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FOAM PREVENTION

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This invention relates to a method and to a composition for reducing or preventing the formation of foam, particularly in the beet sugar refining industry.

In the process of refining beet sugar, the extracted or lixiviated juice is defecated with lime, subjected to a carbonation process for removing the excess lime, concentrated in triple-effect evaporators and finally introduced into a "strike-pan" or vacuum crystallization pan. In three of these phases, namely the defecation, the concentration and the introduction into the vacuum pans, there is a tendency for the solution to foam. This tendency is most persistent in evaporators and it is quite serious because the froth or foam not only impairs the efficiency of the evaporation but it carries over the juices by entrainment, resulting in loss of valuable sugar. Heretofore, many efforts have been made to prevent or retard the formation of foam under these circumstances,—the most generally used reagent being a vegetable oil such as corn oil or cotton seed oil. These anti-foam agents are objectionable because the calcium soaps which are formed are insoluble in aqueous solutions and they therefore separate out in the apparatus in the form of calcium soap scale. An object of my invention is to provide a de-foaming composition which will be water-soluble and which will therefore not separate out in the form of scale and which at the same time will more effectively retard or prevent the formation of foam for a longer period of time than has been heretofore possible.

I have discovered that heavy, non-volatile mineral oils form excellent de-foaming agents if they can be thoroughly dispersed over the surface of an aqueous solution. I have also found that a small amount of a sulfonic compound is an excellent dispersing agent under these particular conditions. Both the sodium and the calcium soaps of sulfonic acids are water-soluble, at least to the degree necessary for the complete dispersion of the mineral oil with which they are used. I may employ sulfonated vegetable oil, such as sulfonated castor oil, or a sulfonated animal oil as my dispersing agent, but I prefer to use sulfonated mineral oil compositions, especially preferentially oil soluble sulfonates or sulfonic acids produced from mineral oil as described in Humphreys U. S. Patent No. 1,286,179. Briefly, they are produced by sulfonation of viscous petroleum oils with concentrated or fuming sulfuric acid. Preferentially oil-soluble sulfonates may be extracted from the oil phase (after sludge separation and after neutralization) by means of a 50% aqueous alcohol solution and they may be purified by extraction with about 70% to 80% alcohol, as described in Divine Pat. No. 1,493,111; these compounds are generally referred to as "mahogany" soaps because of their characteristic color. They may be purified by removal of salt impurities such as sodium sulfate by means of high proof alcohol, as above stated, but they are not necessarily separated from oil because they are used in admixture with oil. Green acid (preferentially water-soluble) soaps may also be used, either alone or in admixture with mahogany soaps.

The petroleum oil is preferably a non-volatile viscous highly treated oil. The so-called white oils or medicinal oils have proved to be satisfactory, but I prefer to use a so-called white vaseline oil or a highly treated residual oil or "bright stock" which is less volatile than the refined distillates which are used in the manufacture of many technical white oils. The treatment of oil with acid shall be sufficient to remove colors, odors and tastes which might contaminate the product.

The proportion of mahogany soap to oil should be kept within certain limits and I have found that excellent results are obtained by using about 1% to 6% of mahogany soap, the rest of the composition consisting of non-volatile oil. If 20% or more of mahogany soap is employed, I have found that foaming may actually be increased instead of being prevented or retarded. The phenomenon is apparently one of surface tension and although it is not thoroughly understood I believe that the proportion of soap to oil has an important bearing in its determination.

My improved anti-foaming composition is employed in about the same proportions as the vegetable oils which have heretofore been used,—about four ounces being sufficient for treating several thousand gallons of juice. As a specific example, I add to 3,600 gallons of juice in beet sugar concentrators, four ounces of a composition consisting of 3% mahogany soap and 97% viscous white oil (upwards of 80 seconds Saybolt at 100° F.). This composition will suppress the foam in the evaporators for about an hour, more than twice as long as an equal amount of the corn oil which has been previously used for this purpose. When the above de-forming agent is added to the vacuum pans, it is immediately effective in breaking the foam,—corn oil requires a period of five minutes to effect a similar result.

While I have described the use of mahogany soaps as dispersing agents for mineral oils, it should be understood that equivalent dispersing means may be employed. The invention is not

limited to the sugar refining industry, but may be useful in any case where foaming must be prevented, and particularly where the foam is due to surface tension phenomena in the presence of calcium alkalinity. Foam prevention is not necessarily accomplished by a mere lowering of the surface tension. Foams are produced by molecular or colloidal substances positively or negatively adsorbed in a gas-liquid interface. Since positively absorbed substances lower the surface tension and negatively adsorbed substances raise the surface tension it is seen that there is no correlation between foaming and surface tension (C. W. Foulk "A theory of liquid film formation", Industrial & Engineering Chemistry, vol. 21, page 815). The effectiveness of antifoam agents is therefore probably due to their effect on the concentration of adsorbed materials in the gas-liquid interface rather than to a raising or lowering of the surface tension. While I have described a preferred embodiment of my invention, it should be understood I do not limit myself to any of the details hereinabove set forth except as defined by the following claims which should be construed as broadly as the prior art will permit.

I claim:

1. The method of retarding formation of foam in a liquid characterized by calcium alkalinity which comprises dispersing a non-volatile petroleum oil thereon by means of a small amount of a sulfonic compound of the class which consists of a sulfonated vegetable oil, a sulfonated animal oil and a sulfonated mineral oil composition.

2. The method of retarding formation of foam in a liquid characterized by calcium alkalinity which comprises dispersing a non-volatile petroleum oil thereon by means of a mineral oil sulfonic acid soap.

3. The method of retarding formation of foam in a liquid characterized by calcium alkalinity which comprises dispersing a non-volatile petroleum oil thereon by means of a mahogany soap.

4. The method of de-foaming beet sugar solutions which comprises adding thereto a small amount of a highly purified non-volatile mineral oil, containing about 1% to 6% of an oil-soluble sulfonic acid compound of the class which consists of a sulfonated vegetable oil, a sulfonated animal oil and a sulfonated mineral oil composition.

5. The method of retarding the formation of foam in industrial solution of the type encountered in the beet sugar refining industry, which comprises contacting the surface of said solutions with a mixture of a non-volatile oil and a small amount of a sulfonic acid compound of the class which consists of a sulfonated vegetable oil, a sulfonated animal oil and a sulfonated mineral oil composition.

6. The method of retarding the formation of foam in industrial solutions of the type encountered in the beet sugar refining industry, which comprises contacting the surface of said solutions with a mixture of non-volatile oils with mineral oil sulfonic acid soaps.

7. The method of retarding the formation of foam in an aqueous industrial solution having a tendency to foam, which comprises contacting said aqueous solution with a mixture of a non-volatile petroleum oil with a small amount of a sulfonic acid soap prepared from a sulfonated oil whereby the concentration of adsorbed materials in the gas-liquid interface of the solution is regulated.

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