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PROCESS FOR MAKING COPPER SOAPS

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This invention relates to a method of preparing copper salts of higher fatty acids.

More particularly, it relates to a method of making copper soaps by direct action of fatty acids and metallic copper.

It has been known that a mixture or solution of copper soaps and fatty acids can be prepared by reacting copper oxide with fatty acids.

An object of my invention is to provide a process for preparing copper soaps directly from metallic copper, and especially from the precipitated copper which is a by-product of the high temperature, high pressure, hydrogenation of copper soaps. A further object is to provide a process for making copper soaps which, if desired, are substantially free from oleaginous impurities.

Heretofore, when oil-free or fatty-acid-free soaps of bivalent or trivalent metals have been needed, it has been common practice to prepare these by the generally applicable procedure of mixing an aqueous solution of the corresponding sodium or potassium soaps with an aqueous solution of a water soluble salt of the metal. Thus copper soaps of oleic acid may, for example, be prepared by mixing equivalent amounts of aqueous solutions of sodium oleate and of copper sulfate. This procedure, while convenient for laboratory practice, is not particularly suitable for large scale commercial preparation of copper soaps, especially when a water free product is required. It necessitates a number of separate steps which it is one of my objects to avoid. It produces wet soaps which, due to their soft and sticky nature, are difficult to dry.

An object of my invention is to prepare dry copper soaps, which may be substantially free from oleaginous impurities, by a direct single stage procedure, thus avoiding the multiplicity of steps inherent in the double decomposition method heretofore commonly used.

It has been known that metallic copper is attacked by higher fatty acids, and that copper soaps are formed as a result. When melted stearic acid is held for some time in a copper vessel, it is known that the stearic acid develops a greenish color as a result of dissolving small traces of copper. This action is so slow, however, that it does not deter the widespread use of copper equipment in the industrial handling of hot fatty acids. Copper tanks used for storing fatty acids and copper pipes through which hot fatty acids are pumped last for many years in this service.

An object of my invention is to provide a process for reacting metallic copper with higher fatty acids, which is so rapid and so economical that it

is suitable for employment in the commercial manufacture of copper soaps.

In the process of my invention, when carried out in a preferred manner, I heat the selected fatty acids to a temperature in the neighborhood of 200° C., add an equivalent amount of comminuted copper (assuming that cupric soaps will be formed), agitate this slurry thoroughly while maintaining its temperature at about 200° C., and blow air through the mixture at a rapid rate. Under these conditions I find that the copper dissolves completely and rapidly to produce a molten mass of dry cupric soaps of good quality, which are substantially uncontaminated with free fatty acids. It is desirable to discontinue the air blowing as soon as the reaction is complete, as judged by the complete dissolution of the copper or by chemical analysis or other convenient means, and then either to cool the molten soaps or to protect them from further contact with air.

When this same procedure is followed with the omission of air blowing, the reaction is entirely too slow and incomplete to be of any commercial interest. In the absence of air blowing, only about one tenth of the copper goes into solution in the time required to complete the reaction according to my process.

As an example of the process of my invention, I add 318 pounds of powdered copper to 2090 pounds of the mixed fatty acids derived from coconut oil, stir this slurry vigorously by means of a mechanical agitator while maintaining its temperature at about 200° C., and blow a vigorous current of air through the mixture until the copper is dissolved. This usually requires about one to one and a half hours. I then shut off the air and transfer the resulting molten copper soaps to a storage tank which may, if desired, be blanketed with nitrogen to avoid unnecessary oxidation of the product.

At the temperature employed in my process, a certain amount of distillation of fatty acids, especially those of lower molecular weight, is found to occur. To prevent this loss, it is desirable to lead the outgoing air through a reflux condenser which drains back into the reaction vessel, or alternatively to start with somewhat more than an equivalent amount of fatty acids to compensate for the distillation loss.

Copper soaps of any of the higher fatty acids may be prepared by this process. Such fatty acids may be derived from any of the naturally occurring fats or glyceride oils, or from waxes or resins, or may be prepared synthetically, as by the catalytic oxidation of petroleum. These fatty

acids, which may contain eight or more carbon atoms in the molecule, and more commonly from twelve to twenty-two, may be saturated or unsaturated, either hydrogenated or unhydrogenated.

A reasonable latitude in the temperature employed in the process is permissible. I find that the reaction occurs undesirably slowly at temperatures as low as 100° C. Prolonged blowing with air, as is required when the reaction occurs slowly, is to be avoided because of the tendency of the fatty acids and soaps to become oxidized and to decompose. For a like reason, i. e., the avoidance of excessive oxidation, temperatures greatly in excess of 200° C. are to be avoided. Accordingly I prefer to conduct my process within the range of 125° C. to 245° C., and I particularly recommend the narrower range of 170° C. to 220° C.

Mechanical agitation is usually helpful, unless a large excess of copper is employed, because copper is so dense that it tends to settle rapidly. Very good gas agitation may, however, be substituted with satisfactory results.

Although air is the most convenient oxidizing gas to use, and is quite suitable, other oxygen-containing gases including pure oxygen may be substituted. In this connection the term "oxygen-containing gas" denotes a gas containing free molecular oxygen.

As a source of metallic copper for my process, I prefer comminuted copper, such as is formed when copper soaps are subjected to reaction with hydrogen at elevated temperature and pressure, although mechanically powdered copper such as copper filings may be used. Even copper turnings or other forms of copper having a large surface per unit of mass, if used in sufficient excess, may be employed, and these are to be considered as coming within the scope of my invention.

Although I prefer to employ substantially equivalent proportions of fatty acid and copper, my process is not limited to such proportions. At times a mixture consisting of copper soaps and free fatty acids may be desirable (or at least unobjectionable) as the final product, and in such cases an excess of fatty acids may be employed in the process. At other times there may be no objection to having free copper in the soaps produced by the process, and in this event the reaction time may be reduced by employing an excess of finely divided copper in the reaction mixture.

My process is particularly applicable and desirable in the preparation of copper soaps for reduction to fatty alcohols by the method described in applications Ser. Nos. 370,072 and 370,073, filed on February 21, 1941, by Richard-

son and Taylor, now U. S. Patents Nos. 2,340,343 and 2,340,344, issued February 1, 1944. When the copper soap of a higher fatty acid is subjected to reaction with molecular hydrogen at quite high temperatures and pressures, the free metal is liberated and a higher fatty alcohol is formed. In the commercial practice of this process it is highly desirable to reuse the resulting free copper in the preparation of another lot of copper soaps for reduction to another lot of alcohols. Copper soaps produced by my process from copper precipitated in this alcohol manufacturing procedure are found to reduce readily to form high yields of fatty alcohols.

Other uses for my invention are in the preparation of copper soaps for the manufacture of paints, especially marine paints, of disinfectants and germicides, of insecticides and fungicides, of bronzing materials, of fish net preservatives, of pharmaceuticals, of lubricants, of water-proofing compositions, and of other materials in which copper compounds and/or water insoluble soaps are advantageously incorporated.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The improvement in processes for forming the cupric soap of a higher fatty acid, which comprises mixing said fatty acid with comminuted copper and blowing an excess of an oxygen-containing gas through said mixture while the latter is at a temperature between 125° C. and 245° C.

2. The process of claim 1, in which substantially equivalent amounts of fatty acid and copper are employed.

3. The process of claim 1, in which mechanical agitation is employed to promote contact between the reactants.

4. The process of claim 1, in which said fatty acid is derived from coconut oil.

5. The process of claim 1, in which the temperature is held within the range of 170° C. to 220° C.

6. The process of claim 1, in which the temperature is approximately 200° C.

7. The process of claim 1, in which the oxygen-containing gas is air.

8. The improvement in processes for forming a cupric soap of a higher fatty acid, which comprises mixing said fatty acid with an excess of metallic copper in a form having a surface area per unit of mass at least as great as that of copper turnings, and blowing an excess of an oxygen-containing gas through said mixture while the latter is at a temperature between 125° C. and 245° C.

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