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LIQUID FUEL AND METHOD OF PRODUCING SAME

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The present invention relates to improvements in the manufacture of composite fuel from coal and oil, such fuel being of the type in which coal or other bituminous material, in a fine state of division, is maintained in suspension in an oil medium.

In accordance with the present invention, coal or the like in a fine state of division is suspended in hydrocarbon oil, and such suspension is stabilized by the incorporation of a small amount of an acidic compound such as an organic or inorganic acid or derivative thereof. In producing the suspension, it has been found that most satisfactory results are obtained by pulverizing the coal or other bituminous material in the presence of a small amount of the acidic stabilizing agent, and thereafter incorporating this mixture in hydrocarbon oil of the nature of fuel oil.

The bituminous materials which may be utilized include bituminous coal, anthracite coal, cannel coal, lignite, high melting point coal tar or petroleum pitches, coke derived from coal or petroleum, and carbonaceous residues resulting from the cracking or destructive hydrogenation of coal or petroleum. The hydrocarbon oils which may be employed as the liquid media are exemplified by relatively high boiling distillates of cracked or uncracked petroleum, coal tar, petroleum tar, residues from the polymerization of hydrocarbon gases and oils, oils or oil fractions from the destructive hydrogenation of coal or petroleum, and heavy residual oils from the refining of petroleum. The bituminous materials are pulverized to pass 100 mesh, and preferably 200 mesh, it having been found that the finer the state of division, the more readily the suspension is stabilized. The proportion of pulverized bituminous material to oil may vary from about 10% to 60% by weight of the oil, a ratio of 40 parts of bituminous material to 60 parts of oil being preferred.

The stabilizing agents which may be employed include sulfuric acid of from 80% to 100% concentration, a concentration of from 93% to 98% being preferred. Spent sulfuric acid from the treatment of hydrocarbon oils which has been recovered and reconcentrated may be used, as may the sludge or sludge acids in which the sulfuric acid has a concentration of at least 80%. Sulfuric acid or phosphoric acid which has been

used in the polymerization of hydrocarbons such as gaseous olefins, or which has been used in the alkylation of isoparaffins with olefins or aromatics with olefins, and which may contain hydrocarbon sulfates or phosphates may be suitably employed in accordance with this invention. Organic sulfonic acids or sulfuric acid sludges containing sulfonic acids resulting from the treatment of hydrocarbon oils with sulfuric acid, oleum, or sulfur trioxide may also be utilized as stabilizing agents. The quantity of acid stabilizer used may range from about 0.1% to 5% based upon the total composite fuel produced, quantities of the order of 0.5% to 1.5% being preferred.

In producing the suspension of bituminous material in oil, we have found that most satisfactory results are obtained by adding to the bituminous material during the pulverizing operation, the desired quantity of acid stabilizer so that such stabilizer may be thoroughly distributed in and over the surfaces of the bituminous particles. The pulverizing of the bituminous material and the addition of the acid stabilizer thereto may be carried out in a suitable apparatus such as grinder or ball mill or Raymond mill, and the resulting pulverized mixture may be incorporated in the hydrocarbon oil by mechanical agitation, or by injection of the mixture into a circulating stream of the oil, or by the use of a homogenizer. In the event that the bituminous material is available in a pulverized state, the acid stabilizer may be distributed therethrough by mixing in a ball mill or other suitable device. Stable suspensions may also be produced by first distributing the stabilizer in the oil and thereafter incorporating the finely divided bituminous material, or by admixing the bituminous material, stabilizer, and oil simultaneously. However, the method first described above is preferred.

Our invention may be further illustrated by the following examples, which, however, are not to be construed as limiting the scope thereof. In these examples, the acid stabilizing agent was distributed uniformly through the pulverized coal by thorough milling in a ball mill. The resulting mixture was dispersed in a hydrocarbon fuel oil having a Furol viscosity of 56 seconds at 122° F. and an A. P. I. gravity of 14°, by feeding the mixture into the oil with vigorous agitation until a homogeneous suspension was obtained. A pul-

verized bituminous coal was employed in the proportions of 40 parts of coal to 60 parts of fuel oil, and the amount of acid stabilizer used was based upon the total composite fuel, i. e., coal plus oil. The stability of the composite fuel was determined by permitting samples to stand in a quiescent state and noting the number of days required to obtain settlement of 30% of the coal initially incorporated in the oil.

Coal (mesh)	Acid stabilizer	Weight, percent	Stability	
			Temp., °F.	Days
150/200	None		77	7.5
150/200	Sulfonic acids from gas oil acid sludge	1.0	77	12.5
150/200	Sulfuric acid (98% conc.)	1.0	77	65.0
200/250	None		120	4.5
200/250	Sulfonic acids from gas oil acid sludge	0.5	120	9.0
200/250	Diisopropyl benzene sul- fonic acids	0.5	120	25.0
200/250	Sulfuric acid sludge from manufacture of medicinal white oil	1.5	120	62.0
200/250	Sulfuric acid (98% conc.)	0.5	120	34.5
200/250	do	1.5	120	68.0

From the above examples it will be seen that a marked improvement in stability of the coal-in-oil suspension was obtained by the incorporation of relatively small quantities of sulfuric acid or sulfonic acids. The most notable improvement was produced with sulfuric acid of 98% concentration, and this stabilizer is preferred since it is relatively inexpensive and readily available.

We claim:

1. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in incorporating a small quantity of a sulfonic acid in said finely divided bituminous fuel, and dispersing said fuel in hydrocarbon oil.

2. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in incorporating a small quantity of petroleum sulfuric acid sludge in said finely divided bituminous fuel, and dispersing said fuel in hydrocarbon oil.

3. A liquid fuel consisting of a sulfuric acid-stabilized suspension of finely divided bituminous fuel in hydrocarbon oil.

4. A liquid fuel consisting of a suspension of finely divided bituminous fuel in hydrocarbon oil and a small quantity of sulfuric acid sufficient to stabilize said suspension.

5. A liquid fuel consisting of a suspension of finely divided coal in hydrocarbon oil and from 0.1% to 5% of sulfuric acid incorporated in said suspension.

6. A liquid fuel consisting of a suspension of finely divided coal in hydrocarbon oil and from 0.5% to 1.5% of sulfuric acid incorporated in said suspension.

7. A liquid fuel consisting of a suspension of finely divided bituminous fuel in hydrocarbon oil, stabilized with an acid from the group consisting

of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid.

8. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in intimately mixing said finely divided bituminous fuel with said hydrocarbon oil and a small but sufficient quantity of an acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid to stabilize said fuel in said oil.

9. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in intimately mixing said finely divided bituminous fuel with said hydrocarbon oil and from 0.1 per cent to 5.0 per cent of an acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid to stabilize said fuel in said oil.

10. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in intimately mixing said finely divided bituminous fuel with said hydrocarbon oil and from 0.5 per cent to 1.5 per cent of an acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid to stabilize said fuel in said oil.

11. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in incorporating a small quantity of an acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid in said finely divided bituminous fuel, and dispersing said fuel in hydrocarbon oil.

12. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in incorporating a small quantity of acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid in said hydrocarbon oil, and dispersing said finely divided bituminous fuel in said hydrocarbon oil.

13. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in pulverizing said fuel in the presence of a small quantity of an acid from the group consisting of sulfuric acid, hydrocarbon sulfonic acids, and phosphoric acid, and dispersing said finely divided bituminous fuel in hydrocarbon oil.

14. A method of producing a stable suspension of finely divided bituminous fuel in hydrocarbon oil, which consists in incorporating a small quantity of sulfuric acid in said finely divided bituminous fuel, and dispersing said fuel in hydrocarbon oil.

15. A liquid fuel consisting of a petroleum sulfuric acid sludge-stabilized suspension of finely divided bituminous fuel in hydrocarbon oil.

16. A liquid fuel consisting of a suspension of finely divided coal in hydrocarbon oil and from 0.1% to 5% of a petroleum sulfuric acid sludge incorporated in said suspension.

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