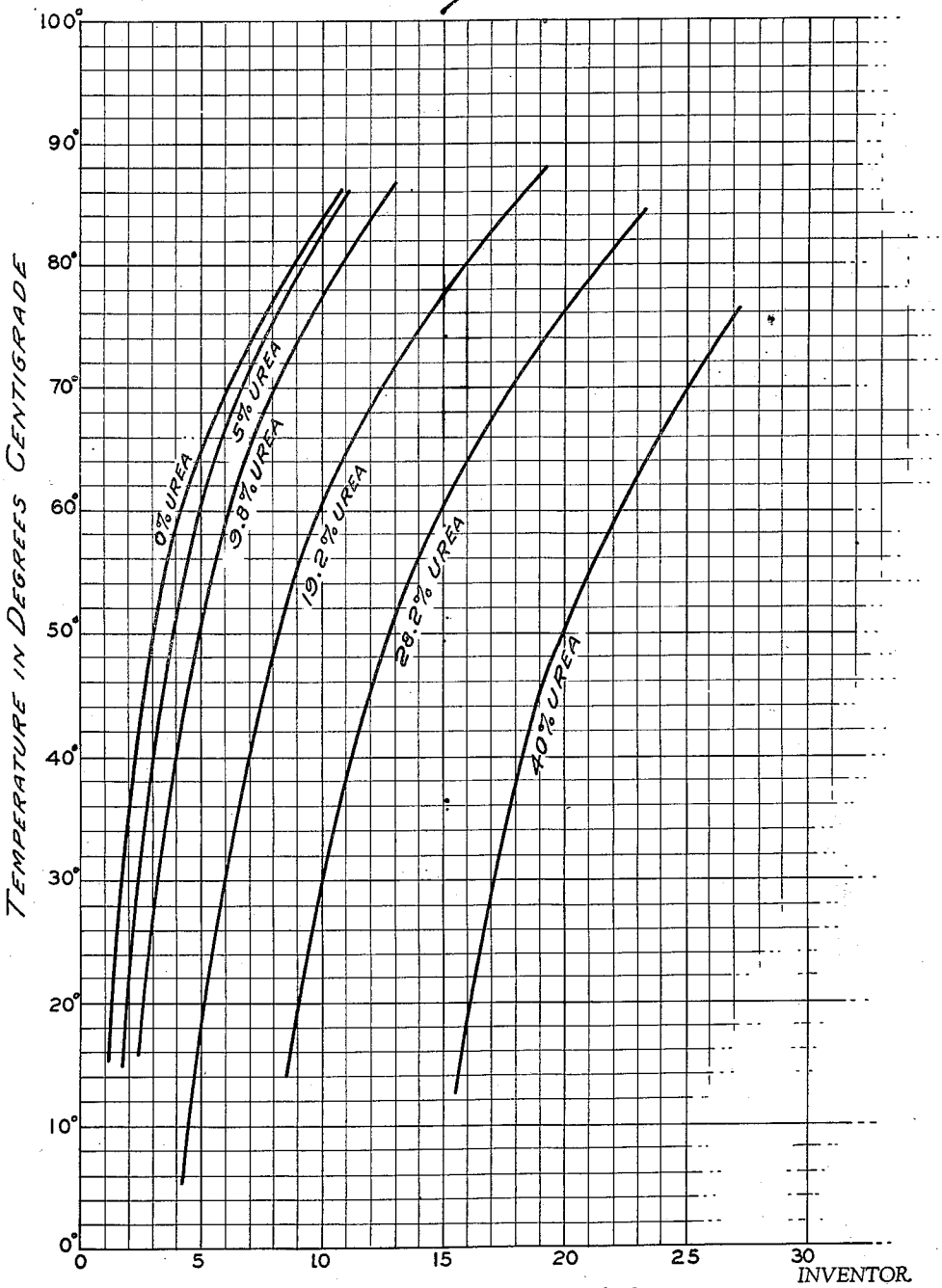
Aug. 5, 1941. R. C. SWAIN 2,251,768

WETTING AND DETERGENT COMPOSITION

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Fig. 1.



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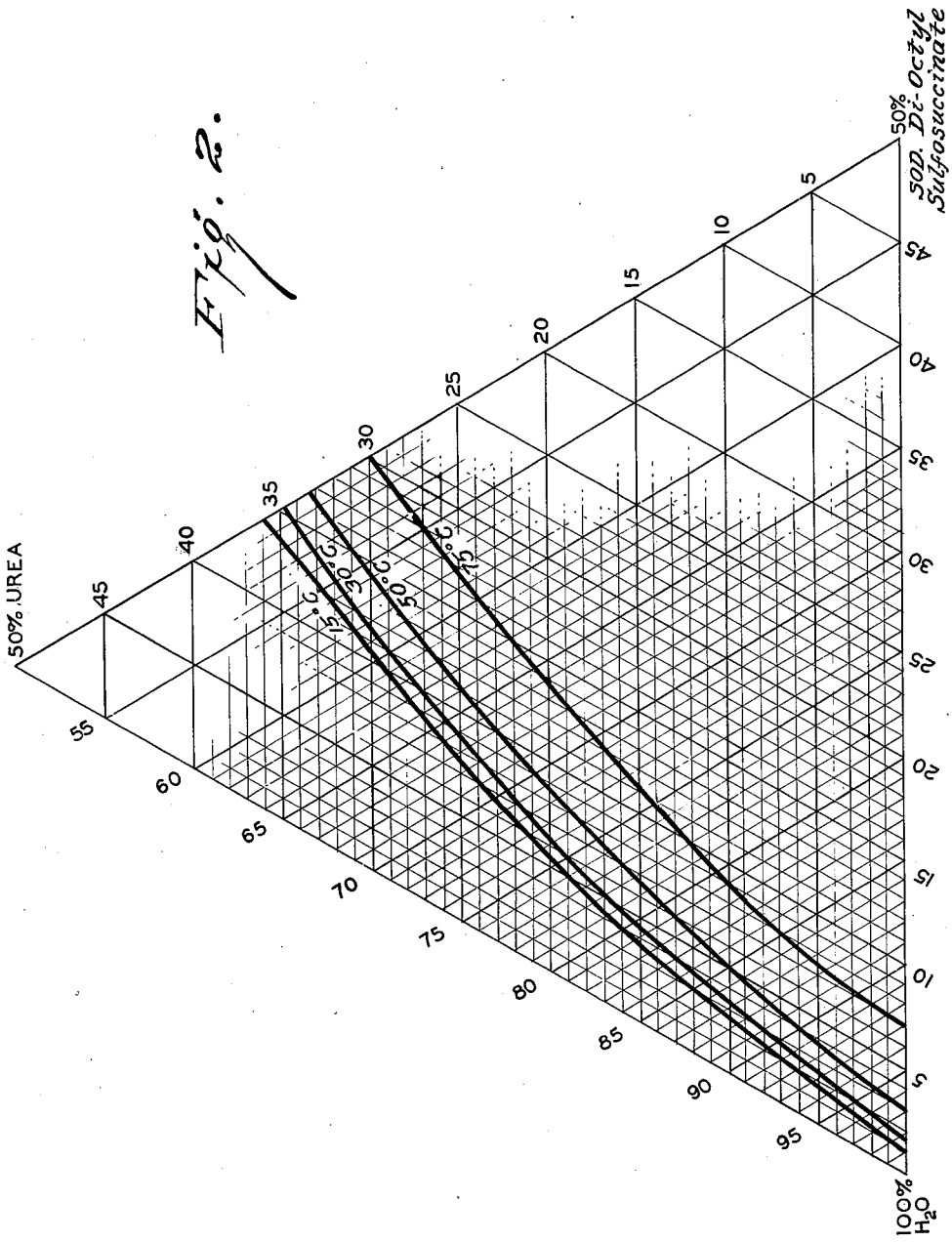
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Fig. 2.



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WETTING AND DETERGENT COMPOSITION

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5 Claims. (Cl. 252—161)

This invention relates to wetting and detergent compositions, and more specifically to compositions of this class containing esters of sulfodicarboxylic acids with aliphatic alcohols of 5–10 carbon atoms. A primary object of the invention is to improve the solubility, and consequently the wetting and emulsifying properties of esters of this class. Another object is the provision of wetting compositions in spray-dried or drum-dried but water-soluble form.

Esters of sulfodicarboxylic acids are described in Patent No. 2,028,091 dated January 14, 1936, where it is pointed out that these compounds are excellent wetting, detergent and emulsifying agents. Although all the esters described in that patent have wetting and emulsifying properties, it has been found that those of the highest wetting and emulsifying power are the esters of sulfodicarboxylic acids with aliphatic alcohols of 5–10 carbon atoms in the chain. Unfortunately, however, the water solubility of these esters decreases with increase in the molecular weight of the esterifying alcohol used, so that these wetting agents cannot be marketed in the form of very concentrated solutions. Of course it is possible to sell the esters in solid form, which is a great advantage insofar as shipping and storage are concerned, but some customers object to the product in this form because they experience difficulty in getting it into solution. On the other hand, when a relatively dilute solution is marketed, such as a 10% aqueous solution, the customer must pay shipping and storage rates on considerable amounts of water in order to obtain a product that is directly usable.

I have now discovered that the esters of sulfodicarboxylic acids with aliphatic alcohols of 5–10 carbon atoms, which are the esters causing the greatest difficulties as regards lack of water solubility, can be solubilized by the addition of urea or its derivatives. The amount of urea to be used will depend, of course, on the concentration in which the wetting agent solution is to be marketed and on the temperature, but I have found in general that about 1 to 3 times as much urea as ester should be used at the higher concentrations. When the sulfodicarboxylic acid ester is to be marketed in lower concentrations, such as 10–20% solutions, this ratio can be lowered somewhat.

At the present time, wetting agents are evaluated on a money basis as determined by the Draves test, which is based on the sinking time of a cotton skein in wetting agent solutions of known concentrations. On this basis the dioctyl ester of sulfo-succinic acid constitutes the cheapest and best wetting agent on the market at the present time, but it is easily possible that fluctuations in the price of other alcohols of 5–10 carbon atoms may change the commercial picture and make the sulfosuccinic acid ester of some other alcohol a better value. The present invention will be illustrated in terms of dioctyl sulfosuccinate because of its present greater commercial value, but it should be understood that this specific illustration is merely representative of the action of urea on any dialkyl sulfosuccinate in which the alkyl group contains from 5–10 carbon atoms, and that the invention in its broader aspects is not limited to the specific examples given.

On the attached drawings, Fig. 1 is a graph showing the solubility of sodium dioctyl sulfosuccinate in urea solutions, illustrating the increase in solubility at varying temperatures with increased urea concentrations, and

Fig. 2 is a triple point diagram showing the composition of a saturated solution containing urea and sodium dioctyl sulfosuccinate at any specified temperature in terms of percent by weight of urea and percent by weight of the dialkyl sulfosuccinate, based on the weight of the final solutions.

Referring to Fig. 1, it will be seen that at 60° C. the dioctyl sulfosuccinate is soluble in water in amounts of less than 5%. In a 20% urea solution its solubility is doubled, and in a 40% solution its solubility is more than quadrupled. The data upon which the curves of Fig. 1 are based was obtained by the synthetic method for the determination of solubility; a known weight of the wetting agent was dissolved by warming with a given volume of urea solution of known concentration and the temperature was recorded at which the mixture became cloudy on cooling.

By successively adding urea in known quantities and recording the clouding points sets of solubility curves similar to those in Fig. 1 have been obtained for the other members of the series. All these curves are similar in shape, but differ among themselves with variations in the original water solubility of the particular ester. For example, sodium diamyl sulfosuccinate and sodium dihexyl sulfosuccinate are about 35 times as soluble in water as sodium dioctyl sulfosuccinate and much less urea is required to form solutions of ordinary commercial strength. At room temperature 40 grams of these esters will dissolve in a liter of

water, 75 grams in a liter of 10% urea solution and 140 grams per liter in a 20% solution of urea. The sodium diheptyl sulfosuccinate is also more soluble than the corresponding dioctyl compound and requires correspondingly smaller quantities of urea.

Sodium dinonyl and didecyl sulfosuccinates are less soluble than sodium dioctyl sulfosuccinate and more urea must be added to obtain solutions of similar strength. For example, only 10 grams of sodium dinonyl sulfosuccinate can be dissolved in a liter of water at 70° C. as compared with 60 grams of the dioctyl ester, and the didecyl compound is even less soluble. It is necessary to use 20% and 30% urea solutions, respectively, to obtain 10% solutions of these two wetting agents which are clear at room temperatures.

The triple point diagram shown on Fig. 2 was obtained by choosing representative temperatures of 15° C., 30° C., 50° C. and 75° C. and calculating the coordinates from the data shown on Fig. 1. From Fig. 2 values can readily be obtained which give the amount of urea required to solubilize any given amount of sodium dioctyl sulfosuccinate at any desired temperature. For example, the amounts required to solubilize 5% and 10% solutions are illustrated in the following table

A. 5% sodium dioctyl sulfosuccinate		B. 10% sodium dioctyl sulfosuccinate	
Urea by weight	Temp.	Urea by weight	Temp.
Percent	*°C.*	*Percent*	*°C.*
19.1	15	29.2	15
16.2	30	27.2	30
10.0	50	22.4	50
0	67	12.3	75
		0	87

The above figures show the marked improvements in the limits of solubility of the sulfodicarboxylic acid esters included in the present invention which can be obtained by the addition of urea thereto. Another important characteristic of such mixtures is the corresponding increase in their rate of solution in water; while the esters themselves are only slowly dissolved or dispersed even at elevated temperatures, their mixtures with urea disperse rapidly. This characteristic overcomes the inherent objection to the marketing of these wetting agents in dry form, for dried mixtures of sulfodicarboxylic acid esters of aliphatic alcohols of 5-10 carbon atoms with 1–6 times their weight of urea can be readily dissolved in warm water or even in cold water by the customer to any desired strength of solution within the limits outlined above.

Although simple physical mixtures of the wetting agent with urea are readily soluble I have found, as another feature of the invention, that very intimate mixtures obtained by drying aqueous solutions containing the wetting agent and urea are even more satisfactory. Such solutions are preferably spray-dried or drum-dried; that is to say, the solutions are spread over the surface of an internally heated rotating drum or are sprayed through the nozzle of a commercial spray-drying machine and the product is collected as a granular spray-dried mixture. For example, a mixture of 6 parts of urea with 1 part of sodium dioctyl sulfosuccinate was dissolved in warm water and sprayed through a revolving nozzle into a rising stream of hot air in an ordinary commercial spray-drying apparatus. In this case the air inlet temperature was 307° F. and the outlet temperature was 230° F., and the spray-dried product was recovered as a light, fluffy powder which dissolved instantly when poured into water. Obviously, any ratio of urea to wetting agent may be used in preparing such spray-dried or drum-dried compositions, depending upon the rate and strength of solution desired by the customer.

From the foregoing description, it will be seen that wetting and detergent compositions of improved water solubility can be obtained from any dialkyl ester of a sulfodicarboxylic acid in which the alkyl groups contain from 5 to 10 carbon atoms, simply by the addition of urea. The action of urea as a solubilizing agent is perfectly general as regards the wetting agents of this class, and by employing the methods outlined above the solubility characteristics of any given wetting agent can readily be determined. Accordingly, it is evident that the present invention provides an improved class of wetting and detergent compositions which may be used to advantage in any of the fields where such compositions have previously been employed and which can be more readily applied by reason of their improved water solubility.

What I claim is:

1. A wetting and detergent composition comprising one part by weight of an ester of sulfosuccinic acid with an aliphatic alcohol of 5 to 10 carbon atoms, together with from 1 to 3 parts by weight of urea as a solubilizing agent therefor.

2. A wetting and detergent composition comprising a 10% aqueous solution of an ester of sulfosuccinic acid with an aliphatic alcohol of 5–10 carbon atoms together with urea in amounts of 1 to 3 times the weight of said ester as a solubilizing agent therefor.

3. A wetting and detergent composition comprising a 10% aqueous solution of sodium dioctyl sulfosuccinate together with from 1 to 3 times its weight of urea as a solubilizing agent therefor.

4. A wetting and detergent composition comprising a granular spray-dried mixture of one part by weight of an ester of sulfosuccinic acid with an aliphatic alcohol of 5 to 10 carbon atoms, together with from 1 to 3 parts by weight of urea as a solubilizing agent therefor.

5. A wetting and detergent composition comprising sodium dioctyl sulfosuccinate together with from 1 to 3 times its weight of urea as a solubilizing agent therefor.

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