Patented June 20, 1933 1,915,040

UNITED STATES PATENT OFFICE

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PROCESS FOR FLOCCULATING POSITIVELY CHARGED EMULSOIDS FROM A DISPERSE MEDIUM

No Drawing. Application filed June 7, 1932. Serial No. 615,950.

This invention relates to and it is the object of the invention to provide a process for flocculating positively charged emulsoids from a disperse medium.

The term "emulsoids" as employed herein may be defined as solvated colloids, which may be dispersions of solids within a liquid, or of a liquid within a liquid. They are organic in constitution.

In order to flocculate emulsoids it is first necessary to bring them to their critical potential, as well as to their critical hydration. The critical potential need not necessarily coincide with the isoelectric point. The critical hydration point is that point in the hydration of the emulsoids at which they will flocculate, providing they are at their critical potential.

An important feature of the present invention, therefore, relates to the desolvation or dehydration of the emulsoids in the disperse medium. Specifically, the invention contemplates the displacement of the adsorbed solvating water film of the emulsoids by molecules for which the nucleus of the emulsoid has a greater affinity than it has for the water molecules of the solvating film. In other words, the invention contemplates the removal of the solvating water film by the phenomena of preferential adsorption.

When the emulsoids are positively charged, the water molecules of the solvating film are oriented over the surface of the nucleus of the emulsoid with the negative OH ends of the molecules pointed inwardly and tenaciously held by adsorption. In order to displace these water molecules, it is necessary to employ molecules which have one end of such polarity, that it will be more strongly adsorbed than the OH end of the water molecule, so that preferential adsorption will take place. It is further essential that the positive ends of the molecules used to displace the water molecules must not be subject to solvation. Furthermore, the water displacing molecules must not be dissociated to any appreciable extent in the water of the disperse medium.

It is, of course, possible to flocculate emulsoids without desolvation or dehydration by "salting out" but in so doing, enormous quantities of salts are required, in comparison to the quantity required when the emulsoids are first de-hydrated. For instance, to effect flocculation of agar agar, an emulsoid, one mol per liter of anhydrous $MgSO_4$ is required. If, however, the agar agar is first desolvated or dehydrated, it can be flocculated by the addition of one millimol per liter of the same salt. The importance, therefore, of desolvating or dehydrating the emulsoids becomes at once apparent.

According to the present invention, the solvating water film of the positively charged emulsoid is displaced by incorporating in the disperse medium alkyl esters of polycyclic acids. It is contemplated that either alkyl esters of polycyclic carboxylic acids, or alkyl esters of polycyclic sulfonic acids may be used.

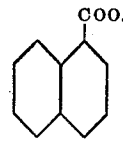
In these compounds the polycyclic group is in the negative end of the molecule. The negative ends of the molecules of these compounds are preferentially adsorbed over the OH end of the water molecules.

The alkyl esters of polycyclic carboxylic acids have the general formula, Ar.COO.R in which,

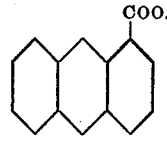
Ar is a polycyclic residue or radical, and,

R is an alkyl group made up of C and H in the proportion of C_nH_{2n+1}.

Exemplary compounds conforming to this general formula are as follows,



which is hexyl 1-napthoate.



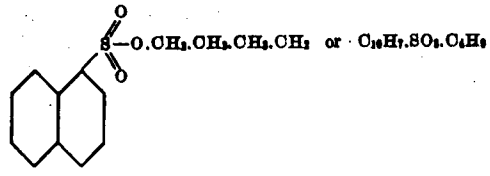
which is amyl 1-anthroate.

The alkyl esters of polycyclic sulfonic acids have the general formula Ar. CO_3.R in which

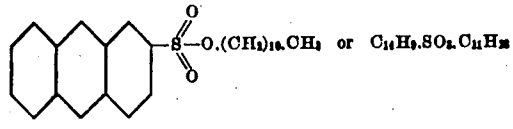
Ar is also a polycyclic residue or radical, and,

R is also an alkyl group made up of C and H in the proportion of C_nH_{2n+1}.

Exemplary compounds conforming to the last above general formula are,



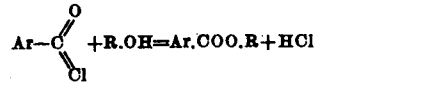
which is butyl 1-napthalenesulfonate.



which is hendecyl 2-anthracenesulfonate.

The above compounds are prepared by the reaction of an acid chloride of a polycyclic acid with a saturated alcohol in the presence of about 5% KOH and at a temperature around 10° C.

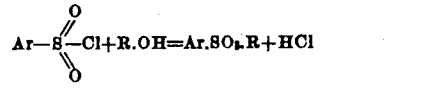
The general reaction for forming the alkyl esters of polycyclic carboxylic acids is:



A specific example of this reaction is that between napthoyl chloride and amyl alcohol, which is as follows, and forms amyl napthoate,

$$C_{10}H_7.COCl+C_5H_{11}OH=C_{10}H_7.COO.C_5H_{11}+HCl$$

The general reaction for forming alkyl esters of polycyclic sulfonic acids is:



A specific example of this reaction is that between 1-napthalenesulfonate chloride and butyl alcohol, which is as follows, and forms butyl 1-napthalenesulfonate,

$$C_{10}H_7.SO_2.Cl+CH_3.CH_2.CH_2.CH_2.OH=C_{10}H_7.SO_3.C_4H_9+HCl$$

While the step of desolvating emulsoids to facilitate their flocculation as wide adaptation, it is of especial utility with respect to the treatment of organic waste liquid, such as sewage and industrial wastes. It will be appreciated, of course, that the step of desolvating the emulsoid is not alone sufficient to effect its flocculation. Accordingly, the complete process of flocculation comprehends not only the initial step of desolvating the emulsoids by the incorporation in the disperse medium of a compound as hereinbefore described, but also comprehends the additional steps of controlling the pH of the solution to permit the flocculation of the desolvated or dehydrated emulsoids by a suitable electrolyte and the final coagulation of the flocculated material.

A specific illustration of the application of the process is as follows: Assuming that it is desired to remove the positively charged emulsoid content from a waste liquid, which positively charged emulsoid content has a ten day bio chemical oxygen demand of 250 to 300, the desolvating or dehydrating compound, for example hexyl 1-napthoate should be added in liquid form in an amount from 40 to 60 pounds per million gallons of waste. Thereafter, the waste should be agitated for a period of from two to four minutes, and then have incorporated therein an electrolyte having a high valent anion and low valent cation such for example as sodium sulfate or sodium phosphate, which will function to neutralize the positive charge carried by the desolvated emulsoid in the acid solution. The flocculated material will readily settle out, or may be removed by filtration.

Of course, the quantity of the compound necessary to desolvate or dehydrate the positively charged emulsoids, will vary with the concentration of the emulsoids in the liquid to be treated. To determine the exact amount of the desolvating or dehydrating compound to employ, it is only necessary to make up a solution of the compound of known strength, and add this solution to a known volume of the emulsoid dispersion in gradually increasing amounts and check the reading on a nephelomeper with a colorimeter attachment, until no further turbidity increase is noticed. This will be the point at which desolvation or dehydration is complete, and the necessary quantity of the compound required can thus be computed from the known volume of the known strength solution of the compound used in the experiment.

What I claim as my invention is:

1. In a process for flocculating positively charged emulsoids from the disperse medium, the step which comprises incorporating in the disperse medium, an alkyl ester of a polycyclic acid.

2. In a process for flocculating positively charged emulsoids from the disperse medium, the step which comprises incorporating in the disperse medium, an alkyl ester of a polycyclic carboxylic acid.

3. In a process for flocculating positively charged emulsoids from the disperse medium, the step which comprises incorporating in the disperse medium, an alkyl ester of a polycyclic sulfonic acid.

4. In a process for flocculating positively charged emulsoids from the disperse medium, the step which comprises incorporating in the disperse medium hexyl 1-napthoate.

5. In a process flocculating positively

charged emulsoids from the disperse medium, the step which comprises incorporating in the disperse medium butyl 1-napthalenesulfonate.

6. A process for flocculating positively charged emulsoids from a disperse medium, comprising incorporating in the disperse medium, an alkyl of a polycyclic acid, then agitating, incorporating calcium hydroxide to bring the pH of the solution to from 8.5 to 9.5, thereafter adding a suitable electrolyte with further agitation, and finally adding a suitable coagulant.

7. A process for flocculating positively charged emulsoids from a disperse medium, comprising incorporating in the disperse medium an alkyl ester of polycyclic carboxylic acid, then agitating, incorporating calcium hydroxide to bring the pH of the solution to from 8.5 to 9.5, thereafter adding a suitable electrolyte with further agitation and finally adding a suitable coagulant.

8. A process for flocculating positively charged emulsoids from a disperse medium, comprising incorporating in the disperse medium an alkyl ester of a polycyclic sulfonic acid, then agitating, incorporating calcium hydroxide to bring the pH of the solution to from 8.5 to 9.5, thereafter adding a suitable electrolyte with further agitation and finally adding a suitable coagulant.

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