of sauerkraut comprising supplying the residual water and nutritive fluid to the said respective storage vessels of the installation according to claim 1 or claim 2 and subsequently supplying said residual water and said nutritive fluid and oxygen to the fermentation vat of said installation, adjusting the pH of the medium within the vat, growing yeast in the residual water in the vat whilst stirring the liquid in the vat and removing heat, by cooling means, so as to maintain a desired temperature, separating foam from the liquid within the vat in the defoaming vat of said installation, subsequently passing the contents of the vat to the centrifugal separator of said installation to obtain a suspension or paste containing an enhanced proportion of yeast as compared with the medium passed to the separator to the said storage vessel of said installation.

4. An installation according to claim 1 substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

5. A process according to claim 3 and substantially as hereinbefore described with reference to the accompanying drawings.

6. Yeast derived from a suspension produced by a method according to claim 3 or claim 5.

FORRESTER, KETLEY & CO.,
Chartered Patent Agents,
Forrester House,
52 Bounds Green Road,
London N11 2EY,
also at
Rutland House,
148 Edmund Street,
Birmingham B3 2LD,
and
Scottish Provident Building,
29 St. Vincent Place,
Glasgow G1 2DT.
Agents for the Applicant.

Printed for Her Majesty's Stationery Office by Burgess & Son
(Abingdon) Ltd.—1981. Published at The Patent Office,
25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

