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PROCESS FOR MAKING USABLE WASTE PAPER CONTAINING BITUMENS

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The present invention relates to a process of deasphaltizing waste paper stock containing asphalt, and/or ridding the waste paper of similar contaminants. More specifically the present invention relates to a process of rendering asphalt and/or similar materials ineffectual in paper stock.

In the manufacture of folding boxboard and other paper products from waste paper, it is desirable and economical to use papers containing asphalt and/or other contaminants. However, the use of such papers requires special handling, and has caused some paper mills to install expensive equipment.

Asphalt is used in paper as a laminating medium for two or more plies of paper. It is also found in heavy duty waterproof wrap with two or more plies of asphalt emulsion saturated sheets laminated with asphalt. Asphalt is also found in paper in a wide range of particle sizes dispersed throughout the corrugating grade, multiwall bags and wrapping paper.

In nature asphalt is found in bituminous materials. It is primarily composed of (*a*) asphaltenes, which are insoluble in low boiling saturated hydrocarbons, and which are soluble in carbon tetrachloride; and (*b*) maltenes, which are soluble in low boiling hydrocarbons. The asphaltenes are the micells and form from 70% to 90% of the total asphalt content; and, the maltenes constitute the intermicellar liquid.

It is an object of the present invention to provide a novel process of making asphalt containing waste papers usable by chemical treatment without any additional outlay for extra equipment.

It is a further object to provide a process for ridding waste paper or paper stock of asphalt and/or similar contaminants.

According to the present invention it has been discovered that waste paper, or paper stock containing asphalt and/or contaminating materials, e.g. tar, wax, and hydrocarbons, can be chemically treated, and the asphalt content in said paper thereby rendered ineffectual. This is accomplished by first dissolving the asphalt and/or contaminants in the said paper stock with a suitable solvent; adding a stabilizer to said paper stock containing the dissolved asphalt to prevent agglomeration of the asphalt and/or contaminant; and finally evaporating the solvent from the paper stock so as to leave the contaminants dispersed in the paper stock as microscopic particles.

Asphalt is completely soluble in aromatic hydrocarbons such as xylene, toluene, heavy aromatic naphtha and Solvesso 100 and 150, manufactured by Humble Oil and Refining Company, and comprise aromatics of 9 and 10 carbon atoms plus a small percent of indans, and toluene, xylene, some heavier aromatics and indans, respectively. However, because of the insolubility of the asphaltene fraction in low boiling saturated hydrocarbons, only partial solubility of the total asphalt particle occurs in such aliphatics as heptane, Varsol I, manufactured by Humble Oil and Refining Co., and Solvasols, manufactured by Mobile Oil Co. Varsol I is a combination of aromatics, olefins and saturated hydrocarbons and Solvasols is a combination of 8–12 carbon atom aromatics and 8–14 carbon atom aliphatics.

In carrying out this invention, an aliphatic type of solvent is preferably used as the solvent media, even though the solvent media does not dissolve the total asphalt particle or containment. The primary function of this type of solvent is to dissolve the maltene part of the asphalt leaving the undissolved asphaltene in an easily dispersible state.

Also, according to the present invention, a certain minimum concentration of solvent is required before any appreciable attack on the asphalt is noted. The concentration of the solvent in the system is best expressed as a function of water volume rather than as a function of the asphalt concentration. For example, it was discovered that equal volumes of solvent would act differently on equal amounts of asphalt at different consistencies, i.e. based on percent dry fiber of the total weight. Satisfactory results were obtained at the higher consistencies, whereas, at the lower consistencies, the asphalt was not fully attacked. In the case of the lower consistencies, the solvent might be considered as being "lost" as immiscible droplets in the large volume of water. In addition, there are differences in the behavior of aliphatic and aromatic hydrocarbons with regard to the concentration requirement through change in asphalt concentration at a fixed consistency. For example, when the aliphatics are used as the solvent media, very little extra solvent is needed as the asphalt concentration is increased from ¼% to 3%, based on dry fiber weight. Whereas, when an aromatic is used as the solvent, increased amounts of asphalt must be accompanied proportionately by increasing the amount of solvent. One possible explanation is that the aromatic, being a complete asphalt solvent, becomes tied up in the dissolution of the asphalt reaction, whereas the aliphatic does not become so involved.

A more detailed explanation brings in the factor of interfacial tension between the solvent and water medium, and the existence of a tough aqueous film surrounding the asphalt particle. As a result of the interfacial tension, the solvent tends to assume the minimum size consistent with the volume of the solvent; and, under agitation the solvent is dispersed as droplets throughout the water medium. Thus, the analogy that the solvent is "lost" in a large volume of water and cannot seek out and attack the asphalt below a minimum solvent concentration.

Similar to the restrictive tension between the solvent and water media to the aqueous film surrounding the asphalt particle, is the presence of physical forces that prevents the solvent from attacking the asphalt at concentrations below a certain minimum peculiar to the particular solvent. Therefore, it is logical to cause a breakdown of the interfacial tension in the system so as to allow the solvent to come into intimate contact with the asphalt. The interfacial tension is broken down through the use of surface active agents.

The use of surfactants, or surface active agents, can effect a reduction of as much as 50% of the solvent requirements by reducing the interfacial tension of the system, thus allowing the solvent to come into intimate contact with the asphaltic particles. Several surface active agents can be successfuly used, for example, tall oil fatty acid, sodium sulphonate, or polyethylene glycol alkyl aryl ether, also known as Triton X–100. Other surface active agents of the general nature of the fore-mentioned surface active agents can also be used. In all cases, approximately 5% surface active agent, based on the solvent volume, is sufficient to reduce the interfacial tension so that intimate contact of the solvent with the asphalt is readily achieved.

As was previously discussed, the use of surface active agents greatly affects the solvent requirements since pre-

vious to the use of surface active agents, certain minimum concentrations had to be attained before the asphalt was attacked. For example, in a fresh water system before the asphalt was attacked, 0.7% Sovasols, based on the water volume, was required to treat 1% asphalt based on the fiber content of the stock paper. Under similar conditions, when 5% Triton X-100 was added, based on the solvent volume, it was found that only 0.4% Sovasols was required to treat the asphalt. However, an extremely important point regarding the effect of a surfactant in this de-asphalting system is that when the amount of surface activation goes beyond the initial amount which reduces the interfacial tension, the solvent tends to become ineffective against the asphalt. One possible explanation of this effect is that the solvent becomes the internal phase of an oil in water emulsion and thus loses it identity as a solvent.

Thus, according to this invention asphalt can be economically dissolved in the first phase of this process by the use of surface active agents, which phase is primarily intended, as was previously disclosed, to disperse the asphalt from asphalt containing kraft paper. However, the dispersed asphalt has a tendency to re-agglomerate, and therefore, in order to prevent the asphalt from re-agglomerating, even after the third phase of this process has been completed, i.e. evaporation of the solvent, a chemical stabilizer such as potassium hydroxide is added to the dissolved asphalt containing mixture. The addition of the chemical stabilizer to the paper slurry, containing the asphalt contaminant constitutes the second phase of this invention.

Other chemical stabilizers which can be used in the stabilization phase according to this invention are inorganic metallic hydroxides which have a tendency to react as saponifiers. The preferred stabilizer for this process is sodium hydroxide.

The pH range of the stabilization reaction is also important to this invention since at a pH of approximately 11.0 to 13.0, the asphalt will tend to re-agglomerate into particles as large as ¼ inch in diameter. At a pH range of approximately 8.0, an emulsion will be formed. At a pH range of 9.0 to 10.0, the exact or desired dispersion can be obtained. The preferred pH range is between 8.5 and 9.5.

Since during the reaction period the pH has a tendency to drop, the desired pH can be maintained by periodic incremental additions of alkali metal hydroxide to the pulped waste paper mix being treated.

The final phase of this invention comprises evaporating the solvent from the pulped paper mix so as to leave the asphalt or the contaminant dispersed in said paper as microscopic particles. This final evaporation phase can be conducted in any suitable manner, as for example with steam. The evaporation of the solvent usually takes place when the temperature has reached approximately about 200° F. Therefore, during the defibering of the paper stock the temperature must be maintained sufficiently low so that the solvent does not evaporate from the system.

The asphalt particles which are formed by this process can be electrostatically precipitated on the fiber with alum or any other suitable reagent, thus allowing the asphalt particles to leave the system via the paper web, or leave the paper web by being trapped by the fiber mat as the paper is being formed onto the cylinder. The resulting sheet appears clean to the eye, however, under microscopic examination, minute particles of asphalt can be seen dispersed throughout the sheet.

The following examples are intended to illustrate the present invention. These examples are inserted without any view of limiting the invention. If not otherwise stated, the parts indicated in the examples are parts by weight.

Example I

A standard pulper was loaded with 1,800 pounds of asphalt containing kraft paper. 3,000 gallons of water were added to adjust the consistency to 6.7% after which steam was added. The stock was then pulped for about 20 minutes; and, the temperature at this time was about 155° F. After pulping 0.5% Varsol I based on the water volume, was added to the pulper, followed by addition of a sufficient amount of caustic to bring the pH in the range of 9.0 to 9.5. The temperature was constantly raised from the end of the pulping cycle so that in the 45 minutes from the time the solvent had been added, the temperature reached approximtaely 200° F., thereby causing the evaporation of the solvent. The pH exhibited a tendency to decline during the pulping cycle thereby requiring intermittent additions of caustic.

Example II

A standard pulper was loaded with 1,800 pounds of asphalt containing kraft to which 3,000 gallons of water were added, followed by the addition .020% Triton X–100. The pulper was then started and steam was added. After 20 minutes the paper stock was defibered and the temperature of the pulper reached 160° F. wherein 0.4% Sovasols based on the 3,000 gallon volume of water was added to the system. Enough caustic was added to raise the pH to 9.3. The pulper was restarted and steam again was added at a rate so that the temperature was raised from 160° F. to 200° F. within 45 minutes. The pH exhibited a tendency to drop, but was maintained between a pH 8.8 and 9.3 by incremental additions of caustic.

Example III

A standard pulper was loaded with 1,800 pounds of asphalt containing kraft to which 3,000 gallons of water were added to adjust the consistency to 6.7%, after which the pulper was started and the steam was added. By the end of 20 minutes the stock had been defibered and the temperature had reached 150° F. The pulper was then stopped and 0.7% Sovasols, based on the water volume, was added along with a solution of KOH to pH 9.5. The pulper was restarted and steam was again added at a rate so that the temperature was raised from 150° to 200° F. within 45 minutes. The 200° temperature was maintained until the solvent odor was absent from the steam vapors coming from the pulper mix. During the reaction period the pH exhibited a tendency to drop, but was maintained between about 8.5 and 9.5 through period incremental additions of KOH.

It is to be noted that water is added to the pulper containing the kraft paper to be treated so that the consistency of the paper is adjusted before steam is added to the system. The preferred adjusted consistency is approximately 6.7% based on the weight of the kraft paper to be treated.

It should also be noted that when this process is used, there is absolutely no danger from build-up of asphalt, even when a closed white water system is used; and, the odor of the solvent is completely eliminated.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not to be limited thereto, but is to be construed broadly and restricted solely by the scope of the appended claims.

I claim:

1. A process for making waste paper, which contains bituminous contaminants, usable by chemical treatment, comprising the steps of:

(*a*) dissolving the contaminants from said waste paper with an aliphatic hydrocarbon;

(*b*) adding an alkali metal hydroxide as a stabilizer to the solution of contaminants, in an amount to result in a pH range of about 8.5 to about 9.5; while

maintaining the temperature in steps (*a*) and (*b*) below the boiling point of said hydrocarbon; and

(*c*) heating the hydrocarbon solution to approximately 200° F., evaporating sufficient solvent to cause the contaminants to become deposited as microscopic particles in dispersion in the waste paper.

2. A process for making waste paper, which contains asphalt contaminants, usable by chemical treatment, which comprises the steps of:

(*a*) dissolving the asphalt from said waste paper with a low boiling aliphatic hydrocarbon;

(*b*) adding sodium hydroxide as a stabilizer to the solution of asphalt in an amount to result in a pH of about 8.5 to about 9.5, while maintaining the temperature in steps (*a*) and (*b*) below the boiling point of said hydrocarbon;

(*c*) maintaining the pH at the range between about 8.5 and about 9.5 by periodic incremental additions of sodium hydroxide; and

(*d*) heating the hydrocarbon solution to approximately 200° F., evaporating sufficient solvent to cause the contaminants to become deposited as microscopic particles in dispersion in the waste paper.

3. A process for making pulped waste paper stock which contains asphalt usable by chemical treatment which comprises the steps of:

(*a*) dissolving the asphalt from said paper stock with a low boiling aliphatic hydrocarbon solvent;

(*b*) adding tall oil to the dissolved asphalt;

(*c*) further adding sodium hydroxide as a stabilizer to the resulting asphalt-containing mixture, whereby the solution will have a pH of about 8.5 to about 9.5, while maintaining the temperature in steps (*a*) to (*c*) below the boiling point of said solvent;

(*d*) maintaining the pH at the range between about 8.5 to about 9.5 by periodic incremental additions of sodium hydroxide; and

(*e*) heating the hydrocarbon solution to approximately 200° F., evaporating sufficient solvent to cause the contaminants to become deposited as microscopic particles in dispersion in the waste paper.

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