

DEHYDRATOR

This invention relates to apparatus for carrying out dehydration of organic material, of the type in which such material is passed from an agitating chamber and through inlet and outlet paths of a dehydrating tower by means of a stream of heated air. Such apparatus is used in the production, for example, of fish meal, and the production of dehydrated meal from various organic raw materials such as meat products, waste materials from poultry and fish processing.

Apparatus of the type referred to is well known in the art, and generally comprises means for the supply of raw material and heated air to an agitator in which the material is partially comminuted and dried until its density is such that it is carried upwardly into a dehydrating tower where final dehydration takes place, the fully treated material being recovered from the air stream beyond the tower by suitable means such as a cyclone.

Equipment of this type known in the prior art suffers from the disadvantage of being incapable of ready adaptation to different types of feed material, and to feed material of different quality. The present invention provides a dehydrating apparatus which offers greater flexibility in this regard, by providing apparatus in which the residence time of material within the dehydrator may readily be altered, even during continuous operation.

According to the present invention there is provided apparatus for carrying out dehydration of organic material which in use is passed from an agitating chamber through first and second paths of a dehydrating tower by means of a stream of heated air, all said material being passed by said stream upwardly along said first path and downwardly along said second path, at least said first path having a substantially constant cross section and there being provided means for selectively varying the length of the path of all said material in said tower so as to vary the residence time of all said material therein.

In a preferred embodiment of the invention, the tower includes therein substantially upright baffle means defining on respective opposite sides thereof said first and second paths and there being provided means



operatively associated with said baffle means for selectively varying the effective height thereof whereby to vary the length of the path of said material in said tower.

5 Preferably the baffle means comprise a series of vertically disposed baffles which may be aligned in a common plane so that the material passes upwardly along the first path on one side of said plane over the highest baffle and downwardly along the second path on the other side of said plane. Preferably means are provided to move a selected baffle or baffles to permit passage of the air stream carrying the material from one side of the plane to the other side of the plane at selected vertical locations to vary the height of the path of material in the tower and the residence time of the material therein.

An embodiment of the invention will now be described, by way of an example, with reference to the accompanying drawings, in which:-

15 Figure 1 is a rear elevation of a dehydrator embodying the present invention, taken in the direction of the line 1-1 of Figure 5;

Figure 2 is a side elevation of the dehydrator taken in the direction of the line 2-2 of Figure 5;

20 Figure 3 is a front elevation of the dehydrator taken in the direction of the line 3-3 of Figure 5;

Figure 4 is a side elevation of the dehydrator taken in the direction of the line 4-4 of Figure 5;

Figure 5 is a plan view of the dehydrator;

25 Figure 6 is an end elevation of agitator blades employed in the dehydrator of Figures 1 to 5;

Figure 7 is a plan view of the agitator blades of Figure 6;

Figure 8 is an end view of an agitator blade;

Figure 9 is a an elevation of the baffles employed in the dehydrator of Figures 1 to 8;

30 Figure 10 is a further elevation of the baffles;

Figure 11 is a plan view of the baffle assembly;

Figures 12, 13 and 14 show schematically the baffles in various positions.

35 The illustrated dehydrator comprises a burner 20 which may be fed with oil or other suitable fuel, to provide by means of a blower (not shown) a stream of hot air to an agitator 21. The pneumatic flow through the

apparatus continues from the agitator 21 via a dehydrating tower 22, a classifier 23, a cyclone 24, exhaust duct 25, an exhaust fan 26 and a flue 27.

Organic material is supplied to the dehydrator from a bin 28 via a screw conveyor 29, driven by a motor 30, to the agitator 21 through a gate 31.

As is well known in the prior art, pneumatic flow through the dehydrator is determined both by the blower of the burner 20, and the partial vacuum produced by the exhaust fan 26.

The operation of the illustrated dehydrator will now be described in more detail, including those features which exemplify the novel characteristics of the present invention.

Raw material from the conveyor 29 falls through a chute 32 to the gate 31, and thence to the interior of the agitator 21. The gate 31 is controlled by means of a solenoid 33 which is controlled in response to the load on the agitator 21, sensed by means of a current transformer in the supply circuit of the agitator motor (not shown). In this way, a controlled and constant supply of feed is maintained within the agitator 21.

Rotating within the cylindrical housing of the agitator 21 on a shaft 34 are two sets of arms 35 (Figures 6, 7 and 8). Each set comprises four arms equally disposed about the shaft 34, and each arm comprises a pair of blades having a V-shaped cross-section as shown in the end view of Figure 8, with the free edges of the blades providing sharp cutting edges 36. As the arms 35 rotate within the agitator 21, the material is constantly thrown around and comminuted by the cutting edges 36. Rapid comminution is achieved by the presence of two cutting edges 36 on each arm, and the V-shaped cross-section of the arms 35 facilitates the capture and agitation of the material.

Hot air is supplied to the agitator 21 from the burner 20 through a duct 37, and this is augmented by hot air supplied from the classifier 23 through a duct 38 as referred to below.

As the material is comminuted and dried within the agitator 21, its density falls until it reaches a level which is such that the head pressure within the tower 22 allows the material to rise with the flow of hot air into the tower 22.

The tower 22 is cylindrical in shape, and is provided with a central vertical shaft 39 (Figure 9). Mounted for rotation on the shaft 39 by means

of collars 40 and 41 are a vertically disposed series of baffles 42, 43, 44 and 45. Each of the collars 40 and 41 may rotate independently on the shaft 39, and the topmost collar 41 is coupled with an electric motor 46.

5 Extending downwardly below the lower edge of each of the baffles 42, 43 and 44, are pairs of lugs 47 and 48 respectively located at position spaced by 90° in relation to the shaft 39. These lugs extend to a point below the upper edge of the underlying baffle, to engage that baffle as the baffle to which they are attached rotates, as described below.

10 The baffles 42 through 45 function to define the inlet and outlet paths for the hot air and dehydrated material within the tower 22 as shown schematically in Figures 12, 13 and 14, the lowermost portion of the inlet and outlet flow being defined by a fixed baffle 49.

When the baffles are in the position as shown in Figure 12, hot air and partially dehydrated material enters the tower from the agitator 21 and passes upwardly on the left-hand side (as viewed in Figure 12) of the fixed baffle 49 and the movable baffles 42 through 45, to pass over the baffle 42 and downwardly to exit from the tower at its lower end on the outlet side of the fixed baffle 49. The motor 46 is arranged to drive the collar 41 in successive quadrants of rotation. Actuation of the motor 46 to move the collar 41 through its first quadrant will cause the baffles to adopt the configuration shown in Figure 13, with the upper baffle 42 rotated through 90° to a position where it no longer influences the air flow through the tower, shortening the passage through the tower and, therefore, the residence time of the feed material. When the motor 46 is actuated to rotate the collar 41 through a further quadrant, the lug 47 of the baffle 42 will engage with the baffle 43, rotating it through 90° so that the path through the tower will be further shortened. Continued operation of the motor 46 will ultimately place the baffles in the position shown in Figure 14, where the minimum path length and minimum residence time is determined by the fixed baffle 49.

Reversal of the motor 46 and continued operation through its quadrants of movement will return the baffles to the maximum residence time condition illustrated in Figure 12, as the lugs 48 successively engage underlying baffles.

35 In this way, in a typical installation employing a 4 metre tower, the residence time of product within the tower can be varied between 0.5



seconds and 4 seconds. Of course, with greater tower heights, longer residence times can be achieved.

The baffles 42 through 45 provide three functions within the tower. They divide the air flow within the single tubular tower, they enable the pneumatic head of the tower to be varied, and also the rotation of the baffles, particularly during their return to the maximum path length condition, permits the clearing from the tower wall of any material which may adhere thereto.

This clearing function may be assisted by the provision of scraping blades 50 (Figure 11), mounted on arms 51 disposed at right angles to the lowermost baffle 45.

Air flow and entrained dehydrated material passes from the tower outlet to the classifier 23, which functions to separate air strata of differing densities in a manner well known in the prior art and not, therefore, described here. The classifier 23 splits the air stream into a stream of hot unsaturated air which is returned to the agitator 21 by the duct 38, and a second stream which contains saturated air and the dried solids, this stream being extracted through a manifold 52. If desired, the classifier 23 may be adjusted to direct solids back to the agitator 21 for further drying.

The dried solids and saturated air stream pass from the manifold 52, upwardly through a duct 53 to the cyclone 24. Dried solids are removed from the cyclone 24 at an air lock 54, while saturated air passes from the cyclone 24, through the duct 25 to the exhaust fan 26, whence it is discharged to atmosphere by means of the flue 27.

As in prior art dehydrators, the heat input may be varied by control of the burner 20, and this combined with the great flexibility of residence time achieved by the adjustable baffles, enables the dehydrator of the present invention to operate satisfactorily with a great range of raw material without extensive modification, as would be required in the prior art dehydrators.

While the invention has been described herein in relation to a preferred embodiment, it will be appreciated that the general principles of novelty which have been disclosed, are capable of application in other ways, and the invention is not, therefore, to be regarded as restricted by the preceding description.

For example, instead of mounting the baffles for rotation about a

(24)

vertical axis, the baffles may be mounted on individual horizontal axes. Other arrangements whereby the baffles may be successively rendered inoperative, will be apparent to the skilled person.

CLAIMS

1. Apparatus for carrying out dehydration of organic material which in use is passed from an agitating chamber through first and second paths of a dehydrating tower by means of a stream of heated air, all said material being passed by said stream upwardly along said first path and downwardly along said second path, at least said first path having a substantially constant cross section and there being provided means for selectively varying the length of the path of all said material in said tower so as to vary the residence time of all said material therein.

2. Apparatus as claimed in Claim 1, in which said tower includes therein substantially upright baffle means defining on respective opposite sides thereof said first and second paths and there being provided means operatively associated with said baffle means for selectively varying the effective height thereof whereby to vary the length of the path of said material in said tower.

3. Apparatus as claimed in Claim 2, in which said baffle means comprise a series of vertically disposed baffles.

4. Apparatus as claimed in Claim 3, in which said baffles may be aligned in a common plane such that said air stream passes upwardly along said first path on one side of said plane, above the highest baffle, and downwardly along said second path on the other side of said plane.

5. Apparatus as claimed in Claim 4, in which at least some of said baffles are capable of movement to vary the effective height of said baffle means so as to allow the passage of said stream from said one side to said other side of said plane at selected locations below the upper edge of said highest baffle.

6. Apparatus as claimed in Claim 4 or Claim 5, in which at least some of said baffles are so mounted as to be individually movable out of said plane.



7. Apparatus as claimed in Claim 6, in which at least some of said baffles are mounted for individual rotation about a vertical axis.

8. Apparatus as claimed in Claim 6 or Claim 7, further comprising driving means associated with said baffles, said driving means being actuatable to a first extent to move said highest baffle out of said plane to an inoperative position so that the effective height of said baffle means and the height of said path of material is determined by the second highest baffle.

9. Apparatus as claimed in Claim 8, in which actuation of said driving means to a second extent causes movement of the second highest baffle out of said plane to an inoperative position so that the effective height of said baffle means and the height of said path of material is determined by the third highest baffle.

10. Apparatus as claimed in Claim 9, in which further actuation of said driving means causes movement of further said baffles out of said plane to inoperative positions so that the effective height of said baffle means and said path is determined by the highest said baffle disposed in said plane.

11. Apparatus as claimed in Claim 10, in which each said movable baffle is engageable with an adjacent said baffle whereby when said driving means moves the respective uppermost baffle beyond a certain extent, said uppermost baffle engages with the adjacent lower movable baffle to move said lower baffle to an inoperative position.

12. Apparatus as claimed in any one of Claims 3 to 11, including blade means associated with said baffles, said blade means being arranged on movement of said baffles to cooperate with the walls of said tower to clear adhering material therefrom.

13. Apparatus as claimed in any one of the preceding claims, in which said agitating chamber includes an agitator having a plurality of arms mounted radially on a rotatable shaft, each said arm comprising a pair of parallel blades, said blades being mutually obliquely disposed to present a



21

V-shape in cross-section parallel to said shaft, the free edges of said blades comprising cutting edges directed in the direction of rotation of said shaft.

5 14. Apparatus for the dehydration of organic material in which the material is passed from an agitating chamber and through a dehydrating tower by means of a stream of hot air, said tower including therein substantially upright baffle means defining on respective opposite sides thereof first and second paths for said material, said baffle means being substantially planar so that air stream proceeds upwardly along said first path on one side of said plane, from one side of said plane across said baffle means to the other side of said plane and downwardly along said second path on said other side of said plane, and means operatively associated with said baffle means for varying the effective height thereof whereby to permit passage of said stream from said one side of said plane to the said other side of said plane at selected vertical locations whereby to vary the residence time of said material in said tower.

20 15. Apparatus for the dehydration of organic material in which the material is passed from an agitating chamber and through a dehydrating tower by means of a stream of hot air, said tower including therein substantially upright baffle means defining on respective opposite sides thereof first and second paths for said material, said baffle means including a series of vertically disposed baffles adapted to be aligned in a common plane so that said air stream proceeds upwardly along said first path on one side of said plane, above the highest said baffle, and downwardly along said second path on the other side of said plane and means operatively associated with said baffles for moving a selected said baffle or baffles whereby to permit passage of said stream from said one side of said plane to the said other side of said plane at selected locations along said baffle means whereby to vary the residence time of said material in said tower.

30 16. Apparatus for carrying out dehydration of organic material, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

