

LUBRICATING OIL WITH IMPROVED
DIESEL DISPERSANCY

1 This invention relates to lubricating oil
compositions exhibiting improved dispersancy in diesel
engines. More particularly, the invention relates to
a method of improving conventional alkenyl succinimide
5 dispersants through use of oil-soluble organic acids.

 It is widely recognized that lubricating oils
for diesel engines are typically subjected to severe
engine operating conditions and that providing a highly
potent sludge dispersant is an important objective in
10 the industry for diesel engine lubricating oil
formulations.

 Dispersants based upon the reaction product
of various polyamines with alkenyl hydrocarbon substi-
tuted succinic anhydrides or acids are known in the art
15 and are disclosed, for example, in U.S. Patent 3,172,892,
issued March 9, 1965 to LeSuer et al and U.S. Patent
3,933,659, issued January 20, 1976 to Lyle et al. The
alkenyl portion of these dispersants is typically a
polymer of a C₂-C₅ monoolefin, especially poly-
20 isobutylene.

 The present invention provides enhancement
of the dispersant potency of these alkenyl succinimide
dispersants in diesel engines through use of
certain organic acids.

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1 wherein R" is a C₉-C₇₀ hydrocarbyl, oil-solubilizing
group and X is hydrogen, nitro, halo or cyano
with the proviso that at least one X is other than
hydrogen.

5 Oil-soluble polyisobutenyl succinimide ashless
dispersants are those formed by reacting a polyisobutenyl
succinic acid or anhydride with a polyalkyleneamine.
The polyisobutenyl group preferably has a number average
molecular weight (Mn) of about 700 to about 5,000, more
10 preferably about 900 to 1,500.

Suitable polyamines for reaction with the
aforesaid succinic acid or anhydrides to provide the
succinimide are those polyalkyleneamines represented
by the formula $\text{NH}_2(\text{CH}_2)_n-(\text{NH}(\text{CH}_2)_n)_m-\text{NH}_2$ wherein
15 n is 2 to 3 and m is 0 to 10. Illustrative are ethylene
diamine, diethylene triamine, triethylene tetramine,
tetraethylene pentamine, which is preferred, tetra-
propylene pentamine, pentaethylene hexamine and the like,
as well as the commercially available mixtures of such
20 polyamines. These amines are reacted with the alkenyl
succinic acid or anhydride in ratios of about 1:1 to
10:1 moles of alkenyl succinic acid or anhydride to
polyamine, and preferably in a ratio of about 2:1.

Such polyisobutenyl succinimide ashless
25 dispersants are used customarily in lubricating oil
compositions in amounts ranging from 0.1 to 10 per-
cent, preferably 0.5 to 5 percent by weight based

1 upon the total weight of the finished compositions. The same amounts are applicable to the acid-treated diesel oil dispersants of the present invention.

5 The improved acid-treated polyisobutenyl succinimide dispersants of the present invention are prepared by adding a suitable acid to a solution of dispersant in hydrocarbon lubricating oil base stock, preferably a concentrated solution of about 40 to 60 wt.% dispersant, preferably about 50 wt.%, is used. The
10 same lubricating oil base stock used in formulating the finished oil is a convenient vehicle for providing the solution. Preferred base stocks are paraffin mineral oils having a viscosity of about 20 to 100 cS min.(37.8°F) and blends of such oils. The acid treatment is effected
15 by heating the solution of dispersant to about 80 to 200°C, preferably to about 100 to 175°C, such as 150°C, and adding thereto 0.1 to 0.5 mole of a suitable organic acid per mole of dispersant. The preferable range of addition is about 0.2 to 0.3 mole per mole of
20 polyisobutenyl succinimide dispersant. The mixture is stirred at this temperature for about 15 minutes to 3 hours until the acid reacts into the system. While not wishing to be bound by this theory, it is believed that at this relatively elevated temperature,
25 a capping reaction occurs whereby an amide is formed between unreacted amino moieties and the organic acid additive. A convenient method of conducting

1 this acid treatment is to add the organic acid as
the final step in the dispersant preparation process,
i.e., after reaction of the polyisobutenyl succinic
anhydride with the alkylene polyamine. Subsequent
5 to this, conventional lubricating oil blending
techniques are followed to provide finished lube
oils exhibiting improved dispersancy in diesel
engines.

The oil-soluble organic acids which can
10 be used in accordance with this invention are acids
containing a hydrogen dissociating moiety which
has a pK of -10 to + 5.0. The term pK can be
defined as the negative logarithm to the base 10
of the equilibrium constant for the dissociation
15 of the oil-soluble organic acid.

As used herein, oil-soluble is defined as
those organic acids which themselves are sub-
stantially soluble in mineral oil at 20°C to at
least 50 weight percent.

20 The oil-soluble organic acids are selected
from the hydrocarbyl substituted maleic acids,
malonic acids, sulfuric acids and mono- and di-
alpha-substituted hydrocarbyl carboxylic acids as
defined above wherein the oil-solubilizing group
25 or groups are hydrocarbyl and containing from 9 to
70, preferably from 20 to 40, optimally 25 to 35,
total carbon atoms. These ranges are considered to

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1 approximate to oil-solubility for the classes of organic acids specified as suitable herein.

Representative examples of oil-soluble maleic acid derivatives are pentadecylmaleic acid,
5 hexadecylmaleic acid, eicosylmaleic acid, triacontanylmaleic acid and polymers of C₂-C₅ monoolefins having from 15 to 70 carbons substituted onto said maleic acid.

Representative examples of malonic acids
10 for use in the invention include the malonic acid counterparts of the above-referenced hydrocarbyl substituted maleic acids, i.e., pentadecylmalonic acid and hexadecyl malonic acid.

Examples of sulfuric acids are pentadecyl-
15 sulfuric acid, hexadecylsulfuric acid, eicosyl-sulfuric acid and triacontanylsulfuric acid.

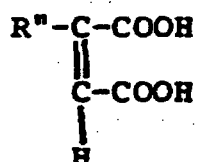
Examples of hydrocarbyl carboxylic acids include alpha-nitro and alpha-di-nitro substituted acids, such as dodecanoic, pentadecanoic, octade-
20 canoic, docosanoic, octacosanoic, tricontanoic and tetracontanoic acid.

Attention is directed to published UK patent application No 81-25954 out of which the present application is divided which shows in its
25 Examples the effect of acid treatment on borated dispersants.



CLAIMS

1. A lubricating oil composition exhibiting improved dispersancy in a diesel engine comprising a hydrocarbon lubricating oil and an acid-treated, oil-soluble polyisobutenyl succinimide dispersant, said dispersant being acid-treated by having incorporated therein, per mole of said succinimide, about 0.1 to 0.5 mole of an oil-soluble organic acid having a pK of -10 to +5 containing a C₉-C₇₀ hydrocarbyl group, said acid being selected from hydrocarbyl-substituted maleic acids of the formula:



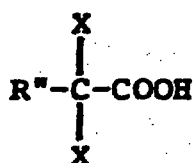
hydrocarbyl-containing substituted malonic acids of the general formula:



hydrocarbyl-substituted sulfuric acids of the general formula:



and mono- and di-alpha-substituted hydrocarbyl carboxylic acids having the general formula:



wherein R^H is a C₉-C₇₀ hydrocarbyl, oil-solubilizing group and X is hydrogen, nitro, halo or cyano

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with the proviso that at least one X is other than hydrogen.

2. The composition of claim 1, wherein the acid treatment is with 0.2 to 0.3 mole of said acid per mole of said succinimide dispersant.
