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ASBESTOS DISPERSIONS

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This invention relates to improvements in the production of colloidal dispersions of chrysotile asbestos fibers in an aqueous liquid, so as to provide them with enhanced adaptability for the production of felted webs or sheets on a paper making machine.

The present invention is more particularly concerned with the improvement of colloidal dispersions of the foregoing class, wherein the asbestos dispersing agent employed is a water soluble fatty acid soap, with the object of reducing inherent stickiness and increasing the freeness of such dispersions, whereby the paper making machines may be operated at greater speed, and better control of thickness and variation in thickness of the felted fibrous sheet may be obtained.

The production of colloidal dispersions of asbestos fibers in an aqueous liquid is in general described in my copending application Serial No. 66,552, filed December 21, 1948, now Patent No. 2,626,213, issued January 20, 1953, said application also describing the production of water-laid felted fibrous asbestos sheets therefrom. As more particularly described therein, a colloidal dispersion of asbestos fibers may be prepared from chrysotile asbestos agglomerates, such as, for example, mill fiber of long or spinning grade length (bagged asbestos fiber of commerce), by placing same in a vessel equipped with vertical cylindrical mixing bars, and gradually mixed therein with water containing chrysotile asbestos dispersing agent to form a slurry of desired concentration for subsequent sheeting on a paper making machine. The amount of dispersing agent employed varies with the character of the particular agent, the amount of asbestos, and the concentration of the slurry.

Thus the aqueous solution should contain an amount of dispersing agent first effective to subdivide the asbestos agglomerates into fibrils of colloidal size and to saturate the fibril surfaces with and to deposit thereon an adsorbed layer of said agent; and second to colloidally disperse said saturated fibrils, this being accomplished by employing an amount of agent in excess of that adsorbable on the asbestos and providing an added or free colloidal dispersion forming and maintaining increment, whereby a stable colloidal dispersion of fine fibers is formed, the majority having a diameter of between 200 and 500 Ångstrom units. These dispersions are alkaline, have a gelatinous and viscous character, and are of a low order of freeness, that is, the liquid can be filtered from the fibers at a relatively low rate as compared to the filtering rate

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in previously conventional paper making processes employing noncolloidal dispersions of fibers.

The water soluble fatty acid soaps have been found to be a desirable class of chrysotile asbestos dispersing agents, both by reason of economy and desirable character of the end products formed when employing them. However, I have found that when employing these water soluble fatty acid soaps as dispersing agent, the dispersions although capable of being formed into paper on, for example, a Fourdrinier wire of a paper making machine, in general only permit the formation of extremely thin sheets, such as, for example, up to about a weight of about 1 gram per square foot corresponding to a thickness of about .001 inch, and at a relatively slow rate of wire travel. This is the result of the high viscosity and extremely low filtering rate of the slurry, and resultant necessity to employ high dilutions. Further, these soap dispersions are of a sticky character, resulting in adhesion which makes it difficult to separate the formed sheet from the wire beyond the suction boxes at a vacuum transfer roll onto a transfer felt, adhesion to the dryer roll, and also other difficulties in subsequent handling. This is probably due to the hydrolysis of the soaps employed during the process of forming the colloidal dispersions.

I have found, in accordance with the present invention, that by subjecting these soap dispersions to a limited and controlled reversion the stickiness of the soap can be reduced and the freeness or filtering rate greatly improved so that the speed at which the fibers may be felted on the paper making machine may be materially increased with attendant economy, greater thicknesses and variety of thickness of sheet formation can be had and slurries of higher concentration than previously may be employed, and difficulties in removing the formed sheet from the wire, and other undesirable qualities formerly resulting from stickiness are eliminated.

I accomplish this controlled reversion, and the aforesaid resultant advantages, by adding to the formed colloidal dispersion, soap compatible alkaline materials adequate to raise the pH of the alkaline dispersion from about 0.5 to 1.5 pH numbers. The probable explanation of the improvement is the reduction of hydrolysis of the soap by the extra alkali. The micelle count is reduced which aids filtering properties, and the stickiness of fatty acid from the soap hydrolysis is greatly reduced.

At the upper end of the increased pH number

range there is a tendency for the good colloidal dispersion to become coarse by the agglomeration of fibers, and beyond this the dispersion may actually be precipitated and clotted. The desired effect within the range given is a slight controlled reversion of the dispersion so as not to lose the desirable colloidal properties, and still make it run better, and is similar to creaming in an emulsion in that the dispersion is not broken but the fibers separate from the liquid phase more readily.

The water soluble fatty acid soaps employed as the chrysotile asbestos dispersing agents of the present invention are preferably those wherein the fatty acid component has a carbon chain length between 12 and 18 carbon atoms, such as the sodium potassium, lithium, ammonium, triethanolamine, morpholine, etc., soaps of oleic, stearic, linoleic, ricinoleic, eleostearic, palmitic, etc., acids.

The alkaline materials which may be employed for the controlled reversion to raise the pH to the previously indicated extent are those compatible with the foregoing soaps, such as sodium hydroxide, potassium hydroxide, ammonium hydroxide, lithium hydroxide, potassium carbonate, sodium carbonate, sodium silicate, and others in controlled amounts which raise the pH without forming insoluble reaction products with the soap, or vice versa, which, in water, can form water soluble soaps with fatty acids.

For example, on a Buechner filter test, a 0.5% colloidal aqueous dispersion of spinning grade chrysotile asbestos fibers formed with 0.25% ammonium oleate as the asbestos dispersing agent, without additional alkali had a pH of 9.2 and took 10–20 times as long to filter as the same dispersion which had been raised to a pH of 10.2 by the subsequent addition of potassium hydroxide. Also, where the straight dispersion was extremely sticky and adhered tenaciously and uniformly to the Fourdrinier wire beyond the suction boxes at the vacuum transfer roll, thereby making holes in the web, in the case of the potassium hydroxide treated dispersion the whole web readily separated therefrom, free from holes.

As another example, a colloidal dispersion was made employing 100 pounds of 3F spinning-grade chrysotile asbestos fiber, 50 pounds of ammonium oleate, and water to form a ⅜% by weight slurry, in accordance with the method of my aforementioned copending application. In the manufacture of paper of 1 mil thickness and 0.7 g. per sq. ft. from this slurry, it had a tendency to adhere to the formation wire and some resistance was met at the low speed of 100 feet per minute in attempting to remove the felted web from the wire by vacuum. The untreated slurry had a pH of 9.4. However, after adding 3 pounds of potassium hydroxide to 1,000 gallons of the above slurry (10% by weight on the asbestos contained therein), to raise the pH to 10.0, the stock ran very satisfactorily at 250 feet per minute, with no sticking tendencies. If this proportion of potash is reduced, the sticking tendency increases and the rate of filtration decreases as shown by the ability to dry the web when passing over vacuum boxes. If this proportion of potash is increased, the strength of the sheet and its smooth formation become impaired to the point where at double the proportion the sheet is too weak to strip without tearing from a Yankee Dryer.

Using the composition above described at ⅝% asbestos concentration, 3 pounds of potash per 1,000 gallons (6% on the fiber content) allows running the weight up to about 2 g. per sq. ft. Increase of the potash to 7 pounds (14% on the asbestos) improves the filtering to the point where the weight of the sheet under the same machine conditions is increased to 5 g. per sq. ft. Increasing this amount to 25% based on the weight of the asbestos, causes serious flocking and clotting of the fiber so that the resulting sheet is too weak to handle off the dryer.

As another example, a sodium oleate dispersion was prepared using the same proportions as in the previous example. The pH of the slurry was 9.5 before addition of alkali, and it was characteristically slow filtering. At a pH of 10.3 obtained by adding 1½ pounds of sodium hydroxide per 1000 gallons it ran well.

As another example, an ammonium linoleate dispersion was prepared using 100 pounds of 4T grade chrysotile asbestos fiber and 33 pounds of ammonium linoleate and diluting to .75% asbestos concentration. This had a pH of 8.9 and was very slow filtering. Sodium meta-silicate was added to bring the pH to 9.8 and the slurry ran well to produce paper of 4 grams per sq. ft. When the pT was raised to 10.4, 5 gram paper was produced, indicating a still greater increase in freeness. At pH 10.8 the dispersion broke, and was useless for making good paper.

It is to be noted that the smaller the excess of asbestos dispersing agent over the breakpoint (minimum asbestos concentration for a given proportion of agent) the less alkaline material is needed to bring up the pH and to free up the slurry. For example, at .5% asbestos concentration, 1 pound of potassium hydroxide will raise the pH adequately for good running where the soap is 20% of the fiber; whereas 2½–3 pounds is necessary where the soap is 50% of the fiber. Also, in the first case an additional pound of potassium hydroxide will break the dispersion, whereas in the second case it is readily tolerated without damage to the dispersion.

I claim as my invention:

1. A method for controlled reversion of a colloidal dispersion of chrysotile asbestos fibers in an aqueous vehicle formed with a water soluble fatty acid soap as the asbestos dispersing agent, which comprises adding thereto a water soluble alkaline material to raise the pH of the dispersion about 0.5 to about 1.5 pH numbers.

2. A method for controlled reversion of a colloidal dispersion of chrysotile asbestos fibers in an aqueous vehicle formed with a water soluble fatty acid soap having from 12 to 18 carbon atoms as the asbestos dispersing agent, which comprises adding a water soluble alkaline material to said dispersion to raise the pH thereof about 0.5 to about 1.5 pH numbers.

3. In the method of treating chrysotile fibrous asbestos agglomerates by mixing them with an aqueous solution of water soluble fatty acid soap to (*a*) subdivide them into fibrils of colloidal size and to saturate the fibril surfaces with and to deposit thereon an adsorbed layer of said soap and to (*b*) colloidally disperse said fibrils, the improvement which comprises adding to said colloidal dispersion a water soluble alkaline material to raise the pH of the dispersion about 0.5 to about 1.5 pH numbers.

4. A method for controlled reversion of a colloidal dispersion of chrysotile asbestos fibers in an aqueous vehicle formed with a water soluble fatty acid soap having from 12 to 18 carbon atoms as the asbestos dispersing agent, which comprises

adding potassium hydroxide to said dispersion to raise the pH thereof about 0.5 to about 1.5 pH numbers.

5. A method for the controlled reversion of a colloidal dispersion of chrysotile asbestos fibers in an aqueous vehicle formed with an ammonium fatty acid soap having from 12 to 18 carbon atoms as the asbestos dispersing agent, which comprises adding a water soluble alkaline material to the colloidal dispersion to raise the pH thereof about 0.5 to about 1.5 pH numbers.

6. A method for the controlled reversion of a colloidal dispersion of chrysotile asbestos fibers in an aqueous vehicle formed with an ammonium oleate as the asbestos dispersing agent, which comprises adding a water soluble alkaline material to the colloidal dispersion to raise the pH thereof about 0.5 to about 1.5 pH numbers.

7. The method of opening chrysotile asbestos agglomerates and colloidally dispersing the resultant fibers to form a slurry adapted for the production of felted fibrous sheets on a paper making machine, which comprises mixing said agglomerates with an aqueous solution of ammonium oleate, the amount of said soap being in excess of that adsorbable on the asbestos and providing an added colloidal dispersion forming and maintaining increment, and then subjecting the dispersion to controlled reversion by adding thereto potassium hydroxide to raise the pH thereof about 0.5 to about 1.5 pH numbers.

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No references cited.