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FOAM STABILIZING AGENT

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This invention relates to foam stabilizing agents, and is primarily for use in solutions which, upon mixture in accordance with general practice, are capable of forming blankets of foam. These foam blankets are composed of carbon dioxide or from gases which are non-supporting to combustion. The reaction results in numerous gas bubbles, providing a blanket which will shut off the supply of oxygen to a fire, and in this manner a very excellent fire extinguishing composition is produced.

A stabilizing agent is required in order to increase the toughness and tenacity of the foam in order that the blanket will be stable, and not easily disintegrated or broken. The theory of the stabilizing agent is that it will increase the surface tension of the water films, which surround the gas bubbles in the foam, so that in this manner a blanket substantially impenetrable to oxygen and other gases will be formed to smother the fire.

In the past various foam stabilizing agents have been employed. Our improved stabilizing agent comprises two materials which in combination have been found very effective for the purpose described. One of said materials consists essentially of the alkali metal salts of the complex sulfonic acids produced by sulfonating a mixture of a petroleum hydrocarbon oil and an added aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl. The other material referred to is a water dispersible colloid which swells in water and has substantially the colloidal characteristics of gelatin.

The alkali metal salts used in making the foam stabilizing agent of this invention are of the same general type as those described in a co-pending application by Robert R. Thurston, Serial No. 670,515, filed May 11, 1933. As disclosed in said application, these alkali metal salts are preferably made by sulfonating a mixture of 90–60% by weight of a petroleum fraction selected from the group consisting of petroleum distillate lubricating oil and solvent extracts of petroleum lubricating oil, with 10–40% of an aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl, to form petroleum hydrocarbon-aromatic sulfonic acids, and neutralizing the resultant sulfonated oily layer with an excess of an alkali metal base to form alkali metal salts of the petroleum hydrocarbon-aromatic sulfonic acids. It has been shown that the aromatic material enters into chemical combination with the petroleum hydrocarbon during the sulfonation reaction to form a complex sulfonic acid which may be termed a petroleum hydrocarbon-aromatic sulfonic acid, by reason of the fact that distillation of the product made with benzol, for example, does not liberate any but a small portion of the benzol used. Without benzol or its equivalent the sludge product is a solid carbonaceous appearing mass which is difficult to handle. With about 10% benzol, the sludge layer is extremely viscous. With 20% benzol the sludge is fairly fluid at room temperature and this fluidity is not materially increased with the use of up to 40% benzol.

The following examples are given of methods which may be followed in the manufacture of said alkali metal salts:

Example 1

The following materials are delivered into a treating vessel which preferably is provided with a steam jacket around the body thereof for heating the contents of said vessel:

	Percent by weight
Petroleum hydrocarbon oil obtained as a distillate from naphthene base crude, said distillate comprising a wide range of lubricating oil fractions	83
Commercial benzol	17
	100

The mixture of petroleum hydrocarbon oil and benzol is heated to a temperature of the order of 155° to 170° F., and concentrated sulfuric acid is added to the mixture. The equivalent of approximately 83% by weight of 100% acid is used, based on the weight of the mixture of petroleum hydrocarbon oil and benzol above described. Either fuming acid or 98% acid may be used, the amount required depending upon the concentration of acid used. The acid is added slowly over a period of about three hours. The mixture is agitated while the acid is being added thereto, and such agitation is continued for about three hours after all of the acid has been added. Thereafter about 54% by weight of water is added to the mixture, based upon the weight of the mixture before adding the acid. The water is added slowly, over a period of about forty-five minutes. The temperature of the mixture is raised to about 190° F. while adding the water. The mixture is agitated while adding the water, and such agitation is continued for about 30

minutes after all of the water has been added. The mixture is then settled for a period of about six hours. At the end of this time the mixture will have separated into three layers. The upper layer, consisting largely of oil, is skimmed off. The lower layer, consisting principally of weak acid, likewise is drawn off. The remaining intermediate layer, which contains the acid material produced by the reaction of the concentrated sulfuric acid on the mixture of petroleum hydrocarbon oil and benzol, is neutralized with 40° Baumé sodium hydroxide, the resulting product having a free alkali content of about from 0.25% to 1% NaOH. This material is finally dried by evaporation of water.

Example 2

The following materials are delivered into said treating vessel:

	Percent by weight
Extract obtained by treatment with liquid sulfur dioxide of a petroleum hydrocarbon oil such as the one described in Example 1	82
Commercial benzol	18
	100

This mixture is processed in the same manner as the mixture referred to in Example 1. The amount of acid used is about 76%, and the amount of water used is about 48%, based on the weight of the mixture of petroleum hydrocarbon oil extract and benzol above described.

It has been found that very satisfactory results can be obtained by sulfonating a petroleum hydrocarbon oil which contains a high percentage of naphthenic compounds as distinguished from paraffinic compounds. Thus excellent results are obtained when using lubricating oils from naphthene base crudes. Likewise very satisfactory results are obtained when using the extracts obtained by treating either a naphthene base lubricating oil or a paraffine base lubricating oil with liquid sulfur dioxide, furfural, or other solvents which have the effect of producing an extract containing a relatively high percentage of the naphthenic compounds originally present in the oil.

Any of the materials in the group consisting of benzol, toluol and diphenyl may be used in the manner above described, toluol and diphenyl producing results which are similar to those obtained when using benzol.

While in Example 1, above, it is stated that the acid material produced by the reaction of the concentrated sulfuric acid on the mixture of petroleum hydrocarbon oil and benzol, is neutralized with sodium hydroxide, it will be understood that other alkaline materials, including the hydroxides of potassium, ammonium and lithium, may be substituted for sodium hydroxide in this step.

Included in the class of materials which has been referred to herein as water dispersible colloids which swell in water and have substantially the colloidal characteristics of gelatin, are such substances as gelatin, acacia, tragacanth, and the like.

Our improved foam stabilizing agent, consisting of the alkali metal salts above described, together with one or more of said water dispersible colloids, can be readily employed with the usual foam producing solutions which, for example, may consist of bicarbonate of soda and aluminum sulphate solutions, arranged in separate compartments of a fire extinguishing apparatus. In this type of foam producing solution the foam stabilizing agent is preferably added to the alkali chamber of the extinguisher, which contains the bicarbonate of soda solution.

The following is an example of foam producing solutions consisting, respectively, of aluminum sulphate and bicarbonate of soda, in which our improved stabilizing agent, consisting of the two materials above described, has been added to the bicarbonate of soda solution:

	Percent by weight
"A" solution	
Aluminum sulfate (hydrated)	43
Water	Balance
"B" solution:	
Sodium bicarbonate	8
Alkali metal salts such as those described in Examples 1 and 2	0.6
Gelatin	0.0075
Water	Balance

The "A" solution and the "B" solution are ordinarily mixed at the scene of the fire to produce the desired foam producing solution for extinguishing the fire. Substantially equal parts of each solution, for example, may be used.

The amount of the above described alkali metal salts which is required may vary within certain limits. Ordinarily the amount required will be from 0.1% to 1% by weight of said alkali metal salts, based on the weight of the mixture which is obtained by mixing the two solutions above described.

The amount of said water dispersible colloids which is required likewise may vary. Ordinarily from 0.001% to 0.01% by weight will be used, based on the weight of the mixture which is obtained by mixing the two solutions above described. From 0.5% to 2% by weight of said water dispersible colloids may be used, based on the amount of said alkali metal salts which is used.

We have observed that with the use of our foam stabilizing agent a blanket of great tenacity is formed. It is impenetrable to oxygen, and in actual use in connection with fires the results have been highly satisfactory and are superior to those obtained with the fire extinguishing solutions which are now on the market. In an analytical test 50 c. c. each of the "A" solution and the "B" solution above described (a total of 100 c. c.) were mixed and the following observations made:

Volume after 2 minutes	c. c.	1000
Volume after agitating	c. c.	970

A similar fire extinguishing solution which is now available commercially, and which does not contain our improved stabilizing agent, was tested in the same manner and the following results noted:

Volume after 2 minutes	c. c.	850
Volume after agitating	c. c.	820

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A fire extinguishing charge consisting of two solutions adapted to unite to produce gases non-supporting to combustion, one of said solutions having mixed therewith a foam stabilizing agent comprising the alkali metal salts of pe-

troleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of a petroleum lubricating oil and an added aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl, and from 0.5% to 2% by weight, based on the amount of said alkali metal salts, of gelatin.

2. A fire extinguishing charge consisting of two solutions adapted to unite to produce gases non-supporting to combustion, one of said solutions having mixed therewith a foam stabilizing agent comprising the alkali metal salts of petroleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of the extract obtained by treating a petroleum lubricating oil with a solvent which has the effect of producing an extract containing a relatively high percentage of the naphthenic compounds originally present in said lubricating oil and an added aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl, and from 0.5% to 2% by weight, based on the amount of said alkali metal salts, of gelatin.

3. A fire extinguishing charge consisting of two solutions adapted to unite to produce gases non-supporting to combustion, one of said solutions having mixed therewith a foam stabilizing agent comprising a relatively large amount of the alkali metal salts of petroleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of a petroleum hydrocarbon oil and an added aromatic hydrocarbon selected from the group consisting of benzol, toluol, and diphenyl, and a relatively small amount of a water dispersible colloid selected from the group consisting of gelatin, acacia and tragacanth.

4. A fire extinguishing charge consisting of two solutions adapted to unite to produce gases non-supporting to combustion, one of said solutions having mixed therewith a foam stabilizing agent comprising from 0.1% to 1% by weight of the alkali metal salts of petroleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of a petroleum lubricating oil and an added aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl, and from 0.001% to 0.01% by weight of gelatin.

5. A fire extinguishing charge adapted to produce a tenaceous foam comprising as an essential ingredient thereof a stabilizing agent consisting of alkali metal salts of petroleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of 90–60% by weight of a petroleum fraction selected from the group consisting of petroleum lubricating oil and solvent extracts of petroleum lubricating oil, and 10–40% by weight of an aromatic hydrocarbon selected from the group consisting of benzol, toluol and diphenyl, and neutralizing the resulting petroleum hydrocarbon-aromatic sulfonic acids with an alkali metal base.

6. A fire extinguishing charge adapted to produce a tenaceous foam comprising as an essential ingredient thereof a stabilizing agent consisting of alkali metal salts of petroleum hydrocarbon-aromatic sulfonic acids produced by sulfonating a mixture of 90–60% by weight of a petroleum distillate lubricating oil, and 10–40% by weight of benzol, and neutralizing the resulting petroleum hydrocarbon-aromatic sulfonic acids with an alkali metal base.

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