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Steam Treatment Apparatus

DESCRIPTION:

Technical Field

- 5 The invention relates to steam treatment apparatus suitable for sterilization, particularly but not exclusively of palm fruit prior to threshing and the extraction of oil.

Background Art

- 10 Palm fruit fresh from the plantation generally requires sterilization by steam treatment to prevent a rise in free fatty acid content which otherwise occurs soon after the fruit has been cut from the tree. Sterilization also facilitates the breaking away of individual fruit from the bunch later in the processing, and assists in conditioning
- 15 the nut within the fruit. Complete fruit bunches are collected into trucks each having a capacity of from 1.5 to 2.5 tonnes of fruit. The trucks are wheeled on rails into a horizontal cylindrical sealable sterilizer vessel, about 2 metres in diameter and of a length sufficient to

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accommodate a number of trucks one behind another. An oil mill may comprises a number of such sterilizers, and may have a throughput of from 10 to 60 tonnes of fruit per hour.

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When the sterilizer vessel is loaded with trucks of fruit, the vessel is sealed, and live steam is introduced, normally at a pressure of about 3 atmospheres gauge. About 230 to 260 kilogrammes of steam per tonne of fruit is
10 required for sterilization, and is condensed in the process. The condensate becomes contaminated with palm fruit oil and debris, and highly polluted. The sterilizer may be provided with a deaerator and/or a short-hold control system whereby the steam is discharged, and the
15 sterilizer refilled, but this produces more pollution. The problem is to dispose of this polluted condensate in an environmentally acceptable manner.

The Invention

20 According to the invention there is provided apparatus for steam treatment comprising a sealable vessel, an inlet for live steam into the vessel, a truck formed with an apertured false bottom for conveying goods to be treated into the vessel, a dam for hindering the escape of
25 condensate from the bottom of the vessel when open, and means for heating the condensate in the bottom of the vessel, the truck having an ^{outer or rec.} bottom formed so as to retain condensate, debris and oil.

30 By forming the bottom of the truck so as to retain condensate, debris and oil, the oil that normally drips from the fruit at this stage can be saved, instead of being left in the treatment vessel in polluted condensate. This oil may be passed on with the fruit or separated at this
35 stage for further processing when the remainder of the oil is being extracted. The condensate which falls outside the

truck is relatively un-polluted, and can advantageously be re-used in the steam treatment by the heating at the bottom of the vessel.

- 5 The truck is ~~preferably~~ formed with an apertured false bottom so that the condensate and oil are retained separate from the fruit. The outer or real bottom is preferably provided with a vent through which liquid contents can be allowed to escape when desired. The vent is kept closed
10 while the truck is in the vessel, and normally until after the entire contents of the truck have been emptied and taken away for further processing. The apparatus may include means for opening the vent before the truck enters the vessel to allow the escape of any liquid (such as rain)
15 which may have collected in the truck. Alternatively, the vent may be left open after the truck has been emptied to prevent any liquid collecting, and may be closed just before the truck enters the vessel. Thus the truck does not convey into the vessel any unwanted liquid as this
20 would be wasteful in that it would require heating.

- Yet another alternative arrangement is for the vent to be opened after the truck has left the vessel and before its solid contents are emptied. Thus the collected oil and
25 condensate could drop into a tray and/or sump. Instead of going through the full milling process, the oil and condensate could be pumped direct to a clarification system. Here oil, water and sludge could be separated before the oil at least is recombined with that extracted
30 later for further processing. The outer bottom of the truck may alternatively or in addition be provided with an overflow pipe having an overhanging cap to allow the escape of water above the predetermined depth while retaining the oil floating on the water.

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Palm oil mills usually generate their own power by burning surplus fibre and shells from the fruit and using a steam engine or turbine, and the steam is also used in the sterilization process. In the apparatus according to the invention, the means for heating in the bottom of the treatment vessel is preferably a box, through which steam is passed, having a number of upright tubes open at the top and forming an integral part of the box. The condensate falls around the inside of the vessel into the tubes, and is quickly re-heated to take further part in the treatment. The upright tubes are easy to clean by access from above. Alternatively, if the steam is available at higher pressure and temperature, the means for heating could comprise a coil or series of pipes in the bottom of the treatment vessel having sufficient surface area to raise the requisite amount of steam for the sterilization. In this alternative, the heating steam would be inside the pipes, whereas in the preferred means above the heating steam is outside the upright tubes in the box. Yet another possibility is for the heating medium to be oil, which could operate at high temperature and be used instead of heating steam in the pipes of the above alternative arrangement.

A gauge is preferably provided for indicating the level of condensate in the bottom of the treatment vessel. Means can also be provided for determining when additional live steam is required and injecting it into the vessel. With the aid of a timer the amount of steam injected can be controlled, and the vessel filled with steam two or three times in a single treatment if desired. The overall amount of steam needed to treat a given quantity of goods is thus reduced with a saving of fuel and water, as the water from the heater is pure and hot and can be re-used. The amount of water can be reduced by flash steam and/or as hot

condensate passed back in the boiler. Thus saving of steam heating of boiler feed water may be achieved and/or low pressure steam supply that can be used instead of main line steam.

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Steam may be raised in a separate generator and used together with main line steam to feed a number of treatment vessels according to the invention under the control of the timer unit. Condensate may be fed back from the vessel to
10 the generator through a filter to remove oil and debris by a pump (before or after the filter) or by gravity depending on height availability. The timer unit cooperates with monitor devices, liquid level and temperature sensors to control the apparatus in a fail-safe manner.

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Drawings:

Figure 1 is a section ~~on A-A~~ near an end cover of a sealable vessel in apparatus according to the invention;
Figure 2 is a central cross section ~~on B-B~~ through the
20 vessel shown in Figure 1;
Figure 3 is a cross section ~~on B-B~~ in Figure 4 of a truck in the apparatus of Figure 1 and 2;
Figure 4 is a side elevation of the truck in Figure 3;
Figure 5 shows details of a vent in the bottom of the truck
25 in Figure 3;
Figure 6 is a section of the vent at right angles to that of Figure 5;
Figure 7 shows details of an overflow pipe in the bottom of the truck in Figure 3; and
30 Figure 8 is a diagram showing an arrangement of a number of treatment vessels in apparatus according to the invention fed by a separate steam generator.

Best Mode

35 With particular reference to Figure 1, a sealable vessel 10

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is provided with an inlet 11 for live steam at the top. A truck 14 conveying palm fruit to be treated in the vessel 10 is shown running on rails 15. A dam 18 (Figure 2) hinders the escape of condensate from the bottom of the vessel 10 when open. Pipes 20 for conveying steam constitute means for heating the condensate in the bottom of the vessel 10. The truck 14 is formed with a solid outer bottom so as to retain condensate, debris and oil.

Figure 1 also shows that the vessel 10 has a steam exhaust valve 22, a deaeration valve or trap 23, a drain valve 24, a condensate return line 25, and an indicator 26 for the level of the liquid in the bottom of the vessel 10. On the outer end of the truck 14 is a wheel 27 to assist in turning over to empty the truck 14.

Figures 3 and 4 show that the truck 14 has a false bottom 30 comprising an apertured plate spaced by a bracket 32 from an outer or real bottom 34. At each side there is a row of holes 36 above the level of the bottom 34 to allow steam to enter to the fruit through the false bottom 30, and condensate, oil and debris to escape into the process on turning over the truck 14. The upper parts of the sides of the truck 14 are apertured, but the lower parts are solid so as to retain condensate. Figures 3 and 4 also show a vent 40 and an overflow 50 which are shown in more detail in Figures 5, 6 and 7.

Turning now to Figure 5, the vent 40 comprises a valve member 42 held in a closed position on a seating 43 by a spring 44, and openable before the truck enters the treatment vessel 10 by a cam 45 pivotted at 46 and actuatable by contact between a trip (not shown) and rollers 47.

Figure 7 shows that the overflow 50 comprises a threaded

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pipe 52 mounted by means of a height adjustment nut 54 in the outer bottom 34. An upper end of the pipe 52 is fitted with a cap 56 which overhangs the open end of the pipe 52 and so allows water above a predetermined depth in the
5 bottom of the truck 14 to escape while retaining oil floating on the water.

Industrial Application

In operation, a number of trucks 14 loaded with palm fruit
10 are rolled into the vessel 10 along the rails 15. The vessel 10 is then sealed, and live steam is introduced through the inlet 11. Air can discharge through the valve 23, and enough steam is allowed in to fill the vessel 10. Steam feed is then cut off, and the level of the condensate
15 in the bottom of the vessel 10 is observed at the indicator 26. When a certain amount of liquid has collected, steam is fed through the pipes 20 in order to re-evaporate the condensate. This is monitored so as to prevent the
20 outsides of the pipes 20 in the vessel 10 becoming dry or flooded, and when necessary the vessel is again filled with steam a number of times to complete the sterilization treatment.

The vessel 10 is exhausted of steam through the valve 22,
25 the valve to the heater pipes 20 is closed, the vessel is unsealed and opened. The trucks 14 are rolled out along the rails 15, and taken away for emptying and passing the fruit to further processing. The trucks 14 contain condensate which has been formed inside the trucks and on
30 the fruit, and which consequently contains palm oil, debris and other pollutants. This is introduced into the process for further treatment with the fruit.

The condensate remaining in the bottom of the vessel 10 has
35 been formed on the inside of the vessel itself and on the

outside of the truck 14, and so is relatively clean and pure. It remains in the bottom of the vessel 10 at a relatively high temperature, and so can be reused in a further sterilization process with a consequent saving of fuel and water.

In the arrangement of Figure 8, four treatment vessels V in apparatus according to the invention are fed with main line steam in the usual way through valves A and by auxiliary steam from a separate generator G through valves B. Each vessel V is provided with an exhaust valve C, a condensate valve D, and a deaerator H. The steam generator G is itself heated by main line steam when admitted through a valve E to a heater coil or vertical tube bank. The generator G is also provided internally with a hood G' to prevent splash being carried over into the vessels V, and externally with a level control LC. Main line steam is fed through a pressure reducing valve F to a low pressure line, and to a flash tank T to which spent main line steam goes after heating the generator G and passing through a steam trap TR. Condensate from the valves D is passed through a pump P and filter to remove oil and debris and thence into the steam generator G.

The valves A, B, C, D, E, F are under the control of a timer unit or sequence controller (not shown) whereby main line steam and auxiliary steam are admitted to the various vessels V and condensate is allowed to leave as appropriate. Depending on the temperature of the main line steam, the stage of the sterilizing cycle in each vessel V, and the temperature of the condensate entering the generator G, the timer unit directs main line or auxiliary steam to each vessel V, and main line steam to the generator G, and allows condensate, steam and/or air to leave each in the most economical manner. The level of

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liquid in the generator G can be increased by direct injection of water if desired, or reduced by discharge of water. By flashing steam to low pressure in the tank T, it can be further utilized in the process lines returning
5 condensate to the boiler feed water tank, thereby saving heat.



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CLAIMS:

1. Apparatus for steam treatment comprising a sealable vessel, an inlet for live steam into the vessel, a truck formed with an apertured false bottom for conveying goods to be treated into the vessel, a dam for hindering the escape of condensate from the bottom of the vessel when open, and means for heating the condensate in the bottom of the vessel, the truck having an ^{outer or real} bottom formed so as to retain condensate, debris and oil.
 2. Apparatus according to claim 1 in which the outer or real bottom of the truck is provided with a vent through which liquid contents can be allowed to escape when desired.
 3. Apparatus according to claim 2 which includes means for opening the vent before the truck enters the vessel.
 4. Apparatus according to any preceding claim in which the means for heating comprises a box, through which steam is passed, having a number of upright tubes open at the top and forming an integral part of the box.
 5. Apparatus according to any preceding claim in which a number of vessels are fed with steam from a separate generator under the control of a timer unit.
 6. Apparatus for steam treatment as herein described with reference to the drawings.
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