Method for processing thin stillage and apparatus for producing a protein-containing product

The invention relates to a method as claimed in the preamble of claim 1 and a device as claimed in the preamble of claim 11.

In the recovery of ethanol in a distillation process, recovered from grains such as corn, wheat and/or triticale, a large amount of stillage is left behind.

This stillage can be used as a feed for livestock farming, among other things.

In the conventional process up until now, the stillage is separated into thin stillage and thick stillage in a decanter. The thin stillage is fed to an evaporator for further reduction in water content and for further concentration. This process step leads to what is known as "stillage syrup". Then, the thick stillage is mixed back in with the stillage syrup and fed to a dryer which takes the dry matter content to above 90 wt.-%. However, this recovered feed can only be fed to ruminants since the fraction of fibrous material is very high, the use of this nutritious feed additive therefore being limited to only a few areas of application.

DE 20 2009 013 389.3 discloses a device for recovering a product in which the thin stillage is concentrated by way of ultrafiltration and then is sent to a dryer together with the thick stillage. This device has essentially proven its effectiveness, but in this case as well, the product produced can only be fed to ruminants. In addition, it has been shown that in the processing of the thin stillage, ultrafiltration can only be operated economically up to a certain concentration level.

Hence, the object of the present invention on the one hand is to provide a method that ensures optimum operation of a filtration unit, and on the other hand provides a device for manufacturing a product of value that contains proteins and fats, and is essentially free of fiber.

Summary

In one aspect, there is provided a method for processing thin stillage, characterized by the following steps:

a) Feeding of thin stillage into a working vessel;

b) Concentrating thin stillage in a filtration unit; and

c) Returning a first substream of concentrated thin stillage to the thin stillage contained in the working vessel in order to adjust the amount of dry matter.

In another aspect, there is provided a device for producing a valuable product containing protein from thin stillage, comprising a working vessel, a filtration unit, a centrifuge, preferably a separator, and a dryer, characterized in that
the filtration unit is connected to the working vessel by way of a return line for a first substream of the concentrated thin stillage.

Detailed Description

The invention meets these objectives referred to above by way of a method with the features of claim 1 and a device with the features of claim 11.

According to the ~~invention~~disclosure, a method for processing thin stillage comprises the following steps:

a) Feeding of thin stillage into a working vessel;

b) Filtering and pre-concentrating thin stillage in a filtration unit; and

c) Returning a first substream of pre-concentrated

thin stillage to the thin stillage contained in the working vessel in order to adjust the amount of dry matter.

By returning the first substream of pre-concentrated thin stillage to the thin stillage located in the working vessel, the dry matter content of the thin stillage can be raised, which facilitates a more optimal process and a higher efficiency of the filtration unit.

Advantageous embodiment variations of the invention are objects of the dependent claims.

After the pre-concentration of the thin stillage by way of the filtration unit, the flow can be split, wherein a first substream is returned to the working vessel and a second substream is further processed.

After the filtration unit, this second substream can be routed to a mechanical solid-liquid separator in which

The wet grains are routed from the decanter 1 to a dryer, such as a drum dryer 2, where the carrier fluid of the wet grains, usually water, is evaporated as much as possible resulting in a nutritious solid, called dry stillage (dried distillers grains with solubles) DDGS, which is used as a feed for livestock farming, among other things.

The thin stillage has a volumetric flow of 6-7 m3/h and is then forwarded to a working vessel 3.

The recovery of proteins and fats from thin stillage TS is described in more detail using a concrete exemplary embodiment in the system of Fig.2.

The working vessel 3 holds $20m^3$ in this concrete exemplary embodiment, and has a total of three inputs 4, 5 and 6. Input 4 of the working vessel 3 is an input for feeding thin stillage (TS) to the system, the input fed from the decanter 1 in Fig. 12, for example. The other inputs 5 and 6 to the working vessel 3 are provided for recycled thin stillage from the process and for the supernatant liquid phase.

The working vessel 3 also comprises an outlet 7 that connects the working vessel 3 to an ultrafiltration unit 9 and allows the transfer of thin stillage from the working vessel 3 to the ultrafiltration unit 9. The thin stillage is transported from the working vessel 3 to the ultrafiltration unit 9 by way of a feed pump 8 at a pressure of 3-4 bar, wherein the feed pump power output is preferably 15 KW.

The ultrafiltration unit 9 is only shown schematically in Fig. 2 and comprises at least one loop pump 10, a cooler 11 and one or more ultrafiltration modules 12.

During the filtration, liquid is drawn out of the thin

Claims

1. A method for processing thin stillage ~~(TS)~~, characterized by the following steps:
a) Feeding of thin stillage ~~(TS)~~ into a working vessel ~~(3)~~;
b) Concentrating thin stillage ~~(TS)~~ in a filtration unit ~~(9)~~; and
c) Returning a first substream of concentrated thin stillage to the thin stillage ~~(TS1)~~ contained in the working vessel ~~(3)~~ in order to adjust the amount of dry matter.

2. The method as claimed in claim 1, characterized in that after the concentration of the thin stillage in a filtration unit ~~(9)~~ a flow splitting is done of the concentrated thin stillage into at least the first substream ~~(TS1)~~ and a second substream ~~(TS2)~~.

3. The method as claimed in claim 2, characterized in that after the flow splitting, at least the second substream ~~(TS2)~~ of the concentrated thin stillage is clarified by a centrifuge, preferably by a separator ~~(16)~~, wherein the thin stillage is further concentrated.

4. The method as claimed in claim 3, characterized in that a concentrated thin stillage with a dry matter amount of more than 12 wt.-%, preferably 18 wt.-% or higher is formed by further concentrating.

5. The method as claimed in claim 3 or 4, characterized in that after clarification, the concentrated thin stillage is dried, forming a product of value containing protein.

6. The method as claimed in one of the previous claims, characterized in that the first substream ~~(TS1)~~ following the flow splitting is at least three times, preferably at least six times greater than the second substream ~~(TS2)~~.

7. The method as claimed in one of the previous claims, characterized in that the thin stillage ~~(TS)~~ fed to the working vessel is prepared by processing grain stillage ~~(WS)~~ in a decanter ~~(1)~~.

8. The method as claimed in one of the previous claims, characterized in that in addition to the concentrated thin stillage a permeate stream ~~(P)~~ is discharged from the filtration unit ~~(9)~~, the permeate stream being routable to an anaerobic wastewater treatment facility or being reusable as process water.

9. The method as claimed in one of the previous claims, characterized in that the flow splitting is done after the concentrating of thin stillage in a filtration unit ~~(9)~~ as a function of the dry matter content of the thin stillage located in the working vessel ~~(3)~~.

10. The method as claimed in one of the previous claims, characterized in that flow control is regulated by way of the flow rate after concentration of thin stillage in a filtration unit ~~(9)~~.

11. A device for producing a valuable product containing protein from thin stillage, comprising a working vessel ~~(3)~~, a filtration unit ~~(9)~~, a centrifuge, preferably a separator ~~(16)~~, and a dryer, characterized in that
the filtration unit ~~(9)~~ is connected to the

working vessel ~~(3)~~ by way of a return line ~~(17)~~ for a first substream ~~(TS1)~~ of the concentrated thin stillage.

12. The device as claimed in claim 11, characterized in that the filtration unit ~~(9)~~ is an ultrafiltration unit.

13. The device as claimed in claim 11 or 12, characterized in that the filtration unit ~~(9)~~ comprises means for flow splitting ~~(15)~~ the concentrated stillage into a first substream ~~(TS1)~~ and a second substream ~~(TS2)~~.

14. The device as claimed in one of the previous claims, characterized in that the means for flow splitting ~~(15)~~ is regulated as a function of the flow rate.

15. The device as claimed in one of the previous claims, characterized in that the centrifuge ~~(16)~~ is connected to the working vessel ~~(3)~~ by way of a return line ~~(18)~~ for returning the clarified centrifugate phase to the working vessel ~~(3)~~.