

PRETREATMENT DEVICE AND PROCESS FOR PAPER PRODUCT FILLER

TECHNICAL FIELD

5 The invention relates to the field of paper products, in particular to a pretreatment device and process for a paper product filler.

BACKGROUND

10 Paper products are widely used in all aspects of human life and production. With the deepening of the application of paper products in the consumer field, the consumption of paper products has grown rapidly. It takes 20 trees of 20-40 years old to produce one ton of paper products, and the recycling rate of waste paper fibers is relatively low. In the period of rapid decline of traditional forest resources and rapid development of industry, the emergence of a new material that replaces traditional
15 paper fibers has great significance and application prospects.

SUMMARY

20 In view of the above shortcomings, the present invention provides a pretreatment device and process for a paper product filler, such that, by pretreating the soil and the residual substances of the biological fermentation reaction, the reuse value of resources is realized.

In order to achieve the above objectives, the present invention provides the following technical solution:

A pretreatment device for a paper product filler, characterized in that the treatment device includes a screw pump, a homogenizer, a material delivery pump, a metering tank, a microwave reactor, a main reactor, an energy conversion system, a
5 decompressor, a dehydrator, a recycling tank and a recycling pump, wherein

a raw filler is input into an input end of the screw pump, and an output end of the screw pump is connected to the homogenizer via a pipe; an input end of the homogenizer is an inlet of the raw filler and is provided with a constantly-open input
10 pipe for high-temperature circulating liquid; the material delivery pump is arranged on a connecting pipe between an output end of the homogenizer and an input end of the microwave reactor; an output end of the microwave reactor is connected to an input end of the main reactor via a pipe; an output end of the main reactor is connected to the energy conversion system via a pipe; the energy conversion system,
15 the decompressor, the dehydrator, the recycling tank and the recycling pump are connected in sequence via pipes; the recycling pump delivers liquid in the recycling tank to the input ends of the main reactor and the metering tank; and an output end of the metering tank is connected to the homogenizer via a pipe so as to form a heat recovery and water recycling system.

20 Further improvements to the above scheme include the following steps:

Step I: feeding the raw filler into the homogenizer via the pipe, adding the high-temperature circulating liquid into the homogenizer for homogenizing and heating,

and delivering the mixed raw filler to the microwave reactor by the material delivery pump;

Step II: delivering an intermediate filler pretreated by the microwave reactor to the main reactor via the pipe;

5 Step III: heating the intermediate filler through a secondary mixing with the circulating liquid and auxiliary heating in the main reactor, and the intermediate filler is subject to a thermochemical reaction so that organic components of the intermediate filler are effectively oxidized into water and carbon dioxide and thus a part of the intermediate filler is reacted to water; and

10 Step IV: exchanging heat effectively from the treated filler solution after the thermochemical reaction in the main reactor to recycling water in the energy conversion system.

To further improve the above scheme, the reaction time in the microwave reactor ranges from 0 minute to 30 minutes and a power of the microwave reactor ranges
15 from 0 to 2,200 KW.

To further improve the above scheme, in the main reactor, a reaction pressure ranges from 0 MPa to 22 MPa, a reaction temperature is higher than or equal to 20°C, and the reaction time is longer than or equal to 5 minutes.

To further improve the above scheme, the raw filler is made of soil and residual
20 substances of a biological fermentation reaction, using municipal sludge, industrial sludge, river sludge, pharmaceutical sludge, medicine residues or distilled grain.

To further improve the above scheme, the mixed raw filler includes 150 parts of the raw filler, oxygen at 0 MPa to 8 MPa, 0 part to 150 parts of oxygen-enriched water, 0 part to 150 parts of H₂O₂ and an appropriate amount of water.

To further improve the above scheme, a concentration of O₂ or O₃ in the oxygen-enriched water ranges from 5 mg/mL to 50 mg/mL.

To further improve the above scheme, treated filler slurry directly enters a slurry pond, without being filtered, to mix with plant fiber, an amount of the treated filler being added is less than 60%, and a paper product added with the treated filler is reused, directly discarded and naturally degraded into planting soil, or reused or discarded after being crushed and restored into planting soil.

To further improve the above scheme, in Step IV, the recycling water is recycled and reused.

The invention has the following advantages:

The paper product prepared with the filler has the highest filling amount up to 60%, and a lot of plant fiber resources can be saved. While the use of the filler can save plant fiber resources, it also reduces the cost of raw materials for the paper products, provides utilization of the raw filler soil and residual substances of biological fermentation reactions as industrialized products, and enhances the resource value of these low-value resources. It effectively protects the excessive logging and utilization of forest resources, reduces carbon emissions, and expands the range of industrially usable resources.

The filler has excellent physical and chemical properties. It not only can be fully dispersed in the slurry, but also can be sufficiently connected to the fibers, so that the retention rate is high, and it can be fully mixed with the fibers, thereby avoiding delamination or uneven dispersion of the paper products prepared. Due to the sufficient filling of the filler and the chemical bonding, the surface of the prepared paper product is smooth and clean, and the problem of powder dropping is avoided. The density of paper products prepared with the filler is close to that of ordinary paper products, and various mechanical properties are better in the case of the same thickness.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of the overall structure of the present invention.

DETAILED DESCRIPTION

15 The technical solutions of the embodiments of the present invention will be clearly and completely described in the following with reference to the accompanying drawings. It is obvious that the embodiments to be described are only a part rather than all of the embodiments of the present invention.

Referring to Figure 1, in order to achieve the above objective, the present invention provides the following technical solutions:

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A pretreatment device for a paper product filler, characterized in that the treatment device includes a screw pump 1, a homogenizer 2, a material delivery pump 3, a metering tank 4, a microwave reactor 5, a main reactor 6, an energy conversion system 7, a decompressor 8, a dehydrator 9, a recycling tank 10 and a recycling pump 11, wherein

a raw filler is input into an input end of the screw pump 1, and an output end of the screw pump is connected to the homogenizer 2 via a pipe; an input end of the homogenizer 2 is an inlet of the raw filler and is provided with a constantly-open input pipe for high-temperature circulating liquid; the material delivery pump is arranged on a connecting pipe between an output end of the homogenizer and an input end of the microwave reactor 5; an output end of the microwave reactor 5 is connected to an input end of the main reactor 6 via a pipe; an output end of the main reactor 6 is connected to the energy conversion system 7 via a pipe; the energy conversion system 7, the decompressor 8, the dehydrator 9, the recycling tank 10 and the recycling pump 11 are connected in sequence via pipes; the recycling pump 11 delivers liquid in the recycling tank 10 to the input ends of the main reactor 6 and the metering tank 4; and an output end of the metering tank 4 is connected to the homogenizer 2 via a pipe so as to form a heat recovery and water recycling system.

Further improvements to the above scheme include the following steps:

Step I: feeding the raw filler into the homogenizer 2 via the pipe, adding the high-temperature circulating liquid into the homogenizer 2 for homogenizing and heating, and delivering the mixed raw filler to the microwave reactor 5 by the material delivery pump 3;

Step II: delivering an intermediate filler pretreated by the microwave reactor 5 to the main reactor via the pipe;

Step III: heating the intermediate filler through a secondary mixing with the circulating liquid and auxiliary heating in the main reactor 6, and the intermediate
5 filler is subject to a thermochemical reaction so that organic components of the intermediate filler are effectively oxidized into water and carbon dioxide and thus a part of the intermediate filler is reacted to water; and

Step IV: exchanging heat effectively from the treated filler solution after the thermochemical reaction in the main reactor 6 to recycling water in the energy
10 conversion system 7.

To further improve the above scheme, the reaction time in the microwave reactor 5 ranges from 0 minute to 30 minutes and a power of the microwave reactor ranges from 0 to 2,200 KW.

To further improve the above scheme, in the main reactor 6, a reaction pressure
15 ranges from 0 MPa to 22 MPa, a reaction temperature is higher than or equal to 20°C, and the reaction time is longer than or equal to 5 minutes.

To further improve the above scheme, the raw filler is made of soil and residual substances of a biological fermentation reaction, using municipal sludge, industrial sludge, river sludge, pharmaceutical sludge, medicine residues or distilled grain.

20 To further improve the above scheme, the mixed raw filler includes 150 parts of the raw filler, oxygen at 0 MPa to 8 MPa, 0 part to 150 parts of oxygen-enriched water, 0 part to 150 parts of H₂O₂ and an appropriate amount of water.

To further improve the above scheme, a concentration of O₂ or O₃ in the oxygen-enriched water ranges from 5 mg/mL to 50 mg/mL.

To further improve the above scheme, treated filler slurry may directly enter a slurry pond, without being filtered, to mix with plant fiber, an amount of the treated
5 filler being added is less than 60%, and a paper product added with the treated filler may be reused, directly discarded and naturally degraded into planting soil, or reused or discarded after being crushed and restored into planting soil.

To further improve the above scheme, in Step IV, the recycling water may be recycled and reused.

10 Although the present invention has been described in detail with reference to the foregoing embodiments, it is possible for those skilled in the art to modify the technical solutions described in the foregoing embodiments, or make equivalent substitutions to some of the technical features. Any modifications, equivalent substitutions, improvements, etc., made within the spirit and principle of the present
15 invention shall be included in the protection scope of the present invention.

CLAIMS

1. A pretreatment device of a paper product filler, comprising a screw pump (1), a homogenizer (2), a material delivery pump (3), a metering tank (4), a microwave reactor (5), a main reactor (6), an energy conversion system (7), a decompressor (8), a dehydrator (9), a recycling tank (10) and a recycling pump (11), wherein

a raw filler is input into an input end of the screw pump (1), and an output end of the screw pump (1) is connected to the homogenizer (2) via a pipe; an input end of the homogenizer (2) is an inlet of the raw filler and is provided with a constantly-open input pipe for high-temperature circulating liquid; the material delivery pump (3) is arranged on a connecting pipe between an output end of the homogenizer (2) and an input end of the microwave reactor (5); an output end of the microwave reactor (5) is connected to an input end of the main reactor (6) via a pipe; an output end of the main reactor (6) is connected to the energy conversion system (7) via a pipe; the energy conversion system (7), the decompressor (8), the dehydrator (9), the recycling tank (10) and the recycling pump (11) are connected in sequence via pipes; the recycling pump (11) delivers liquid in the recycling tank (10) to the input ends of the main reactor (6) and the metering tank (4); and an output end of the metering tank (4) is connected to the homogenizer (2) via a pipe so as to form a heat recovery and water recycling system.

2. A pretreatment process performed by the pretreatment device of the paper product filler according to claim 1, comprising the following steps:

Step I: feeding the raw filler into the homogenizer (2) via the pipe, adding the high-temperature circulating liquid into the homogenizer (2) for homogenizing and heating, and delivering the mixed raw filler to the microwave reactor (5) by the material delivery pump (3);

Step II: delivering an intermediate filler pretreated by the microwave reactor (5) to the main reactor via the pipe;

Step III: heating the intermediate filler through a secondary mixing with the circulating liquid and auxiliary heating in the main reactor (6), and the intermediate filler is subject to a thermochemical reaction so that organic components of the intermediate filler are effectively oxidized into water and carbon dioxide and thus a part of the intermediate filler is reacted to water; and

Step IV: exchanging heat effectively from the treated filler solution after the thermochemical reaction in the main reactor (6) to recycling water in the energy conversion system (7).

3. The pretreatment process of the paper product filler according to claim 2, wherein the reaction time in the microwave reactor (5) ranges from 0 minute to 30 minutes and a power of the microwave reactor (5) ranges from 0 to 2,200 KW.

4. The pretreatment process of the paper product filler according to claim 2, wherein, in the main reactor (6), a reaction pressure ranges from 0 MPa to 22 MPa, a reaction temperature is higher than or equal to 20°C, and the reaction time is longer than or equal to 5 minutes.

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5. The pretreatment process of the paper product filler according to claim 2, wherein, the raw filler is made of soil and residual substances of a biological fermentation reaction, using municipal sludge, industrial sludge, river sludge, pharmaceutical sludge, medicine residues or distilled grain.

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6. The pretreatment process of the paper product filler according to claim 2, wherein, the mixed raw filler comprises 150 parts of the raw filler, oxygen at 0 MPa to 8 MPa, 0 part to 150 parts of oxygen-enriched water, 0 part to 150 parts of H₂O₂ and an appropriate amount of water.

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7. The pretreatment process of the paper product filler according to claim 2, wherein, a concentration of O₂ or O₃ in the oxygen-enriched water ranges from 5 mg/mL to 50 mg/mL.

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8. The pretreatment process of the paper product filler according to claim 2, wherein, treated filler slurry directly enters a slurry pond, without being filtered, to

mix with plant fiber, an amount of the treated filler being added is less than 60%, and a paper product added with the treated filler is reused, directly discarded and naturally degraded into planting soil, or reused or discarded after being crushed and restored into planting soil.

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9. The pretreatment process of the paper product filler according to claim 2, wherein, in Step IV, the recycling water is recycled and reused.