

UNITED STATES PATENT OFFICE

2,072,487

PURIFICATION OF CELLULOSIC MATERIAL

Francis H. Snyder, New York, N. Y., assignor to
Snyder MacLaren Processes, Inc., New York,
N. Y., a corporation of Delaware

No Drawing. Application August 3, 1934, Serial
No. 735,378

5 Claims. (Cl. 92—9)

This invention relates to the purification of cellulosic material and more particularly to the production of pulp from fibrous raw materials. The invention is suitable, in general, for the purification of all types of cellulosic material such as wood chips, waste papers, straw, cotton linters, rag stock, rope, bagging, bast fibers such as ramie, sisal, flax, jute, and pita, and like cellulosic material.

This is a continuation-in-part of my copending application Serial No. 708,003, filed January 23, 1934, now Patent No. 1,983,008, issued December 4, 1934.

The principal object of this invention is to provide an improved process of purifying cellulosic raw materials of the above described character.

An important object of the invention is to provide an improved process of converting cellulosic raw materials of the above referred to character into pulp of high quality.

Another object of the invention is to provide a process of converting cellulosic raw materials into pulp wherein the time of treatment and the amount of pulping chemicals are substantially less than in processes of producing pulp heretofore employed.

A further object of the invention is to provide a simple and commercially feasible modification of conventional pulp cooking processes as a result of the use of which pulps are obtained which are of higher quality than the pulps produced by the conventional pulping processes heretofore employed.

A further object of the invention is to produce a pulp which may be hydrated in materially less time than is required for hydrating conventional pulps.

A further object of the invention is to provide a soda pulp in which the fibers approximate the fiber length of sulfite pulp derived from the same crude fibrous material.

A further object of the invention is to produce a pulp of high quality from coniferous woods which have heretofore been considered incapable of yielding a commercially satisfactory grade of pulp.

Other objects and advantages of the invention will become apparent during the course of the following description.

In its broad aspect the present invention consists in treating cellulosic raw materials of the character referred to above to purify the same by the removal of resinous, gummy and pectous materials and the like by cooking the cellulosic

material in a solution containing a "non-carboxylic organic detergent". Ordinarily, the cooking is conducted in a digester and the cellulosic material boiled in the treating solution under pressure. Generally, as where the production of pulp is the object of the process, the cellulosic material is boiled in a conventional pulp cooking liquor in which is dissolved a minor proportion of a "non-carboxylic organic detergent". However, in some instances, a solution of such a detergent is used alone at high temperatures for the removal of resinous, gummy, and pectous materials, as will more fully hereinafter appear.

As pointed out above, the present invention involves the use of a "non-carboxylic organic detergent". This term is intended to cover compounds having the type formula



wherein M is hydrogen or an alkali-forming metal, X is an acid radicle to which may be linked both an alkyl group and hydrogen or an alkali-forming metal, and R is an alkyl group.

These non-carboxylic organic detergents are known in the art and are commercially available, several of the more important members of this class being known to the trade as "Gardinol", "Nacconol", "Igepon", "Nekal" and "Dreft".

All of these compounds are water-soluble and are particularly characterized by the fact that their calcium and magnesium salts are relatively soluble in water; they are not "salted out" by brines; their useful properties are not adversely affected by acids; and they possess very low surface tension.

In these compounds having the type formula

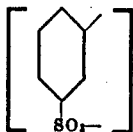


M may be either hydrogen or an alkali-forming metal, as pointed out above. If a particular compound having this type formula is used in an acid medium, M will be hydrogen. If such a compound is used in an alkaline medium, M will be an alkali-forming metal. The term "alkali-forming metal" is intended to include alkali metals (including ammonium) and alkaline earth metals. In other words, the term is intended to cover such metals as sodium, potassium, ammonium, calcium, magnesium and the like.

In these compounds of the foregoing character which have the type formula set forth above, X may be either an organic acid radicle or an inorganic acid radicle such, for example, as a sulfate radicle ($=SO_4$), a silicate radicle ($=SiO_3$), a

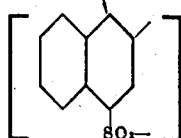
sulfonic acid radicle ($-\text{SO}_2\text{O}-$), a benzene sulfonic acid radicle

5



10 a naphthalene sulfonic acid radicle

15



or other acid radicle to which may be linked both an alkyl group and hydrogen or an alkali-forming metal.

20 In the above referred to compounds having the type formula set forth above, R may be derived from either a normal or an iso-alcohol such as amyl, lauryl, butyl, propyl, isopropyl, oleyl, iso-

25 Among the members of this general class of "non-carboxylic organic detergents" may be mentioned for purposes of specific illustration alkali-forming metal alkyl sulfates, such as sodium amyl sulfate; alkyl-substituted naphthalene sulfonic acids, such as decyl naphthalene sulfonic acid, or an alkali-forming metal salt thereof; alkyl-substituted benzene sulfonic acids, such as amyl benzene sulfonic acid, or an alkali-forming metal salt thereof; and normal alkyl sulfonic acids in which the sulfonic acid radicle is in the terminal position, such as pentadecyl sulfonic acid, or an alkali-forming metal salt thereof.

30 As pointed out above, the present invention contemplates the use as purifying agents of non-carboxylic organic detergents either alone or in conjunction with conventional pulping chemicals. In general, where cellulosic fibrous materials are digested in a solution of non-carboxylic organic detergents, it is necessary to use only small amounts of such treating agent, say from 0.1 of 1% to 1% of the agent on the weight of the cellulosic material. The amount of water used to prepare the treating solution is generally in the neighborhood of 5 parts by weight of water to 1 part of the cellulosic material under treatment.

40 In general, the process comprises cooking the cellulosic material in such a solution of the non-carboxylic organic detergent selected. The mass may be boiled in an open container but it is preferable to heat the material in a digester under pressure up to a temperature of say from 140 to 180° C. Purification and pulping of the cellulosic material is ordinarily effected under such treatment in from 1½ to 3 hours.

60 In ordinary commercial practice where it is desired to produce strong pulp of high quality, it is advisable to employ the non-carboxylic organic detergents in conjunction with a conventional pulp-cooking process, such as the soda, sulfite or sulfate processes. In this modification of the present invention the pulp-cooking process is carried out in conventional manner, except as noted below, and a small amount of a non-carboxylic organic detergent is dissolved in the cooking liquor, say about 0.2 of 1% of the non-carboxylic organic detergent on the weight of the cellulosic material to be treated. Generally, when a non-carboxylic organic detergent is employed in conjunction with conventional pulping chemicals, the

70 amount of the pulping chemicals can be reduced

approximately 25% and an equal quality of product produced. Moreover, when a non-carboxylic organic detergent is employed in a pulp-cooking process, the time ordinarily required for effecting the pulping of the cellulosic material can be cut approximately 50% and an equal quality of product will be secured. In fact, by the practice of the present invention a pulp which is stronger and of better quality than conventional pulps can be obtained because of the reduced amount of treating chemicals and the shorter cooking involved.

The present invention is of wide application and several specific examples of modifications of the process will be set forth below for the purpose of specific illustration. It is to be understood, however, that the present invention is not limited to the particular examples given.

Example I.—Where it is desired to purify bast fibers, such as pita, by the use of a solution of a non-carboxylic organic detergent without other treating chemicals, approximately 2,000 pounds of debarked crude pita, or other bast fiber, are mixed with 5 tons of water and 10 pounds of a non-carboxylic organic detergent, say sodium propyl benzene sulfonate, and the mass introduced into a digester, preferably a rotary digester. The mass is digested at an elevated temperature, say 170° C., for about 2½ hours. The cellulosic material is then removed from the digester and washed thoroughly with water. The resulting product is suitable for use as a textile fiber or in the manufacture of paper.

Example II.—Where it is desired to convert wood into pulp by the use of a solution of a non-carboxylic organic detergent in the absence of other treating chemicals, 2,000 pounds of wood chips may be mixed with 7½ tons of water and about 12½ pounds of a non-carboxylic organic detergent, and the mass digested at a temperature of approximately 170° C. for about 6 hours, after which the pulp is removed from the digester and washed. A very strong wood pulp is produced in this manner.

Example III.—According to this example, wood may be pulped according to the conventional soda process as modified in accordance with the present invention. In this modification, 2,000 pounds of wood chips are mixed with 5 tons of water, 350 pounds of caustic soda and 4 pounds of a non-carboxylic organic detergent. This mass is then treated in accordance with the conventional soda pulp process except that the time of treatment should be limited to from 2½ to 4 hours. Thereafter the treated cellulose material is removed from the digester and washed thoroughly.

Example IV.—When it is desired to produce wood pulp according to the sulfite process, wood chips are treated in accordance with the conventional sulfite process but there should be added to the cooking liquor about 4 pounds of a non-carboxylic organic detergent per ton of wood chips. The mass is digested at an elevated temperature, say 150° C., for about 6 hours. Thereafter, the pulp is removed from the digester and washed thoroughly.

Example V.—According to this example, wood pulp may be produced according to the sulfate process, modified in accordance with the present invention. In this modification, 2,000 pounds of wood chips are mixed with 5 tons of water, 250 pounds of caustic soda, 100 pounds of sodium sulfide and about 6 pounds of a non-carboxylic organic detergent. The mass is cooked in a digester at about 175° C. for about 2¼ to 2¾ hours.

Thereafter, the pulp is removed from the digester and washed thoroughly.

Example VI.—According to this example and the two succeeding examples, waste papers may be converted into pulp. By the processes described, it is possible to use old kraft, box-board, wrapping, news and other low grade stock and produce a pulp which, after bleaching, is substantially snow-white. In the practice of this modification of the process, 2,000 pounds of waste paper are mixed with 5 tons of water, 250 pounds of caustic soda and 4 pounds of a non-carboxylic organic detergent. This mass is cooked in a digester at a temperature of approximately 170° C. for about 4 hours. Thereafter, the pulp is removed from the digester and washed and bleached in the conventional manner.

Example VII.—In this modification of the process 2,000 pounds of waste paper are mixed with 5 tons of water, 5 pounds of a non-carboxylic organic detergent and a conventional sulfite cooking liquor in approximately ½ the amount that would be used if an equivalent weight of wood chips were being treated according to a conventional sulfite cooking process. The resulting mass is introduced into a digester and cooked at a temperature of about 150° C. for about 5 hours. Thereafter, the pulp is removed from the digester and washed and bleached in the conventional manner.

Example VIII.—According to this modification of the process, approximately 2,000 pounds of waste paper are mixed with 5 tons of water, 150 pounds of caustic soda, 75 pounds of sodium sulfide and 5 pounds of a non-carboxylic organic detergent. The resulting mass is cooked in a digester at a temperature of about 170° C. for from 2 to 2½ hours.

Example IX.—In this example and the remaining examples set forth below, there are set forth several modifications of the present invention particularly adapted for the purification of bast fibers such as ramie, sisal, flax, jute and the like, and especially pita which is the bast fiber designated in the examples given. In the first of this group of modifications of the general process, approximately 2,000 pounds of crude debarked pita in the form in which it is delivered to the domestic market, are mixed with 5 tons of water, 200 pounds of caustic soda and 4 pounds of a non-carboxylic organic detergent. This mass is introduced into a digester where it is cooked at a temperature of about 160° C. for about 3 hours. Thereafter, the treated cellulose material is removed from the digester and washed.

Example X.—Crude pita in the form in which it is supplied to the domestic market is introduced into a digester and heated with live steam until the stock is at approximately the boiling point of water. For each ton of fibrous material under treatment, approximately 5 to 10 tons of water are mixed with the stock. The water may be added separately or the treating solution hereinafter described may be dissolved in the water. Assuming that the water has been introduced into the digester, there is next added a treating solution which, for each ton of stock under treatment, may consist of a solution in approximately 50 gallons of water of say from 30 to 40 pounds of a soluble sulfite, either a normal sulfite or bi-sulfite, such as normal sodium sulfite, and from 1 to 10 pounds of a non-carboxylic organic detergent, say sodium lauryl benzene sulfonate. The digester is heated under pressure to elevate the temperature of the stock to approximately

165° C. The liquor is preferably circulated rapidly through the stock by withdrawing it from the lower portion of the digester and introducing it into the top thereof, preferably spraying it on to the top of the mass of material under treatment. After treatment for approximately 1 to 2 hours, the liquor is drawn off and the stock is washed by thoroughly flushing it with an excess of fresh water. Thereafter, the stock is removed and dried for use as desired.

Example XI.—According to this example, the bast fibers under treatment are prepared and treated in substantially the same manner as described in the preceding example with the exception that the treating solution is made up by dissolving in approximately 60 gallons of water about 20 to 40 pounds of a sulfite, say sodium sulfite, from 5 to 20 pounds of sodium thiosulfate, and from 1 to 10 pounds of a non-carboxylic organic detergent.

Example XII.—According to this example, 2,000 pounds of pita or other bast fibers are mixed with 5 tons of water, 150 pounds of caustic soda, 60 pounds of sodium sulfide and about 5 pounds of a non-carboxylic organic detergent. The mass is cooked in the digester at about 160° C. for about 2 hours, after which the cellulosic material is removed from the digester and washed.

A modification of the process as described above, by which purified fibers of unusual strength may be obtained from cellulosic material of the character set forth above, consists in cooking the cellulosic material to be treated in an aqueous solution of an alcohol, such as ethyl alcohol, methyl alcohol, propyl alcohol, glycerol or the like, and preferably ethyl alcohol, in the presence of a non-carboxylic fatty detergent. If desired, the treatment may be conducted in the presence of sodium sulfide or caustic soda. In such case the cooking may be conducted at a lower temperature.

An example of the foregoing modification of the process is as follows:

Wood chips are mixed with about four times their weight of a 50% alcohol solution and about .3% sodium lauryl sulfate on the weight of the wood chips treated. This mass is digested at about 190° C. for from 2 to 4 hours, after which the cellulosic material is removed from the digester and washed. If 5% of the weight of the wood of sodium sulfide or caustic soda is added to the mass in the digester, the temperature of digestion may be reduced to about 175° C. As will be apparent to those skilled in the art, the alcohol employed in the foregoing treatment may be recovered and repeatedly reused in the practice of the process.

The present invention has numerous practical advantages as indicated above. From a commercial standpoint, the two principal advantages of the present process are that the time of treatment is greatly reduced and there may be a substantial reduction in the amount of treating chemicals required, where the invention is practiced in conjunction with conventional pulp-cooking processes.

The fundamental reason why the conventional pulp-cooking processes may be so greatly shortened and the amount of chemicals subject to substantial reduction when non-carboxylic organic detergents are employed is that by the use of these detergents the penetration of the pulping chemicals into the fibers under treatment is tremendously increased. As is well known, crude cellulosic fibers are, in general, made up of a plurality of layers of cellulosic fibers and binding

material. In the conventional pulping processes, the treating chemicals act on the outer layer and dissolve out the binding material after which the chemicals may act upon the next layer and so on until the resinous, gummy and pectous material has been dissolved out, leaving the cellulose fibers free from binding material. In the conventional processes, the action of the pulping chemicals on the several layers which go to make up the composite stalk or fiber bundle is relatively slow due to the fact that the treating chemical cannot penetrate into succeeding inner layers until after the binding material in the outer layers has been dissolved.

I have discovered that where a non-carboxylic organic detergent is employed either alone or in conjunction with a pulping chemical, the treating agents penetrate very rapidly through the body of the fibrous material, thus permitting action of the treating agents upon inner layers of the composite stalk or fiber bundle before the outer layers have been completely dissolved. Thus, where a non-carboxylic organic detergent is used in conjunction with a conventional pulping material, the resulting liquor will penetrate the entire fibrous mass many times more rapidly than a similar liquor not having a non-carboxylic organic detergent dissolved therein. This has been clearly demonstrated in numerous comparative "chip tests".

For example, in conducting one of these tests, a specimen wood chip approximately $2\frac{1}{4}$ inches in length was first painted on one end with a conventional soda cooking liquor in which a dye had been dissolved for the purpose of permitting observation of the penetration of the cooking liquor into the chip. This test was conducted in the cold. It was observed that the penetration of the soda cooking liquor from one end of the chip to the other was approximately 30 minutes. Thereafter, a like wood chip specimen was painted on one end with a sample of the same cooking liquor to which had been added about 0.04 of 1% by weight of sodium lauryl sulfate. This test was conducted under the same conditions as the preceding test and it was observed that the solution penetrated from one end of the chip to the other in approximately one minute. In other words, under the same conditions of operation, the addition of a non-carboxylic organic detergent to a soda cooking liquor increased the speed of penetration of the liquor approximately thirty times.

Other tests were conducted with other cellulosic materials to determine the comparative speed of penetration of pulping liquors with and without the addition of non-carboxylic organic detergents. For example, from one sample of crude, debarked pita fiber, two balls were made by rolling up the fibers, both balls being of the same weight and diameter. These were simultaneously dropped on to the surface of two solutions, one of which was a conventional soda cooking liquor and the other of which was the same liquor to which had been added about 0.04 of 1% of a non-carboxylic organic detergent on the weight of the soda cooking liquor. The time required for each of the balls to sink to the bottom of the container was noted. The ball which had been placed on the surface of the cooking liquor containing a non-carboxylic organic detergent sank almost immediately, the time being estimated at approximately one-fifth of a second. However, the ball which had been placed

on the conventional cooking liquor required approximately five seconds for it to sink.

Numerous comparative tests of the above referred to character have repeatedly demonstrated the great increase in the rate of penetration of pulping chemicals resulting from the use of a non-carboxylic detergent in conjunction therewith. As a result of this increase in the speed of penetration of purifying or pulping chemicals due to the presence of a non-carboxylic organic detergent, the amount of treating chemicals may be substantially reduced without adversely affecting the end result. Due to this fact, and also the fact that the normal time of treatment can be reduced by approximately 50% without adversely affecting the result, there may be produced by the present process a product which is considerably stronger and of better color than a product prepared from the same raw material by a conventional process.

Not only does the present invention result in economy of operation and increase in production in a given period of time but it is also to be observed that the product produced as a result of the practice of the present process is in effect a new and distinct product from a practical and commercial standpoint. For example, in a particular test wood chips were treated with a soda cooking liquor according to the conventional soda pulp process with the exception that the time of treatment was reduced approximately 50% and the amount of caustic soda used was reduced about 25%. In the cooking liquor had been dissolved a non-carboxylic organic detergent to the extent of approximately 0.2 of 1% on the weight of the dry wood chips treated. The pulp produced by this process, after being subjected to a conventional bleaching operation, was submitted for examination by a trained paper chemist who was requested to report on the type and character of the pulp submitted. This chemist, after examining the pulp, promptly commented that it was a good quality of sulfite pulp, whereas it was, in fact, a soda pulp. Of course, as is well known, soda pulp is ordinarily made up of fibers of relatively short length, whereas the fibers in sulfite pulp are several times longer than soda pulp fibers, this being due to the harsher action of the soda cooking liquor on the fibrous material.

The foregoing test clearly demonstrates an important feature of the present invention. By the use of the present invention, a pulp may be produced according to the soda process in which the length of fibers approximates the length of the fibers of sulfite pulp prepared from the same raw material.

Similarly, when pulp is prepared according to the sulfite or sulfate processes, modified in accordance with the present invention, the pulp which is produced is of materially better quality than the pulp produced from the same raw materials by conventional sulfite or sulfate processes. The fibers in such cases are longer and stronger and, in particular, the pulp is markedly more free from shives than is the pulp prepared according to conventional sulfite or sulfate processes. In fact, it has been demonstrated that the pulp produced in accordance with the present invention is substantially completely free from shives.

Another important characteristic of the pulps produced in the practice of the present invention is that the hydration curves for such pulps are substantially steeper than pulps made from simi-

lar raw materials by conventional pulping processes. In other words, the time required for hydrating these pulps is materially less than is required for hydrating pulps produced by conventional pulping processes.

In the pulping of coniferous woods these non-carboxylic organic detergents play a very important function. When they are employed in a pulp cooking liquor used for producing pulp from coniferous woods, the gummy reaction products which are formed during the pulping operation are far more rapidly dispersed in the cooking liquor than is the case when a non-carboxylic organic detergent is not present, with the result that these gummy reaction products are more speedily removed from contact with the cellulose fibers of the material under treatment. Hence, these non-carboxylic organic detergents serve not only to hasten the speed with which the pulping chemical is brought into contact with the resinous, gummy and pectous material present in the fibrous stock under treatment but they also serve to disperse the reaction products of these materials with the pulping chemicals and thereby remove the same from contact with the cellulose fibers. This, of course, accounts in part for the more rapid operation of the present process than similar conventional pulping processes.

The above referred to rapid dispersion of the gummy reaction products due to the presence in the cooking liquor of a non-carboxylic organic detergent also plays an important part in connection with the washing of the treated pulp. Due to the increase in the rate of dispersion, the washing of the treated pulp is accomplished far more quickly and effectively than in the case of pulp prepared from similar raw materials by conventional pulping method.

From a commercial standpoint, the present invention possesses an important advantage in that it renders commercially possible the pulping of such conifers as jack-pine, slash-pine and the like, which are notoriously difficult to pulp satisfactorily. As is well known, in producing pulp from such conifers as slash-pine, the difficulty is ordinarily encountered that a portion of the resinous and gummy material present is far more readily soluble than the portion of such material which is in and adjacent to the heart of the tree, with the result that pulp produced from such woods is generally made up of both under-cooked and over-cooked fibers.

Extensive tests conducted with the above referred to type of conifers have demonstrated that by the practice of the present invention the difficulties heretofore encountered in the pulping of these woods are materially reduced so that it is now possible to prepare pulp of good quality from these woods. This appears to be due to the fact that the non-carboxylic organic detergents employed with the cooking liquors act upon the more difficultly soluble resins and gums in such a manner that they can be removed through the action of the pulping chemicals at substantially the same rate as the more readily soluble resins and gums, with the result that the final product does not contain over-cooked and under-cooked fibers to anything like the same extent as pulps prepared from these woods according to conventional processes. In fact, it has been shown that pulps prepared from such woods according to the present invention are of substantially uniform fiber characteristics. Accordingly, by the practice of the present invention there can be pro-

duced from such conifers as jack-pine, slash-pine and the like, pulps which approximate the quality of pulps produced from the northern deciduous woods. For example, in actual operation of the present invention pulp produced from slash-pine, by the sulfite process, modified to include the use of a non-carboxylic organic detergent in the cooking liquor, was found to be of substantially the same quality as sulfite pulp produced according to the conventional sulfite process from spruce wood.

While I have described in detail the preferred practice of my invention and have set forth numerous modifications of the general process, it is to be understood that the proportions of ingredients, arrangement of steps and other details of procedure may be variously modified without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. A process of producing pulp from waste paper which comprises digesting the same in a pulp-cooking liquor selected from the group consisting of soda, sulfite and sulfate cooking liquors, said cooking liquor having additionally dissolved therein a penetrant selected from the group comprising alkali-forming metal alkyl sulfates; alkyl substituted naphthalene sulfonic acids and alkali-forming metal salts thereof; alkyl substituted benzene sulfonic acids and alkali-forming metal salts thereof; and normal alkyl sulfonic acids wherein the sulfonic acid radicle is in the terminal position and alkali-forming metal salts thereof.

2. A process of producing pulp from waste paper which comprises digesting the same in a pulp-cooking liquor selected from the group consisting of soda, sulfite and sulfate cooking liquors, in the presence of a reagent having the type formula

MXR

wherein M is selected from the group consisting of hydrogen and alkali-forming metals, X is an acid radicle to which may be linked both an alkyl group and hydrogen or an alkali-forming metal, and R is an alkyl group.

3. In a process of producing pulp from waste paper wherein such material is cooked in a boiling cooking liquor having a pulping chemical dissolved therein, said cooking liquor being selected from the group consisting of soda, sulfite and sulfate cooking liquors, the improvement which comprises dissolving in the cooking liquor prior to its becoming spent a penetrant selected from the group comprising alkali-forming metal alkyl sulfates; alkyl substituted naphthalene sulfonic acids and alkali-forming metal salts thereof; alkyl substituted benzene sulfonic acids and alkali-forming metal salts thereof; and normal alkyl sulfonic acids wherein the sulfonic acid radicle is in the terminal position and alkali-forming metal salts thereof.

4. In a process of producing pulp from waste paper wherein such material is cooked in a boiling cooking liquor having a pulping chemical dissolved therein, said cooking liquor being selected from the group consisting of soda, sulfite and sulfate cooking liquors, the improvement which comprises dissolving in the cooking liquor prior to its becoming spent a reagent having the type formula

MXR

wherein M is selected from the group consisting of hydrogen and alkali-forming metals, X is an

acid radicle to which may be linked both an alkyl group and hydrogen or an alkali-forming metal, and R is an alkyl group.

5. The process of purifying waste paper which comprises cooking the same in a pulping liquor selected from the group consisting of soda, sulfite and sulfate pulp-cooking liquors, in the presence of a reagent having the type formula

M.X.R

wherein M is selected from the group consisting of hydrogen and alkali-forming metals, X is an acid radicle to which may be linked both an alkyl group and hydrogen or an alkali-forming metal, and R is an alkyl group.

FRANCIS H. SNYDER.