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(54) **A METHOD FOR PRODUCING A MOLDED FIBRE PRODUCT**

(57) The present disclosure relates to a method of producing a molded fibre product, comprising the steps of:

- a) converting a dry pulp to a wet pulp having a consistency of 2-4 wt.%;
- b) diluting the wet pulp to obtain a diluted pulp having a consistency of 0.8-1.9 wt.%;
- c) storing the diluted pulp in a machine tank;

- d) diluting the diluted pulp from the machine tank to obtain a furnish having a consistency of 0.1-0.7 wt.%;
- e) storing the furnish in a circulation tank;
- f) feeding the furnish from the circulation tank to a forming tank; and
- g) forming the molded fibre product from the furnish in the forming tank.

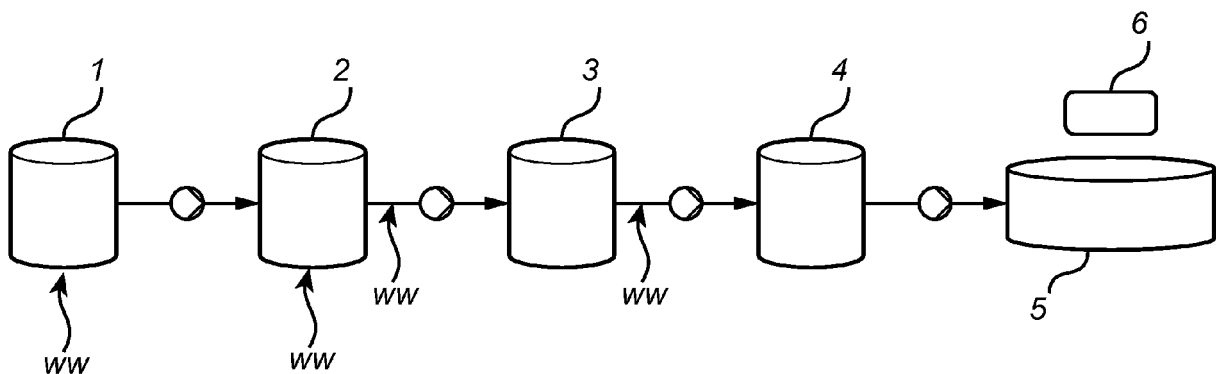


Fig. 1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the field of molded fibre products.

BACKGROUND

[0002] There is a strong desire in today's society to replace plastic packages with more sustainable alternatives. Molded fibre products have emerged as a sustainable alternative to plastic packages.

[0003] However, the high requirements on packages, especially those used for foodstuff, require good control over properties such as stiffness and hydrophobicity.

SUMMARY

[0004] The inventors have realized that there is a need to ensure a consistent production in order to obtain high quality molded fibre products.

[0005] Accordingly, the present disclosure provides a method of producing a molded fibre product, comprising the steps of:

- a. converting a dry pulp to a wet pulp having a consistency of 2-4 wt.%;
- b. diluting the wet pulp to obtain a diluted pulp having a consistency of 0.8-1.9 wt.%;
- c. storing the diluted pulp in a machine tank;
- d. diluting the diluted pulp from the machine tank to obtain a furnish having a consistency of 0.1-0.7 wt.%;
- e. storing the furnish in a circulation tank;
- f. feeding the furnish from the circulation tank to a forming tank; and
- g. forming the molded fibre product from the furnish in the forming tank.

[0006] According to the present method, the fibres are present in a suspension at different consistencies during different steps by the use of a multistep dilution process. The method enables making small consistency changes by first reducing the consistency of the fibre suspension to 5-7 wt.% and then in several steps reducing it to the final 0.1-0.7 wt.%. The multistep dilution process, thus, enables control of the consistency in the forming tank and can thereby ensure a consistent production of high quality molded fibre products having properties that are consistent over a production cycle.

[0007] The consistency of the furnish in the circulation tank and hence, in the forming tank influences the prop-

erties of the molded fibre product such as stiffness and dry content. The consistency will also affect the amount of chemical additives needed to achieve desired properties. Hence, controlling the consistency and keeping it stable, according to the present disclosure, will enable a consistent production and final products having a high quality can be obtained.

[0008] In one embodiment, the method of the present disclosure further comprises the substeps of:

a1) re-pulping the dried pulp in a pulper to obtain an intermediate pulp; and

a2) diluting the intermediate pulp to obtain the wet pulp.

[0009] The dilution step of a2) may be performed using white water obtained from the forming step, step g).

[0010] In another embodiment, the method further comprises dividing step a1) into substeps:

a1.1) preparation of a re-pulped pulp having a consistency of 5.0-7.0 wt.%; and

a1.2) diluting the re-pulped pulp to obtain the intermediate pulp.

[0011] The dilution step of a1.2) may be performed by using washing water that has been used to wash the pulper used to prepare the re-pulped pulp. The washing water may be white water obtained from the forming step, step g).

[0012] In one embodiment, the method further comprises storing the wet pulp prepared in step a) in a storage tank prior to the dilution in step b).

[0013] In one embodiment, the dilution in step b) is performed by using white water obtained from the forming step, step g).

[0014] In another embodiment, the dilution in step d) is performed by using white water obtained from the forming step, step g).

[0015] In one embodiment, the wet pulp obtained in step a) has a consistency of 2-3 wt.%.

[0016] In one embodiment, the diluted pulp obtained in step b) has a consistency of 0.9-1.7 wt.%, such as 1.0-1.5 wt.%.

[0017] In one embodiment, the furnish obtained in step d) has a consistency of 0.4-0.7 wt.%.

[0018] In a further embodiment, chemical additives maybe added to the fibre suspension at any time during the present method. Preferably, at least one chemical additive such as alkyl ketene dimer (AKD), is added to the furnish in the circulation tank.

[0019] During the production of the molded fibre product according to the present disclosure, the fibre suspension is present in several different consistencies and is stored in said consistencies for different time periods. This is beneficial because many chemical additives re-

quire different fibre consistencies and different retention times in order to work optimally.

[0020] In one embodiment, the dry pulp used in step a) has a dry content of 80-95 wt.%, such as 84-92 wt.%. The dry pulp may also have a Canadian Standard Freeness of 375-475 ml, preferably 400-450 ml, when measured according to ISO 5267/2-1980 after repulping according to ISO 5263-2:2204.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Fig 1 shows a schematic view of the different steps of the method.

DETAILED DESCRIPTION

[0022] The present disclosure relates to a molded fibre product produced by a method comprising several dilution steps.

[0023] The method discloses converting a dry pulp into a furnish by means of several dilution steps. The furnish is used in a forming step to prepare the molded fibre product.

[0024] The dry pulp can be chemical and/or mechanical pulp such as chemithermo mechanical pulp (CTMP). CTMP, such as softwood CTMP, is preferred. The pulp preferably has a Canadian Standard Freeness (CSF) of 375-475 ml, preferably 400-450 ml. The CSF is measured according to ISO 5267/2-1980 after repulping according to ISO 5263-2:2204.

[0025] The dry pulp is preferably dried, having a dry content of 80-95 wt.%, such as 84-92 wt.%.

[0026] The first step, step a, of the method of the present disclosure is converting the dried pulp into a wet pulp having a consistency of 2-4 wt.%. This step may comprise re-pulping the dried pulp in a pulper in order to obtain a re-pulped pulp having a consistency of 5-7 wt.%. Preferably the pulper is a low consistency pulper with a capacity to handle large volumes. The dry pulp is preferably diluted to a consistency of 5-7 wt.% prior to re-pulping. The dilution may occur by adding white water obtained from a forming step down-stream of the pulper.

[0027] The re-pulped pulp may be further diluted to form an intermediate pulp. As an example, the consistency of the pulp may be reduced by at least 25 % by this dilution. Accordingly, if the re-pulped pulp has a consistency of 6.0 wt.%, the intermediate pulp may have a consistency of 4.5 wt.% or lower after the dilution.

[0028] The water used to dilute the re-pulped pulp to the intermediate pulp may be washing water used to wash the pulper after pulping. The washing water may be white water obtained from a forming step down-stream of the pulper. The re-pulped pulp may be transferred to a storage tank followed by the washing water, in which case the dilution of the re-pulped pulp to the intermediate pulp occurs in the storage tank.

[0029] The intermediate pulp may be further diluted in order to obtain a wet pulp having a consistency of 2-4

wt.%, such as 2-3 wt.%. The dilution of the intermediate pulp to obtain the wet pulp may occur in the storage tank.

[0030] If the intermediate pulp is obtained directly after re-pulping, the dilution of the intermediate pulp to the wet pulp may occur during the transfer from the pulper to the storage tank (such that the consistency of the wet pulp in the storage tank is 2-4 wt. %). The added water may be white water obtained from a forming step down-stream of the storage tank. The storage time in the storage tank is dependent on the consumption of the furnish in the forming tank but may be 2-6 h.

[0031] In a next step, step b, the wet pulp is diluted to form a diluted pulp having a consistency of 0.8-1.9 wt.%, preferably 0.9-1.7 wt.%, more preferably 1.0-1.5 wt.%.

The dilution may occur during the transfer of the pulp from the storage tank to a machine tank and the dilution may occur by adding white water obtained from a forming step down-stream of the machine tank. The present method further comprises the step of storing the diluted pulp in the machine tank, step c. The diluted pulp may be stored in the machine tank for 30 min - 1.5 h. The residence time, however, is dependent on the consumption rate of the furnish in the forming tank.

[0032] In a further step, step d, the diluted pulp in the machine tank is further diluted and a furnish having a consistency of 0.1-0.7 wt.%, such as 0.4-0.7 wt.% is obtained. The dilution to obtain the furnish may occur during the transfer of the pulp from the machine tank to a circulation tank. The dilution may occur by the addition of white water obtained from a forming step down-stream of the circulation tank. The furnish may be stored in the circulation tank for 5-15 min, step e.

[0033] The method may further comprise monitoring the consistency of the fibre suspension prior to entering the storage tank, the machine tank and/or the circulation tank. By monitoring the consistencies prior to entering the tanks, the desired consistency can be ensured in the tanks.

[0034] In a further step, step f, the furnish in the circulation tank is fed to a forming tank (preferably no dilution step is performed here).

[0035] In a final step, step g, a wire in a form corresponding to that of the end product (typically a tray), is lowered into the forming tank and a fibre layer is formed on the wire by applying vacuum. The formed fibre layer is dried by pressing and heating and a molded fibre product is obtained.

[0036] The method disclosed herein, comprises multiple dilution steps, preferably at least three dilution steps, more preferably at least four dilution steps. Performing the dilution in multiple steps, enables control of the consistency at multiple stages and hence enables a more exact final consistency. The method further enables making small consistency changes by first reducing the consistency to 5-7 wt.% and then in several steps reducing it to the final 0.1-0.7 wt.% which further facilitates the control of the final consistency (consistency of the furnish). By controlling the consistency prior to the forming

step in the range of 0.1-0.7 wt.% and maintaining the consistency within ± 0.05 wt.%, a consistent production of high quality molded fibre products can be obtained. Hence, the combination of the multiple dilution steps together with the dilution conditions, i.e., consistencies, gives rise to superior control of the consistency and hence control over the production and the quality of the molded fibre products.

[0037] Chemical additives such as alkyl ketene dimer (AKD) may be added in order to induce certain properties such as hydrophobicity to the final product. The chemical additives may be added to the fibre suspension at any stage in the present method. Preferably, the chemical additives are added into the circulation tank. The AKD may be added in an amount of 0.3-3 wt. % based on the dry weight of the fibre suspension.

[0038] The addition and the effect of the chemical additives is affected by the consistency of the fibre suspension when the chemical additives are added as well as the retention time. The present method, which allows for several step with different consistencies and different retention times, will thereby also facilitate the addition of the added chemical additives as well as optimise their effect.

[0039] White water from the forming step, step g, is preferably used in all dilution and washing steps in the method disclosed herein. By using the white water in this manner, a reduction of wastewater is obtained and, hence, a more sustainable method for the production of molded fibre products is also obtained.

EXAMPLES

Example 1

[0040] Example 1 discloses a specific embodiment of the production method of a molded fibre product with reference to Fig 1.

[0041] Mechanical pulp having a dry content of 88 % and a Canadian Standard Freeness (CSF) of 425 ml was used as the dried pulp and added into a pulper (1). White water (WW) from a previous forming step was added so that a consistency of 6 wt.% was reached in the pulper (1). The pulp was pulped for about 30 min in order to achieve sufficient shredding and obtain a re-pulped pulp. The re-pulped pulp was transferred to a storage tank (2) and the pulper (1) was washed with white water (from a previous forming step). The wash water was also transferred to the storage tank (2) and used to dilute the re-pulped pulp to an intermediate pulp having a consistency of 4 wt.%.

[0042] The intermediate pulp was further diluted to obtain a wet pulp having a consistency of 3 wt.%. White water from a previous forming step was used to dilute the intermediate pulp and the dilution occurred in the storage tank (2). The average residence time of the wet pulp in the storage tank (2) was 4h.

[0043] The wet pulp was transferred from the storage

tank (2) to a machine tank (3). During the transfer, white water was added in order to dilute the wet pulp to obtain a diluted pulp in the machine tank (3) having a consistency of 1.25 wt.%. The pulp was stored in the machine tank (3) for an average of 1h prior to being pumped to a circulation tank (4).

[0044] During the transfer of the diluted pulp from the machine tank (3) to the circulation tank (4), white water was added in order to dilute the diluted pulp and obtain a furnish in the circulation tank (4) having a consistency of 0.55 wt.%. The furnish was stored in the circulation tank (4) for 5-15 min prior to being feed to a forming tank (5).

[0045] Once the furnish was located in the forming tank (5), a wire (6) in the form of a tray was lowered into the furnish and with the help of vacuum, a wet fibre layer was formed on the wire. The wet fibre layer was then compressed and dried in order to obtain the final molded fibre product.

Claims

1. A method of producing a molded fibre product, comprising the steps of:

- a) converting a dry pulp to a wet pulp having a consistency of 2-4 wt.%;
- b) diluting the wet pulp to obtain a diluted pulp having a consistency of 0.8-1.9 wt.%;
- c) storing the diluted pulp in a machine tank;
- d) diluting the diluted pulp from the machine tank to obtain a furnish having a consistency of 0.1-0.7 wt.%, such as 0.4-0.7 wt.%;
- e) storing the furnish in a circulation tank;
- f) feeding the furnish from the circulation tank to a forming tank; and
- g) forming the molded fibre product from the furnish in the forming tank.

2. The method of claim 1, wherein the step a) comprises the substeps of:

- a1) re-pulping the dried pulp in a pulper to obtain an intermediate pulp; and
- a2) diluting the intermediate pulp to obtain the wet pulp.

3. The method of claim 2, wherein step a2) comprises diluting the intermediate pulp with white water derived from step g).

4. The method of claim 2 or 3, wherein step a1) comprises the substeps of:

- a1.1) preparation of a re-pulped pulp having a consistency of 5.0-7.0 wt.%; and
- a1.2) diluting the re-pulped pulp to obtain the

intermediate pulp.

5. The method of claim 4, wherein the dilution of step a1.2) reduces the consistency by at least 25%. 5
6. The method of claim 4 or 5, wherein step a1.2) comprises dilution of the re-pulped pulp with washing water that has been used to wash the pulper used to prepare the re-pulped pulp. 10
7. The method of claim 6, wherein the washing water is obtained by washing the pulper with white water derived from step g).
8. The method of any one of the preceding claims, wherein the wet pulp prepared in step a) is stored in a storage tank before the dilution of step b). 15
9. The method of any one of the preceding claims, wherein step b) comprises dilution of the wet pulp with white water derived from step g). 20
10. The method of any one of the preceding claims, wherein step d) comprises dilution of the diluted pulp with white water derived from step g). 25
11. The method of any one of the preceding claims, wherein the diluted pulp has a consistency of 0.9-1.7 wt.%, such as 1.0-1.5 wt.%. 30
12. The method of any one of the preceding claims, wherein at least one chemical additive is added to the furnish in the circulation tank.
13. The method of claim 12, wherein alkyl ketene dimer (AKD) is added to the furnish in the circulation tank. 35
14. The method of any one of the preceding claims, wherein the dry pulp used in step a) has a dry content of 80-95 wt.%, such as 84-92 wt.%. 40
15. The method of any one of the preceding claims, wherein the dry pulp used in step a) has Canadian Standard Freeness of 375-475 ml, preferably 400-450 ml, when measured according to ISO 5267/2-1980 after repulping according to ISO 5263-2:2204. 45

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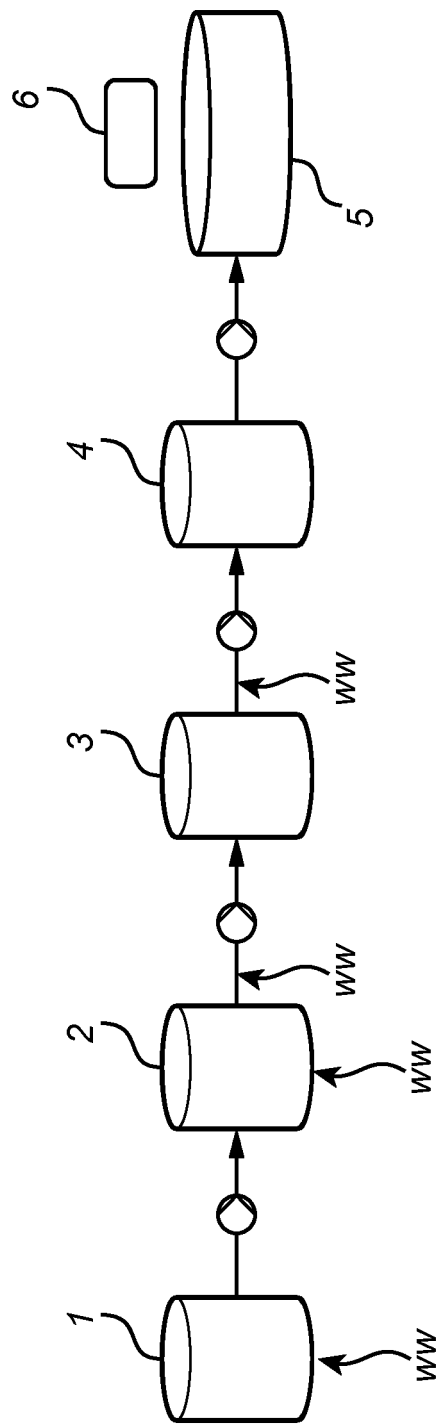


Fig. 1



EUROPEAN SEARCH REPORT

Application Number

EP 22 20 6846

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EPO FORM 1503 03.82 (P04C01)

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A	* page 4, line 5 - page 5, line 24; figures *	4, 5, 7, 13-15	
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A	* paragraphs [0033], [0034]; claims 1-8 *	2-7, 13-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			D21F D21J
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 April 2023	Examiner Pregetter, Mario
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 20 6846

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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