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MANUFACTURE OF PAPER

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This invention relates to improvements in the manufacture of paper and particularly in the manufacture of paper from ligno-cellulose fibres that are obtained from trees.

Paper is made from many types of fibres of varying physical and chemical compositions. The fibres used that are obtained from wood are those that have been delignined by the soda, sulphite or sulphate processes.

Logs are debarked, chips then prepared by chippers and screened to a standard size when used in the chemical pulp process. The chips are then charged to the chemical digesters, the liquor added and the mixture heated gently by steam. Temperatures vary up to 120° F. and pressures seldom exceed 80 pounds per square inch. After cooking the contents of the digester are discharged to the blowpits and if a clean, high grade white pulp is desired it is properly screened and bleached.

Hardwoods delignined by the sulphite process, produce fibres which are strong but brittle and when used in making paper, impart poor folding characteristics to it. The Mullen test at the same time is usually poor and spruce fibres in the form of pulp have to be added to improve these necessary qualities.

The object of this invention is to treat the hardwood pulp in such a way that its strength and folding qualities may be improved.

Another object of this invention is to treat the hardwood fibres in order that smaller quantities of soft pulp prepared from spruce may be added as a filler and softener and yet prepare a paper which is satisfactory for its intended use.

Therefore, according to the object of this invention, the hardwood pulp after bleaching and washing until the solution of pulp and water has a pH of 6.6 may be treated with an emulsifiable mineral oil to impart to the fibres the characteristics as outlined.

A non-gelling emulsifiable oil composition consisting of at least 80% of a mineral oil, an oil soluble sulfonate emulsifier, a lower aliphatic alcohol amine having less than 7 carbon atoms, and a carboxylic acid having more than 6 carbon atoms may be used in treating the pulp.

Non-gelling emulsifiable oil compositions used are those prepared according to U. S. Patent 2,079,803, that issued to John B. Holtzclaw and Carl Winning and are emulsifiable oils, capable of forming emulsions when subsequently mixed with water, can be formed by dissolving in a suitable oil, such as a mineral lubricating oil or a mineral white oil, the oil-soluble alkali soaps of sulfonic acids derived from petroleum hydrocarbons, as for instance, the so-called "mahogany" soaps, obtained as a result of treating a mineral lubricating oil fraction with strong sulfuric acid for the preparation of white oil. However, in preparing soluble oils of that type, a relatively large amount of oil-soluble sulfonates must be used and, according to the present invention, this amount may be greatly reduced by substituting in part therefor, a small amount of an alcohol amine soap of a carboxylic acid, or a mixture of an alcohol amine and a carboxylic acid. The oil-soluble sulfonates may be obtained or purified by any of the known methods, but it is particularly preferred to use oil-soluble sulfonates prepared according to the method described and claimed in U. S. Patent 1,981,799, that issued to Hymm E. Buc, which comprises isolating oil-soluble sulfonates directly from the alcoholic aqueous solution (resulting from the extraction of the acid-treated oil with alcohol) by agitating with alkali carbonates, drawing off and filtering the upper layer and evaporating the filtrate to dryness. Instead of, or in addition to, the pure or impure mahogany soap, any variety of related sulfonates, which are reasonably soluble in the oil base, may be used, such as sulfonated lard oil, Turkey red oil, sulfated higher fatty alcohols, etc.

Triethanolamine is the preferred alcohol amine as it is available commercially. The product on the market usually consists of a mixture of mono-, di-, and triethanolamine, although pure triethanolamine may be used if desired. Also, other alcohol amines and their mixtures may be used; for instance, propanolamines, etc. One feature is the use of a slight excess of alcohol amine over the amount required to neutralize or combine with the carboxylic acid. This excess amine produces more stable emulsions.

Of the carboxylic acids, oleic is generally the most satisfactory, and for a high grade product, the better grades of oleic acid are preferred. Other fatty acids of similar molecular weight (palmitic, lauric, stearic, behenic, etc., linoleic, linolenic, etc.) may be used, also naphthenic acids, rosin acids, or acids formed by the oxidation of oils and waxes, but, in general, it is preferred to use acids having more than 6 carbon atoms and, better still, more than 12 carbon atoms if a single acid is used. Low melting point acids are preferred when fluid products are desired. Highly unsaturated acids are to be avoided where an extra high resistance to oxida-

tion is desired. Mixed acids may also be used, such as those obtained by the oxidation of high molecular weight oils and waxes, particularly paraffin wax. These fatty acids may be used in the free stage or chemically combined with the alcohol amines.

The oil to be used as a base in preparing the emulsifiable oils may be a mineral oil or fatty oil, such as vegetable, animal or fish oil of proper viscosity (generally between that of a very light spindle oil and a heavy lubricating oil). The mineral oil may be either lightly refined as by distillation, solvent extraction, clay treating or treatment with dilute acid, or other chemical treating agent, or it may be a highly refined or so-called white oil, such as the products on the market known as Nujol and Marcol. The preferred mineral oil is one having a Saybolt viscosity of 75 to 200 seconds at 100° F. These oils may be used as such or together with small amounts of addition agents, such as anti-oxidants, dyes, etc.

The proportions of the various ingredients used are quite flexible and may be varied at will, according to the particular properties desired in the finished product. Ordinarily, however, the emulsifiable oil will contain about 80–95% of the mineral or fatty oil base, from 5–10% of mineral oil sulfonates, 0.5–2.0% of an alcohol amines, 0.5 to 3% of carboxylic acid and 0.01 to 5.0% of homogenizer if desired, although it is not intended to be limited to the above proportions.

For the sake of illustration, a number of examples of the non-gelling emulsifiable oil composition are given herewith:

Example 1

	Percent
Oil-soluble sulfonate	7.0
Triethanolamineoleate	1.5
Oil	Balance
	100.0

This soluble oil was found to have an emulsifying power equivalent to that of a similar oil containing 14% of oil-soluble sulfonate, but containing no triethanolamine oleate.

Example 2

	Percent
Oil-soluble sulfonate	7.0
Triethanolamineoleate	1.5
Excess (free) triethanolamine	0.2
Oil (mineral white oil called Marcol)	Balance
	100.0

This soluble oil was found to produce emulsions which were even more stable than those produced in Example 1.

Example 3

About .03% of water was thoroughly mixed into the soluble oil prepared in Example 2. The product was uniform and showed no tendency to gel.

Example 4

	Percent
Sulfonated lard oil	20
Triethanolamine oleate	2
Oil	Balance
	100.0

For example, to illustrate the invention, 7,500 pounds of hardwood pulp per hour, figured on a bone dry weight is passed to a tank or box to which is added ½ of 1% of the mineral oil and emulsifier mentioned herein, per hour likewise based on the bone dry weight. This figures approximately about five gallons of mineral oil composition. The mixture passes to the screens and the fibres are dehydrated on the lapping machines. The laps of pulp are then stored until a run of paper requires this pulp composition. The storage period aids in the penetration of the emulsified oil and makes it more active as a plasticizer. 53 gallons of the mineral oil composition were used in 11 hours in preparing 40 tons of treated pulp during one day. This treated pulp was used later in blending with spruce pulp.

Two samples were prepared by mixing 30% of hardwood pulp and 70% of spruce pulp, one was treated with the mineral oil composition and the other was not treated. The untreated pulp made a sheet of paper which cracked badly when folded but the sheet of paper made from the treated pulp was entirely free of cracks, was bulkier and showed an increase in per cent strength of 15%. Bulk, fold and strength are very important in envelope papers.

Comparative Mullen tests of paper made from mineral oil treated pulp and untreated pulp are here given.

	Treated sheet	Untreated sheet
Per cent strength	1. 38.4 2. 42.2 3. 39.9	1. 33.4 2. 35.7 3. 35.3
Mean	40.1	34.8

Increased per cent strength 15%.

The proportions of pulp used may be varied from 30 to 35% of hardwood and 65 to 70% of softwood pulp. The softwood pulp may be obtained from spruce, fir, poplar and hemlock. The hardwood pulp may be prepared from maples, birch, beeches and many other trees. The amount of oil used may be varied from ¼ to 1%.

I claim:

1. The method of producing a paper of improved fold and strength which comprises adding to an aqueous suspension of hardwood pulp delignined by the sulphite process, a mixture of a petroleum oil and an emulsifier the amount of petroleum oil added ranging from ¼ to 1% by weight based on the dry weight of the delignined hardwood pulp, thereafter mixing 30% of the treated hardwood pulp with 70% of a spruce pulp and making into sheets of paper.

2. The method of producing a paper of improved fold and strength which comprises adding to an aqueous suspension of hardwood pulp delignined by the sulphite process, a mixture of a petroleum oil and an emulsifier the amount of petroleum oil added ranging from ¼ to 1% by weight based on the dry weight of the delignined hardwood pulp, thereafter mixing 30% to 35% of the treated hardwood pulp with 70% to 65% of a spruce pulp and making into sheets of paper.

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