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LUBRICANT AND METHOD OF PRODUCING SAME

William S. Young, Philadelphia, Pa., assignor to The Atlantic Refining Company, Philadelphia, Pa., a corporation of Pennsylvania

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The present invention relates to lubricants and method of producing same, and relates more particularly to lubricants which are substantially insoluble in hydrocarbons and which are suitable for the lubrication of valves, stopcocks, ground joints, and other devices where hydrocarbon-insoluble greases are required.

The lubricants of the present invention are produced by condensing an aliphatic hydroxy polycarboxylic acid containing not more than 6 carbon atoms per molecule with an aliphatic polyhydroxy compound such as a glycol or polyglycol, and incorporating in the reactant mixture subsequent to the initiation of the condensation reaction, a small amount of an aluminum soap of a higher fatty acid, i. e., from about 1% to 10% by weight of an aluminum soap of a fatty acid containing from 12 to 18 carbon atoms per molecule.

In accordance with this invention, an aliphatic hydroxy polycarboxylic acid is mixed with the glycol or polyglycol, and the mixture is heated for a suitable period of time at a temperature such as to produce a fluid resinous product. After the condensation reaction has commenced, a suitable quantity of an aluminum soap is added to the mixture and the heating is continued until the soap is dissolved or uniformly dispersed and the condensation reaction has been carried to the desired extent, whereupon the entire mixture is cooled and there is obtained a lubricant of desired consistency. Such lubricant may vary in consistency, ranging from a viscous liquid to a tacky grease, depending upon a variety of factors such as the ratio of hydroxy polycarboxylic acid to glycol, the temperature and duration of heating, and the quantity of aluminum soap added. In general the glycol will be in excess of the hydroxy polycarboxylic acid, for example, 1 to 2 moles of glycol or polyglycol to 1 mole of hydroxy polycarboxylic acid. The temperature for effecting condensation of the reactants may range from 150° C. to 200° C., good results being obtained at 175° C. to 185° C. The duration of the heating will depend upon the temperature employed and the degree of condensation required. Heating from 30 to 90 minutes usually affects the desired condensation with the production of fluid or plastic resinous materials which are esterification or polymerization products of considerable molecular weight. In producing the lubricant, it has been found that the aluminum soap must be added after the condensation reaction has been initiated, otherwise the soap appears to inhibit or even prevent the reaction. On the other hand,

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the soap should not be added to the reaction mixture after the desired condensation has been effected, since the additional period of heating required to incorporate the soap will cause over-condensation or over-polymerization with the resultant formation of too viscous or even solid resins. Depending upon the consistency desired in the final lubricant, the amount of aluminum soap may vary between 1% and 10% by weight of the resinous component. Amounts of soap greater than about 10% gives a non-uniform, grainy product unsuitable as a lubricant, therefore, it is necessary to restrict the quantity of soap to that which is uniformly compatible with the resinous component.

The aliphatic hydroxy polycarboxylic acids suitable for use in accordance with this invention may be exemplified by hydroxymalonic acid, hydroxysuccinic acid, tartaric acid, citric acid, and the trihydroxyglutaric acids. The glycols or polyglycols employed in the condensation reaction with the hydroxy polycarboxylic acids include ethylene glycol, propylene glycol, butylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and the higher polyglycols, or mixtures of two or more of these compounds. The aluminum soaps of the higher fatty acids useful in preparing the lubricants of the present invention include the aluminum salts or soaps of lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, lineolic acid, ricinoleic acid, oxidized petroleum wax acids, and the like.

The present invention may be illustrated by the following example, which, however, is not to be construed as limiting the scope thereof.

1 mole of citric acid and 1.5 moles of tetraethylene glycol were mixed and heated at 180° C.–185° C. for ½ hour, the mixture being continuously stirred during the heating. At this time, the vigorous evolution of gas which initially took place had largely subsided, and 8% by weight of aluminum stearate was slowly added, with stirring, until the soap was dissolved. The hot mixture was then rapidly cooled to about 100° C. and dewatered by evacuation. The product was then cooled to room temperature and was ready for use as a lubricant, such product being a tacky grease substantially insoluble in paraffinic or aromatic hydrocarbon solvents. During the condensation or polymerization of the initial reactants, the degree of condensation or polymerization was tested periodically by removing a few drops of the hot mixture and allowing them to fall upon a cold surface, thereupon observing the fluidity of the mixture. Final consistency of

the product was determined by noting the behavior of the cold lubricant when rubbed between the fingers. The consistency could be varied, within limits, by controlling the degree of condensation or polymerization, as well as the amount of the aluminum soap added.

A grease, as prepared above, was found eminently suitable for the lubrication of valves, stopcocks, and ground joints, since it possessed a good consistency and a high initial resistance to flow, thereby avoiding plugging of valve or stopcock bores, and did not cause sticking or "freezing" of valves, stopcocks, or ground joints when such devices were subjected to moderately high temperatures.

I claim:

1. A method of producing a lubricant, which consists essentially in heating a mixture of 1 mol of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 mols of a glycol at 150° C. to 200° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of an aluminum soap of a higher fatty acid containing 12 to 18 carbon atoms subsequent to the initiation of the condensation reaction but prior to the completion thereof.

2. A method of producing a lubricant, which consists essentially in heating a mixture of 1 mol of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 moles of a polygylcol at 150° C. to 200° C. to condense said reactance to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of an aluminum soap of a higher fatty acid of from 12 to 18 carbon atoms subsequent to the initiation of the condensation reaction but prior to the completion thereof.

3. A method of producing a lubricant, which consists essentially in heating a mixture of 1 mol of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 moles of a polyethylene glycol at 150° C. to 200° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of aluminum stearate subsequent to the initiation of the condensation reaction but prior to the completion thereof.

4. A method of producing a lubricant, which consists essentially in heating a mixture of 1 mol of citric acid with 1.5 moles of tetraethylene glycol at 180° C. to 185° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of aluminum stearate subsequent to the initiation of the condensation reaction but prior to the completion thereof.

5. A lubricant produced by heating a mixture of 1 mole of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 moles of a glycol at 150° C. to 200° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of an aluminum soap of a fatty acid containing 12 to 18 carbon atoms subsequent to the initiation of the condensation reaction but prior to the completion thereof.

6. A lubricant produced by heating a mixture of 1 mole of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 moles of a polygylcol at 150° C. to 200° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of an aluminum soap of a fatty acid containing from 12 to 18 carbon atoms subsequent to the initiation of the condensation reaction but prior to the completion thereof.

7. A lubricant produced by heating a mixture of 1 mole of an aliphatic hydroxy polycarboxylic acid of not more than 6 carbon atoms with 1 to 2 moles of a polyethylene glycol at 150° C. to 200° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 1% to 10% by weight of aluminum stearate subsequent to the initiation of the condensation reaction but prior to the completion thereof.

8. A lubricant produced by heating a mixture of 1 mole of citric acid with 1.5 moles of tetraethylene gylcol at 180° C. to 185° C. to condense said reactants to a fluid resinous product, and incorporating with said reactants from 5% to 10% by weight of aluminum stearate subsequent to the initiation of the condensation reaction but prior to the completion thereof.

WILLIAM S. YOUNG.

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