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[54] **PROCESS AND COMPOSITION FOR MANUFACTURING TOP LINER AND THE LIKE FROM PRINTED AND COATED STOCK**

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[58] **Field of Search** ..... 162/5, 72, 77, 4; 252/351, 252/352, 357, 139, 136, DIG. 1

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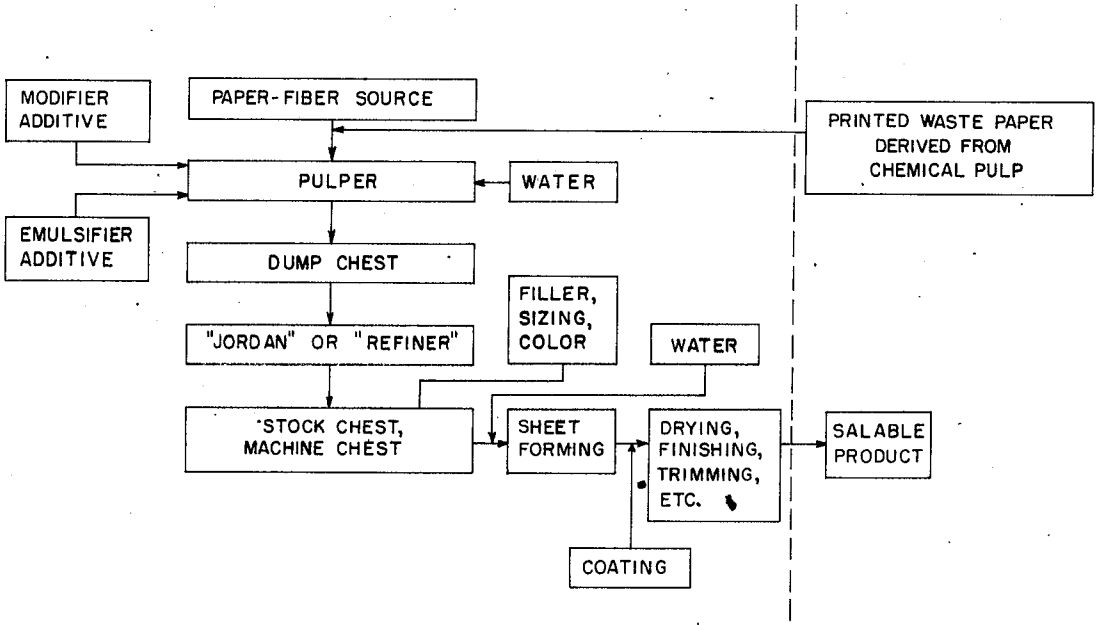
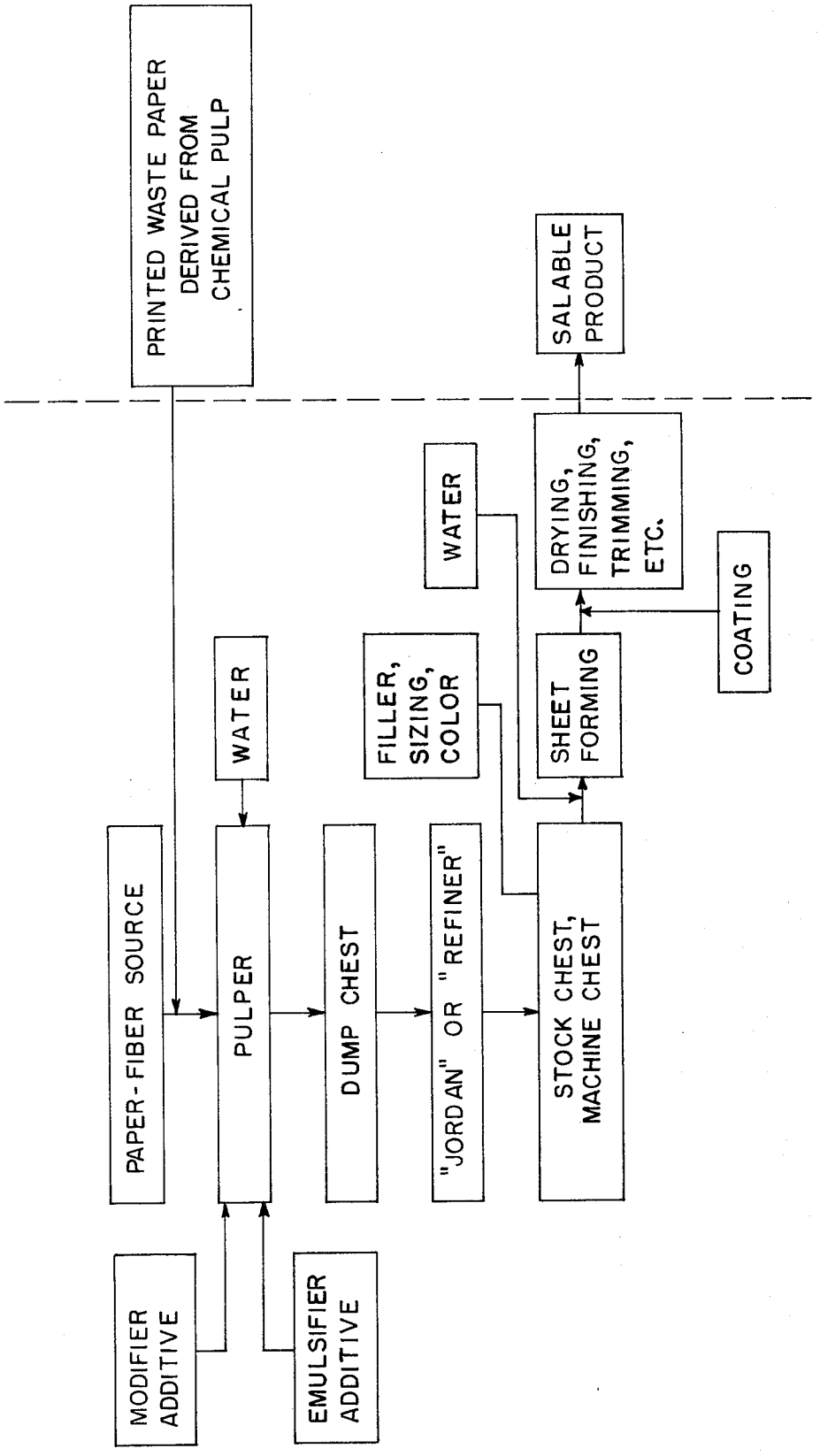
[57] **ABSTRACT**

A method and composition for use in accordance therewith are disclosed for manufacturing top liner and other coated paper products from printed and coated paper and paperboard derived from chemical pulp with conventional paper making equipment. The furnish is pulped in the presence of an effective amount of ethoxylated aliphatic alcohol emulsifier in admixture with a second material selected from the group alkali metal phosphate salt and alkali metal silicate salt. No hydrogen peroxide or other bleaching agent need be present, and no extra washing or ink-separating steps are required. A sheet formed from the released fiber is coated, using a conventional starch coating method, to produce a white top liner or other coated paper product.

22 Claims, 1 Drawing Figure




PRINTED WASTE PAPER DERIVED FROM CHEMICAL PULP
SALABLE PRODUCT
WATER
DRYING, FINISHING, TRIMMING, ETC.
COATING
FILLER, SIZING, COLOR
SHEET FORMING
WATER
PAPER-FIBER SOURCE
PULPER
DUMP CHEST
"JORDAN" OR "REFINER"
STOCK CHEST, MACHINE CHEST
MODIFIER ADDITIVE
EMULSIFIER ADDITIVE

PROCESS AND COMPOSITION FOR MANUFACTURING TOP LINER AND THE LIKE FROM PRINTED AND COATED STOCK

This invention generally relates to a method of utilizing cellulosic fibers released from printed and coated paper products manufactured from chemical pulp to manufacture high quality top liner and similar coated paper products. The present invention is also directed to a composition which can be used in practicing this method.

In conventional paper and paperboard manufacture, there are at least four different kinds of wood pulp which are commonly identified as mechanical pulp, sulfite pulp, sulfate pulp and soda pulp. While mechanical pulp is prepared by purely mechanical means, sulfite, sulfate and soda pulps are prepared by chemical means. Mechanical pulp contains all of the wood constituents except the bark and that which is lost during storage and transportation. Chemical pulps are essentially pure cellulose having been freed of unwanted lignin and other non-cellulosic components of the wood which are dissolved away by the chemical pulp treatment. Chemical pulps, accordingly, are much superior in quality to mechanical pulp for fine paper making. As a result of the special processing required, however, chemical pulps are considered too expensive for the cheaper grades of paper, such as newsprint. The relatively high cost of chemical pulp paper products makes it highly desirable to provide a process whereby waste from such products, even though printed and colored, can be used as a source for cellulosic fiber in the manufacture of paper products, particularly high quality paper products such as, for example, top liner and similar coated paper products.

While numerous methods of de-inking paper products have been suggested heretofore, these methods have generally involved the steps of either the separation of ink from the slurry containing the fiber or the bleaching of released fibers to eliminate the ink color from the fiber-containing system. More specifically, these prior art deinking processes have generally contempated as an essential thereto, the elimination of ink particles prior to sheet formation by conventional liquid-solid separation techniques such as, for example, skimming, flotation and filtration, or either conjointly or in the alternative, bleaching of the released fibers.

It is an object of this invention to provide an improved method and composition for recovering cellulosic fibers from printed and coated chemical pulp products, and for manufacturing coated paper products therewith such as, for example, top liner and the like.

Another object of the present invention is to treat printed and coated furnish derived from chemical pulp products to release the cellulosic fibers thereof and change the physical condition of the coloring and coating material contained therein to a condition wherein such fibers can be used to produce paper products which, when coated with conventional starch-clay coatings, are substantially white paper product such as, for example, top liner.

Another object of this invention is to provide a method of manufacturing coated paper products from printed and coated furnish manufactured from chemical pulp, which method utilizes existing conventional papermaking equipment and which does not require the use of special washing steps, bleach treatment, such as, for example, with hydrogen peroxide, or the like.

These and other objects which will be apparent hereinafter are all achieved in accordance with the method of this invention which is described in general, and in connection with particularly preferred embodiments hereinafter, with the aid of the accompanying drawing which is a schematic flow sheet of a paper making system wherein the process of the present invention may be employed.

The process described on the flow sheet generally includes steps well known and widely used in the art of manufacturing paper products such as top liner and the like and which, therefore, need not be extensively discussed herein. In accordance with an important aspect of this invention, however, printed waste paper derived from chemical pulp such as, for example, dixie cups, milk cartons, magazines, and the like is charged to a conventional pulper, along with water, a special emulsifier additive and a modifier additive. Agitation in the pulper is, in some embodiments, preferably carried out with the contents of the pulper at an elevated temperature, such as, for example, about 170° F. After the cellulosic fibers are released, the resulting slurry is transferred to a dump chest, and subsequently passes through a conventional "Jordan" or "refiner," stock chest, machine chest, and then to a sheet-forming machine. Conventional filler, sizing, color and the like can be added at the machine chest if desired. In accordance with the present invention, the sheet produced in the sheet-forming machine is coated using conventional coating methods, and the coated sheet is subsequently processed by conventional drying, finishing, trimming and the like.

The term "pulper," as used herein, is to be understood to include any equipment suitable for pulping, such as a conventional high speed pulper (Hydropulper, T.M.), likewise, as used herein, the term "sheet-forming machine" is intended to include conventional paper sheet-making machines such as Fourdrinier machines, cylinder machines, and the like.

Emulsifier additives which are used in accordance with this invention are water-soluble emulsifiers from the group consisting of ethoxylated aliphatic alcohols. The modifier additives are selected from the group consisting of alkali metal phosphate salts and alkali metal silicate salts.

The water-soluble emulsifiers referred to above are derived from substantially water-insoluble aliphatic alcohols by ethoxylation using well known techniques. Preferred ethoxylated aliphatic alcohols uselful in accordance with this invention are those in which the hydrophobic portions of the molecules are mixtures of straight chain alcohols. For example, water-insoluble alcohols having from 5 to 20 carbons are useful as the hydrophobic moiety, and the mole ratios of combined ethylene oxide to hydrophobe can vary from 1:1 to 1:50. The preferred surface active compounds of this class are the alkyl polyethyleneoxy ethanols in which the starting (alkyl) alcohol is a secondary alcohol having a number of carbons in the range 11–15, and wherein the molar ratio of ethylene oxide and hydrophobic alcohol is in the range 5:1 to 15:1 with compounds having the average molar ratio in the range of 5:1 to 9:1 being most preferred. A number of such compositions are commercially available; for example, such compositions are available under the trade names

"TERGITOL 15-S-5," "TERGITOL 15-S-7," "TERGITOL 15-S-9," "TERGITOL 15-S-12," and "TERGITOL 15-S-15." These compositions are mixtures of homologues wherein the hydrophobic alcohol is a mixture of secondary C_{11-15} alkyl alcohols and wherein the molar ratios of ethylene oxide to hydrophobic alcohol are reportedly 5, 7, 9, 12 and 15, respectively. While it is not intended that the invention be limited by any theories, it is noted that the most preferred surface active materials of this class are compounds in which the hydrophobic constituent is bonded at a secondary carbon, possibly providing a desirable degree of wettability in addition to outstanding emulsification characteristics.

An example of a preferred emulsifier in the ethoxylated aliphatic alcohol class which is derived from a primary liner C_{12-15} aliphatic alcohol having an ethoxy/hydrophobe molar ratio of 12:1 is "NEODOL 25-12" (T.M.). An example of an emulsifier derived from lauryl alcohol and having an ethyleneoxy/alcohol ratio of 12:1 is "LIPAL 12 LA" (T.M.). An example of an emulsifier derived from lauryl alcohol and having an ethoxy/hydrophobe molar ratio of 8:1 is known as "TRYCOL LAL-8" (T.M.). Although alkyl polyethoxyethanols produced from linear primary hydrophobic alcohols, particularly those having 12 to 15 carbons, are also contempated for use in accordance with this invention, the secondary alcohol-derived compounds are preferred.

The emulsifier additive of this invention is added in an amount from 0.1% to 5.0% by weight based on the weight of the colored stock used.

It has been observed that the use of several of the most preferred commercially available emulsifiers, referred to above, tends to be accompanied by substantial foaming. It has been found that conventional defoamers can be used to control whatever may be considered an undesirable amount of foaming without adversely affecting the performance of the method of this invention with respect to the manufacture of high quality coated paper products from printed and coated paper furnish.

A number of "TERGITOL 15-S-N" commercially available emulsifiers are recited hereinbefore in which "N" is a number in the range 5–15. With the use of those commercially available materials identified by such names in which the "N" is the number 7, and greater numbers, the co-joint use of a defoamer is preferred.

It has also been found that ethoxylated alkyl phenols, such as "IGEPAL CO 430," "TRITON X-102," "TRITON X-114," can be used in conjunction with the ethoxylated aliphatic alcohol type emulsifiers of this invention. These surface active materials have an effect on the extent of foaming and also have a highly beneficial effect on the dispersing of ink particles which are visible under 30 power magnification to such an extent that they are no longer visible under 30 power magnification. Preferred supplemental materials are ethoxylated alkyl phenols in which the alkyl substituent is octyl and nonyl. Alkyl phenoxy polethoxyethanols of this type are widely available surface active materials. The most preferred compounds of this class are those in which the alkyl substituent of the phenol group is tertiary octyl and in which the ratio of moles of ethylene oxide per mole of hydrophobe is in the range 7–8. Such most preferred materials are commercially available under the name "TRITON X-102" and "TRITON X-114." However, compounds of the ethoxylated alkyl phenol class having linear alkyl groups, such as octyl and nonyl, or in which the phenol is dialkyl substituted, are also contemplated for use as a supplemental emulsifier in accordance with this invention. A nonyl phenol with a 10.5:1 ethyleneoxy/alkyl phenol ratio is "IGEPAL CO-710" (T.M.). A nonyl phenol having a 20:1 ratio of ethyleneoxy/alkyl phenol is "SURPHONIC N-200" (T.M.). An octyl phenol-derived compound of this class having an ethyleneoxy/octyl phenol ratio of 15:1 is "TRITON X-165" (T.M.).

The modifier additives which are used in accordance with this invention include the sodium and potassium salts of phosphoric and silicic acid although sodium salts are preferred because of cost considerations. Thus, any of the fully or partially neutralized sodium and potassium salts of orthophosphoric acid are preferred metal salts for use as modifier additive, in accordance with the method of this invention. Aqueous solutions of alkali metal silicate salts such as sodium silicate solutions are preferred forms of the modifier additives for use in accordance with this invention.

In accordance with an important aspect of the present invention, a formulation is provided for practicing the above described method. This formulation comprises an emulsifier additive of the type generally described above, a modifier additive of the type described above, or in lieu thereof, a material which by reaction in the slurry will provide the desired alkyl metal phosphate salts and/or alkyl metal silicate salts, and a suitable stabilizer which operates to prevent separation and/or freezing of the emulsifier and modifier additives during the handling, shipping and storage thereof.

A preferred formulation for use in the practice of the present invention which is especially suitable for use at high pH ranges (8-10) is comprised of the following:

Component	Per Cent (by weight)
A. Alkyl polyetheneoxy ethanols in which the alkyl portion is a secondary alcohol having 11–15 carbons and wherein the average molar ratio of combined ethylene oxide and secondary alcohol is in the range of 5:1 to 9:1	40–80
B. Orthophosphoric acid	10–50
C. Isopropyl alcohol	5–20

In using the above formulation, a suitable base such as sodium hydroxide is added with the formulation to the pulper to produce the modifier additive (e.g. phosphate salt) in situ by reaction of such base with the phosphoric acid component.

The isopropyl alcohol component in the above formulation is used primarily to raise the cloud point to prevent separation in hot weather and to lower the freezing point in cold weather. Other suitable substitutes for this component will, accordingly, be apparent to those skilled in this art and would include, by way of example, only, ethyl alcohol, methyl alcohol and butyl alcohol.

A particularly preferred embodiment of the above described formulation is composed of 60% by weight of

a suitable ethoxylated aliphatic alcohol such as "TERGITOL 15-S-5," 30% by weight of orthophosphoric acid, and 10% by weight of isopropyl alcohol.

Since certain of the water-soluble emulsifiers used in the present invention may produce foaming, it may be necessary to either incorporate a conventional antifoamer or defoamer constituent in the above formulations or, alternatively, separately add such defoamer to the pulper along with the formulation. Suitable anti-foaming or defoamer materials will be apparent to those skilled in this art and, accordingly, a specific and detailed description thereof is not deemed necessary. Typically, however, these suitable anti-foaming or defoamer constituents would include those compositions which are currently commercially available under the trademark "IGEPAL CO-430" and "NETRONYX 622." These materials are used in amounts which are sufficient to control to the desired extent, or eliminate, foaming in the paper making system.

If desired, the alkali metal phosphates can be eliminated entirely and may be highly desirable in certain installations wherein it is considered beneficial to public waterway ecology to avoid phosphates. In such instances, alkali metal silicate, or mixtures of sodium silicate and sodium hydroxide (e.g. 50:50 mixtures) can be used with the emulsifier additive of this invention. The amount of modifier additive which is used is preferably the minimum amount which will provide a pH in the range 8–10, more preferably in the range 9–10.

In the following examples, and throughout the specification and claims, all amounts are expressed in parts by weight, all temperatures are expressed in degrees Fahrenheit, and all percents (%) are expressed in percent by weight based on the weight of the material referred to, unless otherwise indicated.

EXAMPLE 1

Scrap colored paper from products made from chemical pulp, and comprising dixie cups, milk cartons, National Geographic magazines, and the like, was charged to a 2,000 lb. pulper and an emulsifier additive "TERGITOL 15-S-5," which was described hereinbefore, was added thereto at the rate of 30 lbs. of emulsifier per ton of scrap paper charged. Sufficient water is charged to provide a consistency of about 5%. An aqueous solution of sodium orthophosphate (10%) is added in an amount sufficient to adjust the pH of the aqueous system to 10.0. The resulting admixture was heated to a temperature of 180° F. The contents of the pulper are thoroughly beaten and agitated during the heating cycle. The scrap paper is gradually defibered and the ink is released in the aqueous phase. The resulting fiber slurry-ink mixture is used in a cylinder machine process. It is noted that the slurry is not substantially diluted or cooled prior to its use in the cylinder machine. The resulting sheet is subsequently processed in a conventional coating method using a starch-clay coating, and the final product of the method of this invention is a white top liner of excellent quality free of waxy spots and visible ink specks.

EXAMPLE 2

The procedure of Example 1 is repeated, except that the emulsifier is added in the form of a prepared solution comprising "TERGITOL 15-S-5," phosphoric acid (75%) and isopropyl alcohol in the weight ratio 60:30:10. Also, in the present example, sodium hydroxide is added instead of sodium phosphate to bring the pH to 10.0. Otherwise the conditions set forth in Example 1 are utilized and the product produced in accordance with the present example is substantially identical to the product produced in accordance with Example 1. It is noted that sodium phosphate is formed in situ during the pH adjustment step.

EXAMPLE 3

The procedure of Example 1 is repeated except that the emulsifier used in Example 1 is replaced by "TERGITOL 15-S-7" which was described hereinbefore, and furthermore, an effective amount of a defoamer mixture comprising "IGEPAL CO-430" and "NETRONYX 622" is used in conjunction therewith.

EXAMPLE 4

The procedure of Example 1 is repeated, except that instead of the sodium phosphate salts a 50:50 mixture of sodium hydroxide and sodium silicate is added to the aqueous system in an amount sufficient to raise the pH to 10.0. Thus, in the present example, no phosphates whatsoever are utilized. The results of the present example are substantially identical to the results achieved in the method of Example 1.

EXAMPLE 5

The procedure of Example 4 is repeated except that the material added to the aqueous system comprises a mixture of "TERGITOL 15-S-7" and the defoamers used in Example 3. The results obtained are substantially identical to those achieved in Example 1.

By way of further illustration, other alkali metal phosphate salts which can be used in accordance with the present invention include sodium hexametaphosphate, sodium tripolyphosphate, and monobasic, dibasic and tribasic phosphates.

As the term is used herein, the so-called "coating" method is any well-known conventional coating method for example, roll, air knife, spray coating and tub sizing. Tub sizing is carried out on relatively dry paper, or on surfaces which may or may not have been previously or partly sized in the beating operation. The material used for this treatment must have adhesive properties. The principal substances used for adhesive properties in tub sizing methods include animal glue, modified starches and wash sizes. The operation of tub sizing is carried out either on the papermaking machine itself, or in a separate sizing press employing air drying. The paper contacts size material, then runs through rolls that remove the excess material and finally runs over drying rolls. This type of sizing operation is used further to enhance the water resistance of the paper, and especially to make it take ink evenly without blurring, even after erasures.

In the method of this invention, the formed sheet, prior to coating, is in some instances lightly colored. However, any coloring remaining on the paper is so disposed that, after the coating step, the coloring is no longer visible and the product is uniformly white. Moreover, even though some of the paper used in the furnish, in all of the examples, included some waxed materials, the product of the process of this invention is free of wax specks or spots and is readily printable.

In the foregoing specification, a detailed description has been provided with respect to certain preferred em-

bodiments of the present invention. It will be appreciated, however, that modifications and variations therefrom may be made by those skilled in the art without departing from the spirit and scope of this invention. Accordingly, the present invention is to be limited only by the scope of the appended claims.

We claim:

1. A method for manufacturing top liner and the like from printed and coated stock derived from chemical pulp, comprising the steps: agitating said stock together with an emulsifier and an additive in water to release the fibers and disperse the printing and coating constituent of said stock in said water, wherein the emulsifier is an ethoxylated aliphatic alcohol, and wherein said additive is selected from the group consisting of alkali metal phosphate salts, alkali metal silicate salts and mixtures thereof, said emulsifier being present in an effective amount in the range 0.1% to 5% based on the weight of said stock, said additive being present in an amount from 0.0125% to 6.25% based on the weight of said stock, and said dispersing of said stock being conducted at an alkaline pH, said dispersing step resulting in the formation of a slurry wherein said stock as well as the printing and coating constituents thereof are dispersed; charging said slurry to a sheet forming machine and forming a paper sheet from the resulting released fibers; coating the resulting sheet with an opaque coating.

2. The method of claim **1** wherein the ethoxylated aliphatic alcohol is a hydrophobic secondary alcohol having from 11–15 carbons, and wherein the average molar ratio of etylene oxide to hydrophobic alcohol is in the range 5:1 to 15:1.

3. The method of claim **1** wherein the ethoxylated aliphatic alcohol is one in which the hydrophobic portion is a mixture of straight chain aliphatic alcohols and the average mole ratio of the combined ethylene oxide to hydrophobic portion is in the range 1–50.

4. The method of claim **1** in which the emulsifier is an alkyl polyethyleneoxy ethanol in which the alkyl portion is derived from a secondary alcohol having 11–15 carbons and wherein the average molar ratio of combined ethylene oxide and secondary alcohol is in the range 5:1 to 9:1.

5. The method of claim **1** in which the emulsifier is derived from a water-insoluble secondary alcohol having a number of carbons in the range 11–15, and in which the emulsifier has an average molar ratio of combined ethylene oxide to said secondary alcohol in the range 7:1 to 15:1, and in which an anti-foaming agent is also present during the agitation.

6. A composition for use in the manufacture of top liner and the like from printed and coated stock derived from chemical pulp, said composition consisting essentially of from 40% to 80% by weight of an ethoxylated aliphatic alcohol, from 10% to 50% by weight of a modifier additive selected from the class consisting of alkali metal phosphate salts, alkali metal silicate salts and mixtures thereof, and from 5% to 20% by weight of a stabilizer which prevents separation of said ethoxylated aliphatic alcohol and said modifier additive during the shipping and handling of said composition.

7. The composition of claim **6** wherein said stabilizer is an alkyl alcohol having from 1 to 4 carbon atoms.

8. The composition of claim **6** wherein said modifier additive is orthophosphoric acid.

9. The composition of claim **6** wherein the ethoxylated aliphatic alcohol is a hydrophobic secondary alcohol having from 11–15 carbons, and wherein the average molar ratio of ethylene oxide to hydrophobic alcohol is in the range 5:1 to 15:1.

10. The composition of claim **6** wherein the ethoxylated aliphatic alcohol is one in which the hydrophobic portion is a mixture of straight chain aliphatic alcohols and the average mole ratio of the combined ethylene oxide to hydrophobic portion is in the range 1–50.

11. The composition of claim **6** in which said ethoxylated aliphatic alcohol is an alkyl polyethyleneoxy ethanol in which the alkyl portion is derived from a secondary alcohol having 11–15 carbons and wherein the average molar ratio of combined ethylene oxide and secondary alcohol is in the range 5:1 to 9:1.

12. The composition of claim **6** in which said ethoxylated aliphatic alcohol is derived from a water-insoluble secondary alcohol having a number of carbons in the range 11–15, and in which the emulsifier has an average molar ratio of combined ethylene oxide to said secondary alcohol in the range 7:1 to 15:1 and in which an anti-foaming agent is also present.

13. A composition for use in the manufacture of top liner and the like from printed and coated stock derived from chemical pulp, the active components in said composition consisting essentially of from 40% to 80% by weight of an ethoxylated aliphatic alcohol and from 10% to 50% by weight of a modifier additive selected from the class consisting of alkali metal phosphate salts, alkali metal silicate salts and mixtures thereof.

14. The composition of claim **13** wherein the ethoxylated aliphatic alcohol is a hydrophobic secondary alcohol having from 11–15 carbons, and wherein the average molar ratio of ethylene oxide to hydrophobic alcohol is in the range 5:1 to 15:1.

15. The composition of claim **13** wherein the ethoxylated aliphatic alcohol is one in which the hydrophobic portion is a mixture of straight chain aliphatic alcohols and the average mole ratio of the combined ethylene oxide to hydrophobic portion is in the range 1–50.

16. The composition of claim **13** in which said ethoxylated aliphatic alcohol is an alkyl polyethyleneoxy ethanol in which the alkyl portion is derived from a secondary alcohol having 11–15 carbons and wherein the average molar ratio of combined ethylene oxide and secondary alcohol is in the range 5:1 to 9:1.

17. The composition of claim **13** in which said ethoxylated aliphatic alcohol is derived from a water-insoluble secondary alcohol having a number of carbons in the range 11–15, and in which the emulsifier has an average molar ratio of combined ethylene oxide to said secondary alcohol in the range 7:1 to 15:1 and in which an anti-foaming agent is also present.

18. A composition for use in the manufacture of top liner and the like from printed and coated stock derived from chemical pulp, the active components in said composition consisting essentially of from 40% to 80% by weight of an ethoxylated aliphatic alcohol and from 10% to 50% by weight of phosphoric acid.

19. The composition of claim **18** wherein the ethoxylated aliphatic alcohol is a hydrophobic secondary alcohol having from 11–15 carbons, and wherein the average molar ratio of ethylene oxide to hydrophobic alcohol is in the range 5:1 to 15:1.

20. The composition of claim 18 wherein the ethoxylated aliphatic alcohol is one in which the hydrophobic portion is a mixture of straight chain aliphatic alcohols and the average mole ratio of the combined ethylene oxide to hydrophobic portion is in the range 1–50.

21. The composition of claim 18 in which said ethoxylated aliphatic alcohol is an alkyl polyethyleneoxy ethanol in which the alkyl portion is derived from a secondary alcohol having 11–15 carbons and wherein the average molar ratio of combined ethylene oxide and secondary alcohol is in the range 5:1 to 9:1.

22. The composition of claim 18 in which said ethoxylated aliphatic alcohol is derived from a water-insoluble secondary alcohol having a number of carbons in the range 11–15, and in which the emulsifier has an average molar ratio of combined ethylene oxide to said secondary alcohol in the range 7:1 to 15:1 and in which an anti-foaming agent is also present.

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