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(54) **METHOD FOR IMPROVING FIBER SOFTNESS OF HIGH YIELD PULP**

(57) Disclosed is a method for improving fiber softness of high yield pulp, including a high yield pulp; the method comprises: treating the high yield pulp with ozone; and treating with cellulase; the disclosure offers the following advantages: The high yield pulp in the present disclosure is sequentially treated with ozone and cellulase. Removal of lignin on the surface with ozone increases the softness of the fiber and loosens the fiber structure. Therefore, treating the fiber with ozone can open a "channel" for the entry of cellulase. Then the cellulase allows water molecules to enter the fiber, and the distance between fiber macromolecule chains increases, which causes the fiber to deform with reduced stiffness, thereby improving the softness. Therefore, by treating with cellulase based on the pretreatment of high-yield pulp with ozone, the present disclosure increases the accessibility of cellulase and fiber. Besides, ozone as a green agent can improve the softness of the fiber without or with little pollution to the environment.

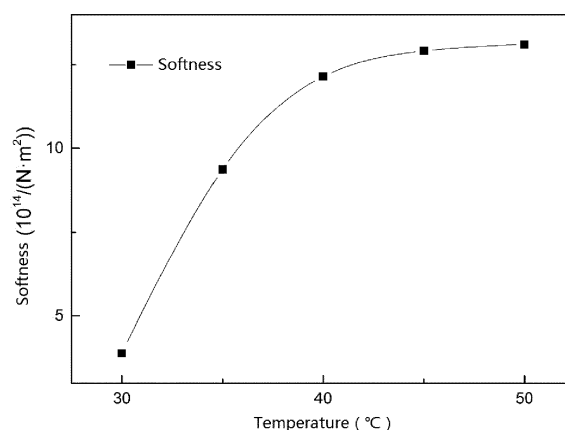


FIG. 1

Description

FIELD

[0001] The present disclosure relates to a method for improving fiber softness of high yield pulp.

BACKGROUND

[0002] As a pulping technology with high yield, high quality, and low pollution, the chemimechanical pulping process emerged in 1970s, which is one kind of high yield pulping. The high yield pulp obtained from high yield pulping has characteristics of high yield and low pollution, such that a paper factory can manufacture products with premium quality at a lower cost. It can be said that high yield pulp fills up the blank between conventional mechanical pulp and chemical pulp in respect of performance. In recent years, owing to its so many functional advantages in papermaking, such as high bulk factor, high stiffness, large opacity, good dimensional stability, and good printability, etc. the high yield pulp has gained wide applications in various kinds of paper and paper boards.

[0003] With improvement of quality of life, people focus more and more on paper softness, which gradually exposes the drawback of high yield pulp, i.e. poor softness, one of bottlenecks restricting development of the high yield pulp. The Chinese patent No. 2016105224934 discloses a method of manufacturing a paper towel containing high yield pulp, comprising: subjecting the high yield pulp to refiner beating through a crushing-type beating process, wherein the beating consistency is 20%, and the freeness of the pulp is controlled to 250~400ml. On the one hand, pretreating the high yield pulp using the crushing-type beating process will reduce the volume of fiber cavities, thereby affecting the water retention value of pulp fibers and water- absorptivity of paper towels; and on the other hand, the crushing pretreatment has less impact on lignin of the fiber, thereby affecting inter-fiber bonding force in the paper towel and reducing the mechanical strength of the paper towel.

SUMMARY

[0004] An objective of the present disclosure is to provide a method for improving fiber softness of high yield pulp, which enables removal of part of lignin from the high yield pulp fiber to thereby improve fiber softness.

[0005] To achieve the objective above, the present disclosure provides the following technical solution: a method for improving fiber softness of high yield pulp, including a high yield pulp with a pulp consistency of 1~3%, the method comprising steps of:

[0006] Step 1: treating the high yield pulp with ozone, wherein the concentration of ozone is 10~30%, the treatment temperature is 30~50°C, the treatment duration is 60~210s, and the pH value during treatment is 2.5~4.5;

[0007] Step 2: treating the treated high yield pulp from step 1 with cellulase, wherein the content of cellulase is 0.1~3EGU/g, the treatment duration is 30~60min, the PH value during treatment is 45~60°C.

[0008] Preferably, the treatment temperature in step 1 is 30°C, 35°C, 40°C, 45°C or 50°C, respectively; the concentration of ozone is 10%; the treatment duration is 120s, the PH value during treatment is 3, and the consistency of the high yield pulp is 2%.

[0009] Preferably, the consistency of high yield pulp in step 1 is 1.5%, 2%, 2.5%, 3% or 3.5%, respectively; the treatment temperature is 30°C, the concentration of ozone is 10%; the treatment duration is 120s, the pH value during treatment is 3.

[0010] Preferably, the temperature when treating the high yield pulp with ozone is controlled and adjusted by water bath.

[0011] Preferably, the ozone reacts with the high yield pulp in a three-neck flask.

[0012] Preferably, the cellulase reacts with the high yield pulp in a 1000ml beaker.

[0013] Preferably, the cellulase in step 2 includes one of or a mixture of at least two of endoglucanase, exoglucanase, and β -glycosidase.

[0014] In view of the above, the present disclosure offers the following advantages: the high yield pulp in the present disclosure is sequentially treated with ozone and cellulase. Because the ozone has a relatively low dissolvability, it can hardly enter the inside of the fiber; therefore, it first acts on the fiber surface such that ozonation attacks the primary wall lignin, the outer wall of the secondary wall and the intercellular lignin, wherein the lignin side chain is oxidized (by polymer depolymerization), the aromatic ring is broken (ring-opened), forming an organic acid which is dissolved in water. With loss of yield, the primary wall and the intercellular layer selectively remove lignin and expose the surface hydrophilic substances. The removal of lignin on the surface increases the softness of the fiber and loosens the fiber structure. Therefore, treating the fiber with ozone can open a "channel" for the entry of cellulase. Then the cellulase can hydrolyze the amorphous region of fiber, allowing water molecules to enter the fiber, and the distance between fiber macromolecule chains increases, which causes the fiber to deform with reduced stiffness, thereby improving the softness. Therefore, by treating with cellulase based on the pretreatment of high-yield pulp with ozone, the present disclosure increases the accessibility of cellulase and fiber. With an intention to reduce use of cellulase and improve the post-treatment fiber softness, the present disclosure offers a dual-beneficial and prospective process for treating high yield pulp; besides, ozone as a green agent can improve the softness of the fiber without or with little pollution to the environment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Hereinafter, the present disclosure will be fur-

ther illustrated with reference to the accompanying drawings:

Fig. 1 shows a schematic diagram of softness with ozone under different temperatures;

Fig. 2 shows a schematic diagram of softness with ozone under different pulp consistencies.

DETAILED DESCRIPTION OF EMBODIMENTS

[0016] A method for improving fiber softness of high yield pulp, including a high yield pulp with a pulp consistency of 1~3%, the method comprising steps of:

[0017] Step 1: treating the high yield pulp with ozone, wherein the concentration of ozone is 10~30%, the treatment temperature is 30~50°C, the treatment duration is 60~210s, and the PH value during treatment is 2.5~4.5;

[0018] Step 2: treating the treated high yield pulp from step 1 with cellulase, wherein the content of cellulase is 0.1~3EGU/g, the treatment duration is 30~60min, the PH value during treatment is 45~60°C.

[0019] The high yield pulp in the present disclosure is sequentially treated with ozone and cellulase. Because the ozone has a relatively low dissolvability, it can hardly enter the inside of the fiber; therefore, it first acts on the fiber surface such that ozonation attacks the primary wall lignin, the outer wall of the secondary wall and the intercellular lignin, wherein the lignin side chain is oxidized (by polymer depolymerization), the aromatic ring is broken (ring-opened), forming an organic acid which is dissolved in water. With loss of yield, the primary wall and the intercellular layer selectively remove lignin and expose the surface hydrophilic substances. The removal of lignin on the surface increases the softness of the fiber and loosens the fiber structure. Therefore, treating the fiber with ozone can open a "channel" for the entry of cellulase. Then the cellulase can hydrolyze the amorphous region of fiber, allowing water molecules to enter the fiber, and the distance between fiber macromolecule chains increases, which causes the fiber to deform with reduced stiffness, thereby improving the softness. Therefore, by treating with cellulase based on the pretreatment of high-yield pulp with ozone, the present disclosure increases the accessibility of cellulase and fiber. With an intention to reduce use of cellulase and improve the post-treatment fiber softness, the present disclosure offers a dual-beneficial and prospective process for treating high yield pulp; besides, ozone as a green agent can improve the softness of the fiber without or with little pollution to the environment.

[0020] The temperature for treating the high-yield pulp with ozone is controlled via a water bath. The water bath is simple to operate and has a good heating effect, such that it may guarantee that the adjusted temperature reaches the set temperature range to thereby guarantee the thermostatic effect of the temperature. The ozone reacts with the high yield pulp via a three-neck flask,

which is convenient for adjusting ozone concentration and pH value during the test; the adjustment of the ozone concentration can be independent from the adjustment of pH value, thereby improving the efficiency of adjustment. The cellulase reacts with the high yield pulp via a 1000ml beaker, which facilitates stirring during the cellulase treatment to thereby improve the treatment effect; the cellulase in step two includes one of or a mixture of at least two of endoglucanase, exoglucanase, and β -glucosidase, which may be adjusted according to different high-yield pulps so as to meet different needs, thereby offering a good applicability.

First Example:

[0021] A method for improving fiber softness of high yield pulp, including a high yield pulp with a pulp consistency of 2%, the method comprising steps of:

Step 1: treating the high yield pulp with ozone, wherein the treatment temperature was 30°C, 35°C, 40°C, 45°C or 50°C, respectively; the concentration of ozone was 10%; the treatment duration was 120s, the PH value during treatment was 3, and the consistency of the high yield pulp was 2%;

Step 2: treating the treated high yield pulp from step 1 with cellulase, wherein the content of cellulase was 0.5EGU/g, the treatment duration was 30min, the PH value during treatment was 45°C.

[0022] The treated high yield pulp was subjected to softness detection, wherein the curve relationship between the detected softness and the treatment temperatures is shown in Fig. 1.

Second Example:

[0023] A method for improving fiber softness of high yield pulp, including a high yield pulp with a pulp consistency of 2%, the method comprising steps of:

Step 1: treating the high yield pulp with ozone, wherein the treatment temperature was 30°C; the concentration of ozone was 10%; the treatment duration was 120s, the pH value during treatment was 3, and the consistency of the high yield pulp was 1.5%, 2%, 2.5%, 3% or 3.5%, respectively;

Step 2: treating the treated high yield pulp from step 1 with cellulase, wherein the content of cellulase was 0.5EGU/g, the treatment duration was 30min, the pH value during treatment was 45°C.

[0024] The treated high yield pulp was subjected to softness detection, wherein the curve relationship between the detected softness and the consistencies of the high yield pulp is shown in Fig. 2.

[0025] Additionally, the ozone treatment in step 1 may also treat the high yield pulp by changing the ozone consistency, or the ozone treatment duration, or the pH value during treatment.

[0026] Besides the preferred embodiments above, the present disclosure also has other embodiments. Those skilled in the art may make various variations and alterations based on the present disclosure, and such variations and alterations should fall within the scope defined by the appended claims without departing from the spirit of the present disclosure.

cellulase reacts with the high yield pulp in a 1000ml beaker.

7. The method for improving fiber softness of high yield pulp according to claim 1, wherein the cellulase in step 2 includes one of or a mixture of at least two of endoglucanase, exoglucanase, and β -glycosidase.

Claims

1. A method for improving fiber softness of high yield pulp, including a high yield pulp with a pulp consistency of 1~3%, the method comprising steps of:

Step 1: treating the high yield pulp with ozone, wherein the concentration of ozone is 10~30%, the treatment temperature is 30~50°C, the treatment duration is 60~210s, and the PH value during treatment is 2.5~4.5;

Step 2: treating the treated high yield pulp from step 1 with cellulase, wherein the content of cellulase is 0.1~3EGU/g, the treatment duration is 30~60min, the PH value during treatment is 45~60°C.

2. The method for improving fiber softness of high yield pulp according to claim 1, wherein the treatment temperature in step 1 is 30°C, 35°C, 40°C, 45°C or 50°C, respectively; the concentration of ozone is 10%; the treatment duration is 120s, the PH value during treatment is 3, and the consistency of the high yield pulp is 2%.

3. The method for improving fiber softness of high yield pulp according to claim 1, wherein the consistency of high yield pulp in step 1 is 1.5%, 2%, 2.5%, 3% or 3.5%, respectively; the treatment temperature is 30°C, the concentration of ozone is 10%; the treatment duration is 120s, the PH value during treatment is 3.

4. The method for improving fiber softness of high yield pulp according to any one of claims 1~3, wherein the temperature when treating the high yield pulp with ozone is controlled and adjusted by water bath.

5. The method for improving fiber softness of high yield pulp according to any one of claims 1~3, wherein the ozone reacts with the high yield pulp in a three-neck flask.

6. The method for improving fiber softness of high yield pulp according to any one of claims 1~3, wherein the

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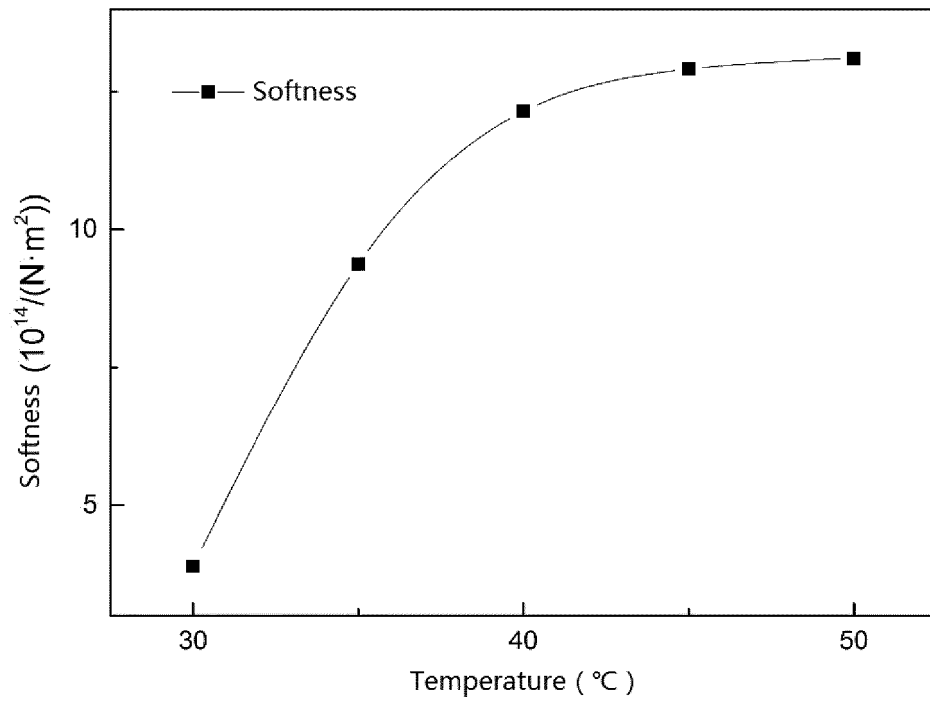


FIG. 1

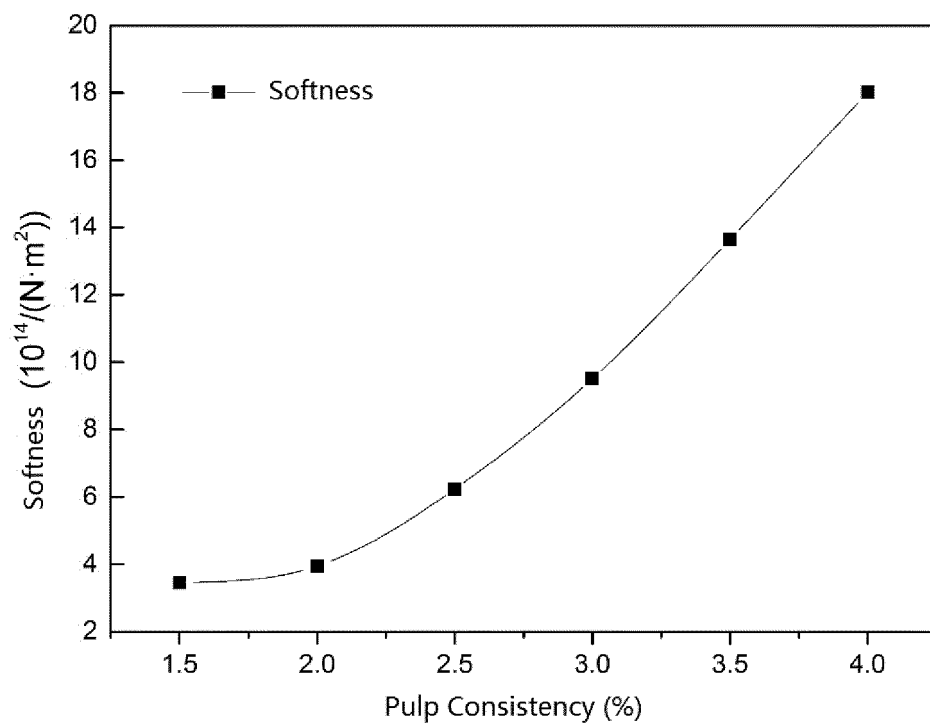


FIG. 2



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 EP 19 21 9097

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