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(54) Title: A METHOD FOR MANUFACTURING MECHANICAL PULP AND A USE OF THE MECHANICAL PULP

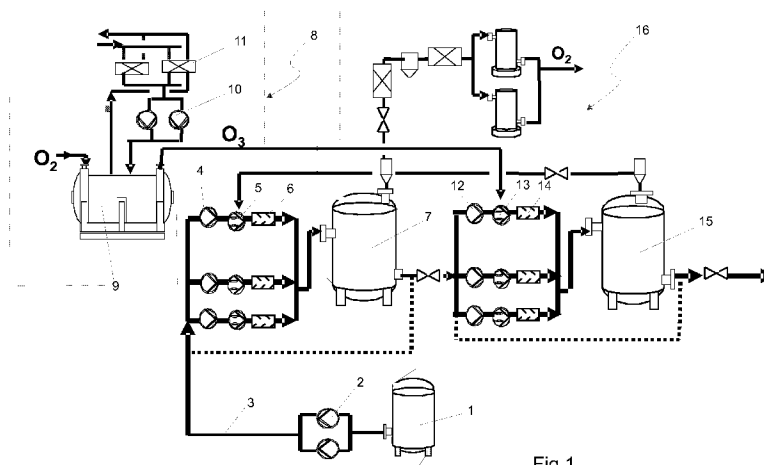


Fig.1

(57) Abstract: The present invention relates to a method for treating mechanical pulp. The method comprises bringing resinous mechanical pulp into process in a process water flow, ozonating the resinous pulp at a temperature which is between 80 and 87°C, preferably between 80 and 85°C, and at pH which is less than 4, adjusting the pH of the pulp after the ozonation process to correspond to the pH required in bleaching, and bleaching the pulp. The present invention also relates to a use of the pulp.

A method for manufacturing mechanical pulp and a use of the mechanical pulp

5 The present invention relates to a method for treating mechanical pulp and a use of the mechanical pulp.

Pitch is a harmful substance in mechanical pulp manufacture. When the raw material is spruce the pitch content is quite low so that it is not probable that the pitch will cause any uncontrolled problems. However, if the raw material
10 is pine, which contains more pitch than spruce (about three times more), the pitch or pitch and fibers will deposit on surfaces during the processing of the resinous raw material, e.g. in a paper machine, or a printing machine, and thereafter detrimental effects are to be expected. Thus, in order to use pine as a pulpwood, the pitch must be reduced or removed, or it must be modified
15 to less harmful components.

The above-mentioned tasks can be accomplished by the method of the invention whose characteristic features are conformable to claim 1.

20 The pulp is treated with ozone in order to remove, reduce or modify the pitch. The pitch is one of the first pulp components with which ozone reacts. However, ozone also tend to react with lignin and as a result, chromophoric compounds are released into the process water. Therefore, the brightness of the pulp is deteriorated, and it cannot fully be recovered afterwards in a
25 subsequent bleaching step in which either dithionite or peroxide is used.

By the method of the invention, it is possible that the pitch is reduced, removed or modified by treating the pulp with ozone so that the optical properties can be recovered by the subsequent bleaching step. In practice, it
30 may be adequate that the pitch content of pine is reduced so that its pitch content after the ozonation corresponds to the pitch content of spruce.

In the method of the invention, the starting raw material consists of logs which have been ground in a PGW (pressure groundwood) process or a GW
35 (groundwood) process. The logs are softwood species, preferably pine (*Pinus sylvestris*), or Southern pine (genus *Pinus*, several different species).

Pine is a highly resinous material whose utilization in mechanical pulping has been a problem because the resinous part of the material is harmful in a process. Pine may be used as a mixture with spruce in groundwood (GW) or pressure groundwood (PGW) pulp. For example, the pine content of the pulp
5 may be 20 to 60 wt.-%, or the pulp may entirely consist of pine. In general, the present method is useful when the pitch content of the wooden raw material is more than 0.8 wt.-% and more useful when the pitch content is more than 2.0 wt.-%. However, nothing prevents the use of the method for raw materials whose pitch content is 0.8 wt.-% or lower but the benefits may
10 be smaller with those materials.

In the method of the invention, resinous mechanical pulp is brought into process in a process water flow. The pulp is ozonated at a consistency which is between 0.5 and 4 %. The pulp is ozonated so that ozone is injected to a
15 mass flow before a container, such as a mass pulp silo. The resinous pulp is ozonated at a temperature which is above 70°C, usually between 80 and 87°C, preferably between 80 and 85°C. In order to achieve the above-mentioned temperature ranges, it is normally required to lower the temperature of the circulating water because the normal temperature is
20 around 95°C.

The ozonation process produces acidic by-products, such as organic acids, which reduce the pH. Therefore, the ozonation takes place at pH which is less than 4 if no means for increasing the pH has been used. However, there
25 is no need to increase the pH because it has been discovered that if the pH is increased over 4 it causes darkening of the pulp. Thus, the natural drop of the pH leads to favourable conditions for treating the pulp if the dose of the ozone is kept on a level less than 1 g/ 1 g pitch to be split. The pulp is preferably ozonated in more than one step; for example, two subsequent
30 steps may produce better result than only one step. In practice, there may be two subsequent silos before which there are injectors which bring the ozone in the process. Before the first silo the pH may be 3.4 and before the second silo 3.2, i.e. the pH may preferably vary between 3.2 and 3.4. The ozone reacts almost immediately with the pitch so that in the gas exiting from the
35 process there is not significant amounts of residual ozone, or there is not at all ozone.

The total amount of ozone in several steps in series is equal to or less than 1 g ozone/ 1 g pitch to be split, preferably 0.6 – 0.8 g O₃/ 1 g pitch. The amount of the pitch is a theoretical amount which has been calculated by using estimations that spruce contains 0.8 wt.-% of pitch and pine contains 2.4 wt.-% of pitch, i.e. one ton of spruce theoretically contains 8000 g pitch, and one ton of pine theoretically contains 24000 g pitch. The practical target is to reduce the pitch content of pine so that it is on the same level with the pitch content in spruce. Normally, the pitch of spruce does not affect pulp or papermaking processes. An overdose of ozone should be avoided because ozone, as mentioned above, tends to react with lignin and as a result, the process water and the pulp will darken.

It is possible to decrease the temperature of the circulating water of the groundwood mill by leading replacement water of lower temperature to the circulating water. The replacement water may be e.g. circulating water from a paper machine which may be situated in the flow direction behind the groundwood mill. Besides lowering the temperature, the replacement water is cleaner than the circulating water of the groundwood mill and thus, the relative amount of the chromophoric compounds reduces in the circulating water and the darkening of the pulp through the process water is reduced. The replacement water may be led in a filtrate chest in which it mixes with the circulating water. Excess circulating water is led out of the process. Heat is recovered from the water by heat exchangers.

After the ozonation the pH of the pulp is adjusted to correspond to the pH of a bleaching step. Thereafter the pulp is bleached by using, for example, dithionite or peroxide. A typical pH range for dithionite bleaching for ozonated pulp is from 4.7 to 5.3, and for peroxide bleaching around 10.5. Therefore, the level to which the pH is adjusted before bleaching is dependent on the subsequent bleaching process. Suitable pH adjusting agents include sodium hydroxide (NaOH), sodium bicarbonate (Na₂CO₃), magnesium hydroxide (Mg(OH)₂), calcium hydroxide (Ca(OH)₂), or their mixtures.

According to one embodiment of the invention, the above-mentioned preferred temperature range, i.e. the range from 80 to 85°C, may be wider

and/or higher (i.e. temperatures up to 95°C are possible) but replacement water is required to clean the circulating water.

The obtained pulp will be used in a paper manufacture process for producing mechanical pulp containing paper grades, such as machine finished specialty (MFS) papers for advertising material, direct mailing, magazines, newspaper inserts and newspapers, newsprint, supercalendered, or base papers for light weight coated papers. The papermaking fibers of such grades may entirely consist of mechanical pulp fibers. It is possible that the mechanical pulp in the paper entirely consists of the ozonated pine but it is also possible that only a certain amount of the mechanical pulp is pine and has been obtained from the process in question. For example, the ozonated GW or PGW pine may be used as a mixture with thermomechanical (TMP) spruce, or chemical pulp. Typical composition of furnishes of the above-mentioned papers grades may be:

Paper grade	PGW (wt.-%)	TMP (wt.-%)	Chemical pulp (wt.-%)	Filler (wt.-%)
Newsprint	40 - 50	50 – 60	0	0 – 10
SC	50	-	25	25
LWC, base paper	55	-	35	10

Example.

20

Eight industrial scale trials were made. Estimations that spruce contains 0.8 wt.-% of pitch and pine contains 2.4 wt.-% of pitch were used, and the required amount of ozone was calculated by using the estimations. The target was that the pitch content of the ozonated pulp should not exceed 0.8 wt.-%. The results of the calculations are shown in table 1.

25

Table 1. Calculations for industrial scale trials.

Trial	PGW pine proportion (wt.-%)	Average pitch in a pulp (wt.-%)	Pitch to be removed (wt.-%)	Pitch to be removed (kg/ton)	Amount of ozone (kg/pitch kg)
1	50	1.60	0.80	8.00	1.29
2	20	1.12	0.32	3.20	0.81
3	20	1.12	0.32	3.20	0.40
4	33	1.33	0.53	5.28	0.75
5	33	1.33	0.53	5.28	0.70
6	33	1.33	0.53	5.28	1.49
7	50	1.60	0.80	8.00	1.03
8	50	1.60	0.80	8.00	0.82

- 5 It was found that the amount of pitch was on an acceptable level after the ozonation. The pulps were led to the paper manufacture. Besides the trial pulp, each paper contained from 5 to 10 wt.-% inorganic filler. The obtained papers did not leave any pitch deposits on roll surfaces. Good results were obtained in printing trials.

10

Next, the invention will be described referring to a drawing which shows a layout of the ozone treatment process.

- Fig. 1 shows a layout of the ozone treatment process. Mechanical pulp has been ground in a grinder from logs, preferably pine logs, to mechanical pulp. There may be several parallel grinders. The mechanical pulp slurry is led to a buffer tank 1 from which it is pumped by pumps 2 to a mass transfer piping 3.

- The pulp slurry is led via the mass transfer piping 3 to a booster pump 4 which raises the pressure of the slurry. An injector 5 brings ozone/oxygen mixture to the slurry from a ozone generating system 8. The ozone generating system 8 (marked by a dashed line) comprises an ozone generator 9, pumps 10 and heat exchangers 11. Mixers 6 stir the

ozone/oxygen mixture into the slurry. As can be seen from Fig. 1, there may be parallel pumps 4, injectors 5 and mixers 6. The ozonated slurry is led to a first mass pulp silo 7. In the first mass pulp silo, the ozone reacts with the pitch in the pulp in a first ozonating step so that the pitch is reduced, removed or modified.

After the first ozonating step, principally the same process step is repeated in a second ozonating step. An injector 13 brings ozone/oxygen mixture to the slurry from the ozone generating system 8. Mixers 14 stir the ozone/oxygen mixture into the slurry. There may be parallel pumps 12, injectors 13 and mixers 14. The ozonated slurry is led to a second mass pulp silo 15. In the second mass pulp silo 15, the ozone reacts with the pitch in the pulp in a second ozonating step so that the pitch, which is left after the first ozonating step, is reduced, removed or modified.

After the pulp has been treated with the ozone, the ozone is led to an ozone destruction section 16 (marked by a dashed line). Ozone is converted to oxygen, and released from the process.

The pulp is led from the second mass pulp silo 15 to a bleaching step (not shown). Before the bleaching, the pulp is treated with alkali so that its pH is suitable for the following step. Suitable alkalis may be sodium hydroxide (NaOH), sodium bicarbonate (Na_2CO_3), magnesium hydroxide ($\text{Mg}(\text{OH})_2$), calcium hydroxide ($\text{Ca}(\text{OH})_2$), or their mixtures.

One skilled in the art understands readily that the layout of the process may be different from the process illustrated in Fig. 1 but it still works according to the basic principle described in this application.

30

Claims:

1. A method for treating mechanical pulp, the method comprising
 - bringing resinous mechanical pulp into a process in a process water flow,
 - ozonating the resinous pulp at a temperature which is between 80 and 87°C, preferably between 80 and 85°C, and at pH which is less than 4,
 - adjusting the pH of the pulp after the ozonation process to correspond to the pH required in bleaching, and
 - bleaching the pulp.
2. The method according to claim 1, **characterized** in that the resinous pulp is ozonated in more than one step, preferably in two steps.
3. The method according to claim 1 or 2, **characterized** in that the amount of ozone is at the most 1 g/ 1g pitch to be split calculated from the theoretical pitch content.
4. The method according to claim 2, **characterized** in that the resinous pulp is ozonated before two successive mass pulp silos.
5. The method according to any preceding claim, **characterized** in that a part of the process water flow is replaced by water which is cleaner than the process water flow after ozonating the pulp but before bleaching the pulp.
6. The method according to claim 5, **characterized** in that the part of the process water flow is replaced by circulating water from a paper machine.
7. The method according to any preceding claim, **characterized** in that the pulp is ozonated at a consistency which is between 0.5 and 4 %.
8. The method according to any preceding claim, **characterized** in that the pulp is bleached with dithionite or peroxide.
9. A use of a pulp produced according to any preceding claim in the paper manufacture.

10. The use according to claim 8, **characterized** in that the pulp is at least partially made of pine.

- 5 11. The use according to claim 8, **characterized** in that the pulp consists of pine.

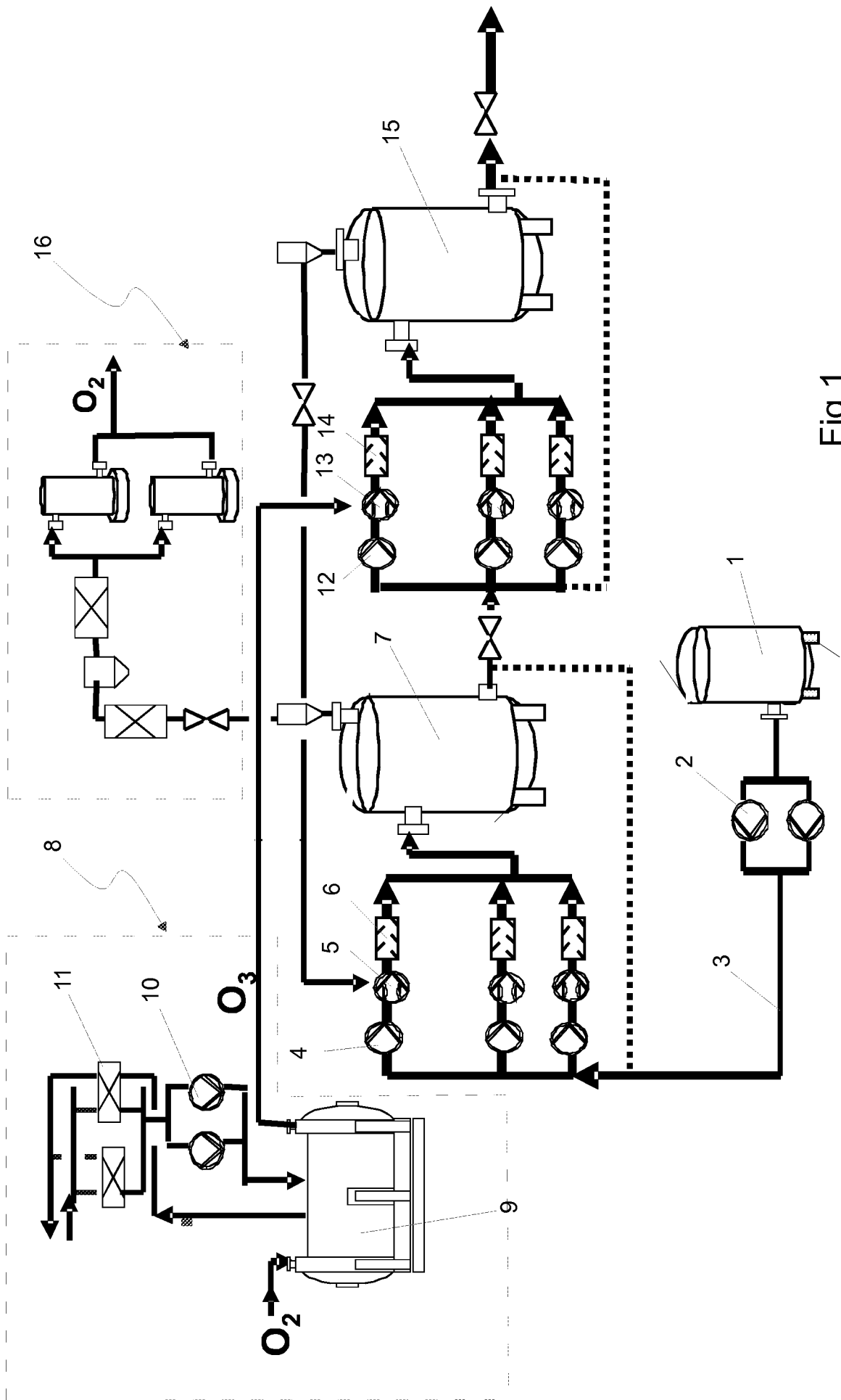


Fig.1

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2009/050717

A. CLASSIFICATION OF SUBJECT MATTER

INV. D21C9/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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22 January 2010

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INTERNATIONAL SEARCH REPORT

International application No
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