

UNITED STATES PATENT OFFICE

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SULPHITE CELLULOSE DIGESTION

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In the usual sulphite cellulose digestion where a solution containing bi-sulphite of lime or alkali and a surplus of sulphur dioxide over and above that required to combine
5 with normal sulphite to form bi-sulphite is used as cooking liquor, which surplus in the following is called free sulphur dioxide, and where the digestion is made under pressure at a temperature of 120° C. or above, it has
10 appeared that the free sulphur dioxide content of the liquor rapidly diminishes even at the beginning of the digestion and before the chips that are to be digested have been softened or their lignin substances dissolved.
15 This is due to the fact that the pores of the chips (gas and air cavities) get filled with sulphur dioxide, because the free sulphur dioxide escapes from the digesting liquor even at temperatures below the boiling
20 point of the liquor and consequently enters into the chips before these have been penetrated by the liquor. Lignin and other non-cellulose components that are to be dissolved from the chips, have a strong inclination to
25 take up sulphur dioxide at an early stage of the digestion and for said reason there is a strong concentration of sulphur dioxide in the chips and a diminishing of the sulphur dioxide content of the liquor at the beginning
30 of the digestion and before the liquor has completely penetrated the chips.

This rapid entry of sulphur dioxide into the chips at the beginning of the digestion has an unfavorable influence on the further
35 progress of the digestion because the sulphur dioxide collected in the pores of the chips is a hindrance to the penetration of the liquor into the chips and also because the concentration of sulphur dioxide in the chips effects a too
40 rapid reaction with the lignin content of the chips whereby lignin-sulphonic acids difficult to dissolve and of an unstable character are formed.

The bi-sulphites of the liquor should react
45 with the lignin-sulphonic acids formed through the sulphur dioxide reaction so as to form lignin-sulphonic salts which salts are more easily dissolved and more stable than the sulphonic acids primarily formed and it
50 results from this that if the liquor cannot

penetrate into the chips freely or if the sulphur dioxide reaction in the chips takes place too rapidly before the penetration of the liquor the consequences as regards the digestion may easily be unfavorable. Such consequences are the formation of insoluble lignin products resulting in undissolved inner portions of the chips, dark coloring of the cellulose and an incomplete digestion.

To prevent these inconveniences, in the usual sulphite digestion process care is taken
60 when starting the digestion to have the temperature rise slowly which causes a slackening up of the reaction speed of sulphur dioxide, providing at the same time an opportunity for the liquor to enter with its contents
65 of bi-sulphite into the chips.

If the digestion is carried out with alkali-bi-sulphite, the recovery of the alkali is facilitated by keeping the waste liquors at a high
70 degree of concentration and for that purpose varying quantities of waste liquors from previous digestions are added to that cooking liquor. When using such a liquor in the digestion another inconvenience will present
75 itself, namely that the liquor penetrating into the chips carries with it large quantities of organic materials which are easily influenced by the sulphur dioxide concentrated in the chips in the same way as the organic contents
80 of the chips themselves. It has consequently proven to be a difficult thing to carry out digestions of sulphite cellulose with cooking liquors containing waste liquors from previous digestions.

The present invention aims to improve the digestion process by removing the causes of an irregular digestion process, and also to
85 render it possible to add waste liquors to the liquor used for digestion of sulphite cellulose.

In the usual digestion processes where bi-sulphite and sulphur dioxide are jointly introduced into the digester in the same liquor, it is impossible upon heating, on account of the effect upon the sulphur dioxide gas occasioned thereby, to prevent a premature concentration of the sulphur dioxide content in the chips with the attendant consequences
95 noted.

According to the present invention the sul- 100

phur dioxide is subsequently added independently so that the necessary chemicals i. e. bisulphite and sulphur dioxide come in contact with the chips in the order which proves to be most advantageous for the reaction, viz.: bisulphite first and then sulphur dioxide, thereby preventing an unduly rapid penetration of sulphur dioxide or an abnormally high concentration of sulphur dioxide in the chips.

This is done by preparing an aqueous solution containing bi-sulphites with little or no free sulphur dioxide, and on account of solubility factors, it is preferable to use alkali bi-sulphite in these cases. The second solution is prepared by introducing sulphur dioxide gas from a digester or from another source preferably into waste liquors or weak liquors obtained when washing cellulose from earlier digestions, and introducing it in such a quantity that the solution will have a high content of free sulphur dioxide or is saturated with sulphur dioxide at the temperature of the solution.

This solution contains the free sulphur dioxide that is required for the reaction and the presence of bi-sulphite in this solution is immaterial.

The above two solutions form the real digestion liquor but they are not introduced simultaneously.

The process may be suitably carried out in the following way: To the digester which is filled with chips the bi-sulphite solution is added. After the chips have been saturated with the solution the major part of it is tapped off so that only a small quantity remains.

After this, the digester is filled up with the solution prepared from waste liquor or washing water containing a high concentration of free sulphur dioxide, and the digestion is started.

As the temperature of the digester rises the sulphur dioxide gas is set free in the usual way, but it is prevented from penetrating too rapidly into the chips, for the same are already saturated with bi-sulphite solution and no abnormal concentration of sulphur dioxide gas is possible which would give rise to a premature influence on the lignin substances by the sulphur dioxide.

The bi-sulphite of the solution with which the chips are saturated before the sulphur dioxide reactions can occur, immediately reacts with the lignin-sulphonic acid formed by the penetrating sulphur dioxide, and the reactions will therefore take a regular and normal course even when no precautions are taken as regards a rapid rise of the temperature when starting the digestion.

As dry chips can take up their own weight of bi-sulphite liquor, the alkali bi-sulphite used for the preliminary soaking of the chips, may be provided with such a high concentration of bi-sulphite that before the addition of SO_2 solution, the chips contain the

quantity of bi-sulphite required for carrying out the digestion process.

The solution of sulphite added to the digester may be made so concentrated that for instance a quantity of solution corresponding to one fourth only of the free volume of the digester will contain enough alkali metal sulphites for carrying through the reactions noted. In using such a solution, the quantity introduced into the digester may either correspond approximately to one fourth of the free volume of the digester, in which case there will be no subsequent removal of the solution, or if desired the digester may be filled more or less completely with such solution. In the latter case, however, after the soaking with the concentrated sulphite solution has been completed, the excess solution should be tapped off from the digester, at least to the extent that sufficient space will be provided for the succeeding solution of sulphur dioxide, and to a further extent if desired.

While in the foregoing I have indicated the use of a solution of sulphur dioxide in waste liquor and/or washing water from previous digestions, and in practice it is more expedient to use such a carrier for the sulphur dioxide, the solution may if desired consist simply of an ordinary water solution of the sulphur dioxide without any complement of waste liquor and/or washing water.

I claim as my invention:

1. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material with a solution of a sulphurous acid salt of the group: alkali metal, alkaline earth, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

2. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material with a solution of an alkali metal salt of sulphurous acid, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

3. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material with a solution of an alkaline earth salt of sulphurous acid, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

4. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material with a solution of an alkali metal salt of sulphurous acid, then adding a solution of sulphur dioxide in waste liquor and/or wash water from a similar digesting operation to obtain a higher concentration of organic matter in the waste liquor of the instant oper-

ation, and digesting the cellulose-containing material in said solutions.

said digester provides a sufficient quantity of the salt for the digestion, adding a solution of sulphur dioxide to said digester, and digesting the cellulose-containing material in said solutions.

In testimony whereof I affix my signature.
GUSTAF HAGLUND.

5 The sulphite cellulose digestion process which comprises, first soaking the cellulose-containing material in a solution of a sulphurous acid salt of the group: alkali metal, alkaline earth, until the material is suitably saturated with said solution, then adding a solution of sulphur dioxide, and digesting
10 the cellulose-containing material in said solutions.

6. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material with a solution of a sulphurous acid salt of the group: alkali metal, alkaline earth, said solution being provided in excess of that capable of being absorbed by said material, removing a substantial portion of the excess solution
20 after absorption, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

7. The sulphite cellulose digestion process which comprises, first intimately contacting the cellulose-containing material in a solution of a sulphurous acid salt of the group: alkali metal, alkaline earth, said solution having such concentration of the sulphurous acid salt that the quantity of solution absorbed by said material will contain sufficient sulphurous acid salt for carrying out digestion, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

8. The sulphite cellulose digestion process which comprises, first soaking the cellulose-containing material in a solution of the group: alkali metal, alkaline earth, bi-sulphite, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

9. The sulphite cellulose digestion process which comprises, first soaking the cellulose-containing material in a solution of alkali metal bi-sulphite until said material has substantially reached its absorption limit as regards said solution, said bi-sulphite being provided in such concentration in said solution that the quantity of bi-sulphite contained in the solution absorbed is sufficient for carrying out the digestion, then adding a solution of sulphur dioxide, and digesting the cellulose-containing material in said solutions.

10. The sulphite cellulose digestion process which comprises, first soaking the cellulose-containing material with a solution of a sulphurous acid salt of the group: alkali metal, alkaline earth in a digester, removing from the digester such portion of the unabsorbed solution as is necessary to accommodate the quantity of a sulphur dioxide solution to be used for the digestion process, said first-named solution containing said salt in such concentration that the portion remaining in

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