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Research area: Process aims

Pulp production // Recovered paper treatment

Key words:

Stray starch, process water, metabolism, recovered paper molar mass, pulper

TITLE:

Reducing the metabolism of stray starch in the process water of paper mills to improve the efficiency of biomass utilisation

Background/Problem area

Studies have shown that appreciable amounts of starch are introduced into the pulp together with the recovered paper. Owing to the weaker bonding forces, the starch is removed together with the process water from as many as 70 % of the fibres during pulping in the pulper. Actually, the substance, known as stray starch, contains active components immediately after pulping that can bring about an increase in strength during papermaking.

The stray starch metabolises relatively fast in the process water so that only a small amount of the starch introduced together with the recovered paper is retained in the fibre network and only a slight increase in strength can be achieved in the finished paper.

In addition, the stray and metabolising starch leads to an increased COD loading in the process water as well as in the effluents. This increases the costs of effluent treatment. Moreover, unused stray starch and its degradation products can give rise to corrosion, deposit formation, odour generation and efficiency losses of chemical additives.

In the light of all these points, the question arises how the starch introduced together with the recovered paper can best be prevented from metabolising so that it can continue to develop its strength-enhancing action in the finished paper.

Objectives/Research results

It was therefore the objective of the research project to create the preconditions to ensure that the starch present in the recovered paper can be used effectively to develop strength in the finished paper.

In framework of numerous laboratory tests and three operating tests were shown that a suitable treatment of the process water can reduce the bacterial counts by several decades and therefore the microbial contamination significantly.

Thereby the effect of starch degrading enzymes were decreased so much that with selected chemical substances, biocides, especially sodium hypochlorite and alternatively with flash pasteurisation the starch metabolism could be prevented completely. Depending on the load of the process water the effect could continue up to three hours.

Additional physical treatment procedures, e.g. ultrasonic treatment, electrical pulsed fields and most of the biocides effect also a significant but not complete reduction of the starch metabolism. With individual further development also these procedures can be optimised in that way to get almost complete starch preservation.

By the starch metabolism in the stock preparation the starch is cut down in that way, that the strength in the produced paper is 10 to 20 % lower as if the added starch would be complete effectively. If the process water were treated in the described way, the starch from the recycled paper could be settled down to the paper fibres and result in a strength benefit in the same size.

Application/Economic benefits

The amounts of wet-end and surface starch can be reduced significantly because strength-enhancing amounts of stray starch are being retained. Due to the diminished use of surface starch, drying energy can also be saved and the associated CO_2 emissions be cut as well. These measures can potentially save starch costs in a magnitude of 2 to 9 Euros per tonne of paper produced.

On the other hand, the COD loadings, that are largely due to the metabolising starch and are passed on to the effluent treatment plant, can be reduced as well, together with a drop in the specific sludge accumulation, oxygen and energy requirements in the aeration stage.

In addition, the negative effects in the process (e.g. corrosion, deposit formation, odour generation, reduced efficacy of additives) can be diminished as well and thus the operation of the plant improved.

Period of time: 01.02.2013 – 31.01.2015

Remarks

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