UNITED STATES PATENT OFFICE

2,150,926

PROCESS OF MAKING AND BLEACHING PAPER

Hans O. Kauffmann and George M. Wolfe, Jr., Buffalo, N. Y., assignors to Buffalo Electro-
Chemical Company, Inc., Buffalo, N. Y.

No Drawing. Application July 3, 1937,
Serial No. 153,947

5 Claims. (Cl. 92—40)

This invention relates to a process for bleaching sheet material formed of fibrous pulp of vegetable origin and more particularly to the bleaching of such sheet material by the employment of hydrogen peroxide or substances generating hydrogen peroxide in solution.

In the manufacture and sale of paper, one of the important characteristics considered is the degree of whiteness of the paper. In general, efforts to obtain white paper have been directed to treatment of the pulp in order to obtain a high degree of color elimination in the pulp, and many procedures have been suggested whereby the vegetable fiber pulp, whether the same be of wood or of rag content, was subjected to vigorous bleaching action of many types of bleaching reagents, the most important being alkaline hypochlorite.

In these prior bleaching procedures one common characteristic is the high liquor ratio, that is, the ratio of solid material or fiber to liquid. Thus, when bleaching in the beaters, the liquor ratio may be 1 to 12, as calculated on the weight of pulp, or even as high as 1 to 25, where only about 4% of pulp is present in the solution. Thus, in bleaching the pulp large quantities of bleaching solutions are required, and relatively high concentrations of bleaching material must be used in the solutions. In any event, the bleaching ingredient is used inefficiently and large quantities consumed in obtaining a specified resultant degree of white. In addition, the solution carrying the pulp contains certain quantities of water soluble materials upon which the bleaching material acts without producing a compensating decrease in the color of the pulp.

It is an object of the present invention to provide a method for bleaching sheet material, such as paper formed from fibrous pulp of vegetable origin, that is relatively more economical than the procedures used heretofore. It is also an object of the invention to provide a method of bleaching paper wherein the liquor ratio of the bleaching solution to pulp is very considerably reduced over the liquor ratios used heretofore. As a resultant advantage of the use of low liquor ratios while bleaching sheet material, high bleaching efficiency is obtained and the losses of bleaching material are maintained at a minimum.

In addition, the present procedure can be adapted for use with mechanisms and apparatus presently in use for the manufacture of paper and sheet material in general.

A particular advantage of the process resides in the fact that a white paper of a high degree of white, as compared to the magnesium carbonate standard is obtained, and a paper which possesses excellent tenacity strength and a strength not capable of reproduction where the vigorous bleaching of the pulp, required to obtain comparable whiteness, has been performed as the disintegrating action of the oxidizing agent upon the pulped fibers has been avoided. A further advantage of the process is the production of paper of a high degree of whiteness capable of maintaining its whiteness and which shows little yellow tint after subject to ultra violet rays and tested for fading.

In accordance with the procedures of the present invention the vegetable fiber suitable for the production of the grade designated as "white paper", whether the same be wood pulp, rag pulp, linen pulp or other conventional vegetable fiber, is beaten in the usual or conventional manner in the usual type of beater, and the usual fillers or white pigmenting material added in the usual way. Such a conventional pulp will comprise a suspension of vegetable fibers in an aqueous solution wherein the content of fiber is from about 3 to about 10% with a usual average of around 4%. This fibrous pulp is then fed onto a paper forming machine of the usual type provided with a screen, the fiber pulp formed into sheets, the sheet being then passed to a belt and carried to rollers. The matted vegetable fiber thus formed into a wet lap of sheet material and still containing relatively little strength and possessing a relatively high water content is subjected to suction either on one or both sides of the sheet, whereby the water content is reduced to about 50 to 200% of the weight of the dry fiber, giving a liquor ratio from about 1:0.5 to 1:2.0.

In accordance with the procedures of the present invention, a solution containing or generating active oxygen is incorporated in this wet lap in any conventional way, as for example, by spraying or dipping and the like, and, an aqueous solution of this bleaching material being readily compatible with the liquor still remaining in the pulp fibers, is readily absorbed by the fibers so that the sheet is fully and uniformly impregnated from the surface to the interior with the bleaching solution. The so impregnated sheet is then subjected to controlled drying, during which period bleaching occurs. For instance, the sheet is then fed from the bleaching sprayers following the suction rolls to the drying rolls and subjected to caloric drying whereby water is progressively eliminated until a sheet is produced having from

55
about 5 to 15% moisture, more or less, depending upon the relative humidity of the atmosphere, the time of contact with the drying rolls and the temperature of the drying rolls. During the drying of the wet fiber sheet impregnated with the peroxide generating bleaching agent, water is gradually eliminated from the sheet, still further reducing the liquor ratio whereby the concentration of peroxide is gradually built up and the fibers in effect brought into contact with a concentrated and vigorous bleaching agent. By this procedure a bleached paper sheet of excellent whiteness is produced.

Examination of the paper produced shows that the whole of the fibers is bleached. The core of the paper is bleached due to the fact that the bleaching solution impregnates the wet lap or pulp sheet completely and during the drying period by passage over the heating rolls, the sheet is heated from the exterior to the center with rapid evaporation from the surface and as moisture is thus evaporated any unreacted peroxide or peroxide generating solution is gradually drawn to the surface and during its passage exerts a bleaching action upon the interior and a final complete bleach at relatively high concentration upon the surface of the paper.

As already indicated herein above, the preferred bleaching agent is hydrogen peroxide and within this term is comprehended materials generating active oxygen in solution such as the perborates, persilicates, alkali metal and alkaline earth metal peroxides and the like. In general, commercial hydrogen peroxide, such as the 100 volume product now marketed, is very desirable and may be sprayed upon the pulp sheet either in slightly acid, neutral or alkaline condition. In many instances it is desirable to use an alkaline solution of the bleaching agent; materials such as soda ash, trisodium phosphate, caustic soda, sodium silicate and the like, may be added to the peroxide in any desired quantity. In general, this quantity will be controlled by the properties of the resultant paper and the effect of the alkali upon the peroxide. Usually the pH value of alkaline peroxide solution for treating pulp sheets will be below about pH 11. Where the paper contains sizing materials, for instance, starch, casein and the like, the pH should be such as to maintain the pH at a value adjusted to the desired value either by adjusting the pH value of the peroxide solution or of the pulp itself.

It has been found that as the water evaporates from the pulp sheet the alkaline material deposited in the fiber and, in the case of sodium silicate particularly, aids in producing a finish upon the completed sheet discharged from the hot rolls.

The concentration of peroxide in the bleaching solution and the amount of peroxide upon the wet pulp sheet will be regulated by the condition and composition of the pulp stock. In general, the amount of bleaching solution incorporated in the wet pulp sheet will be that quantity sufficient to produce about 1-4 volume concentration in the liquor. However, these though through the experiments we have indicated that the bleaching solution is to be sprayed upon the wet lap, any means of incorporating the bleaching solution in the wet fibers with a low liquor ratio is contemplated by the invention and to this end the peroxide may be included with the pulp or added thereto at any point in the consolidation of the fibers or after the consolidation and before final drying to the end that the wet lap contains a liquor ratio of less than 1:2.0 and sufficient peroxide so that upon drying the requisite bleach is obtained.

Where finishing size or surfaceing materials are added to the paper the active oxygen generating material may be added with these materials and the wet lap or partially dried lap passed through this solution and then over the final finishing rolls.

From the foregoing it will be seen that the present invention provides a procedure for manufacturing paper of good whiteness by employing apparatus currently in use with efficient and economic use of the bleaching agent employed.

What is claimed is:

1. The method of producing sheet material of unified vegetable fibers by forming an aqueous pulp of the fibers into a sheet and removing a substantial proportion of the water from the fibers producing a pulp sheet wherein the liquor ratio is between about one-half to one to two to one, which comprises incorporating a bleaching solution generating active oxygen in and throughout the pulp sheet and thereafter eliminating substantially all the moisture from the sheet whereby the bleaching agent is progressively concentrated for effectively bleaching the fibers.

2. The method of producing sheet material of unified vegetable fibers by forming an aqueous pulp of the fibers into a sheet and removing a substantial proportion of the water from the fibers, producing a pulp sheet wherein the liquor ratio is between about one-half to one to two to one, which comprises incorporating a bleaching solution generating active oxygen in and throughout the pulp sheet and thereafter eliminating substantially all the moisture from the sheet whereby the bleaching agent is progressively concentrated for effectively bleaching the fibers.

3. The method of producing sheet material of unified vegetable fibers by forming an aqueous pulp of the fibers into a sheet and removing a substantial proportion of the water from the fibers, producing a pulp sheet wherein the liquor ratio is between about one-half to one to two to one, which comprises incorporating a bleaching solution generating active oxygen in and throughout the pulp sheet and thereafter eliminating substantially all the moisture from the sheet whereby the bleaching agent is progressively concentrated for effectively bleaching the fibers.

4. The method of producing sheet material of unified vegetable fibers by forming an aqueous pulp of the fibers into a sheet and removing a substantial proportion of the water from the fibers, producing a pulp sheet wherein the liquor ratio is between about one-half to one to two to one, which comprises incorporating a bleaching solution generating active oxygen in and throughout the pulp sheet and thereinafter heating the so impregnated pulp sheet to dry the same whereby the bleaching agent is progressively concentrated for effectively bleaching the fibers.

5. The method of producing sheet material of unified vegetable fibers by forming an aqueous pulp of the fibers into a sheet and removing a
substantial proportion of the water from the fibers, producing a pulp sheet wherein the liquor ratio is between about one-half to one to two to one, which comprises incorporating a bleaching solution generating active oxygen in and throughout the pulp sheet by spraying a bleaching solution containing sodium silicate and hydrogen peroxide upon the pulp sheet and heating the so treated sheet to eliminate substantially all the moisture therefrom whereby the bleaching agent is progressively concentrated and the fiber effectively bleached.

HANS O. KAUFFMANN.
GEORGE M. WOLFE, Jr.