(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 280 417**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **88300859.1**

(51) Int. Cl.[4]: **C10L 1/18**

(22) Date of filing: **02.02.88**

(30) Priority: **27.02.87 US 19984**

(43) Date of publication of application:
31.08.88 Bulletin 88/35

(84) Designated Contracting States:
DE GB

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(54) **Diesel fuel injector additive comprising polyalkenyl succinic acid, diesel fuel containing same and method of use thereof.**

(57) Formation of deposits in fuel injectors of diesel fueled engines is inhibited by addition of an alkenyl succinic acid to the diesel fuel.

The invention provides a composition, for inhibiting the formation of deposits in diesel fuel injection systems, comprising an alkenyl succinic acid or mixtures thereof, a composition comprising a diesel fuel and, in an amount effective to inhibit formation of deposits in injection systems, an alkenyl succinic acid or mixtures thereof and a method of inhibiting the formation of deposits in fuel injectors of diesel fueled engines which comprises adding to said diesel fuel a composition comprising an alkenyl succinic acid or mixtures thereof in an amount effective to inhibit the formation of deposits.

The acid may be tetrapropenyl succinic acid and the compositions may comprise a hydrocarbon solvent such as xylene.

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DIESEL FUEL INJECTOR ADDITIVE COMPRISING POLYALKENYL SUCCINIC ACID, DIESEL FUEL CONTAINING SAME AND METHOD OF USE THEREOF

Background of the Invention

I. Field of the Invention

This invention relates to a diesel fuel additive and a diesel fuel composition comprising same. More particularly, the invention relates to the inhibition of deposit formation in the fuel injectors of diesel fueled engines by incorporation into said fuel of a composition comprising a polyalkenyl succinic acid.

The relatively recent increase in the use of fuel injection systems for internal combustion engines has resulted in the need for additives which will inhibit the formation of deposits within and around the injector orifices. Fuel injectors are used in both gasoline and diesel fueled engines but the mechanism for inhibiting deposit formation within and around the orifices of the fuel injectors in such engines are quite different because of the quite distinct difference in the composition of gasoline and diesel fuels.

Accordingly, it has been found that the determination of the usefulness of additives in gasoline and diesel fuels is empirical and that an additive useful in a gasoline fuel is not necessarily indicated as an additive for a diesel fuel and vice versa. In fact, the nature of fuel additives is such that, even within the same fuel system, the effectiveness of additives is quite specific. For example, a detergent additive for gasoline fuels designed to keep a carburetor in clean condition is not necessarily effective in a gasoline fueled engine having fuel injectors. Similarly, an additive for inhibiting deposit formation in carburetors or fuel injectors in a gasoline engine is not likely to be effective as a formation deposit inhibitor in the intake manifold or the combustion chamber of that engine. Accordingly, indications of the usefulness of an additive in a gasoline engine for a specific purpose has little value in indicating the possible use of the additive for that purpose in a diesel fueled engine.

Because of the complex hydrocarbon nature of diesel fuels which, of course, are substantially heavier than gasoline fuels, there is a tendency toward the formation of deposits within and around the orifices of fuel injectors resulting in the consequent clogging of the injectors and decreased engine performance.

Accordingly, there is a need to inhibit the formation of such deposits. That need is met by the present invention which provides a polyalkenyl succinic acid additive which inhibits the formation of deposits in injection systems for diesel fueled engines.

II. Prior Art

Polyalkenyl succinic acids and derivatives thereof have been used as fuel additives. Thus:

U.S. Patent No. 2,993,772 discloses a process for inhibiting the formation of deposits in internal combustion engines which comprises adding to the fuel an additive which is an ester of an alkenyl succinic acid having 8 to 31 carbon atoms in the alkenyl group and an alcohol.

U.S. Patent No. 3,117,091 discloses a rust preventive compound for various fuels which is a partial ester of an alkenyl succinic anhydride and a polyhydric alcohol.

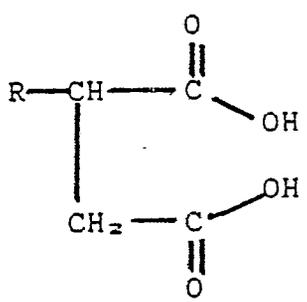
U.S. Patent 3,346,354 discloses a hydrocarbon fuel composition capable of reducing intake valve and port deposits, which fuel contains an alkenyl succinic acid or an alkenyl succinic ester.

U.S. Patent No. 3,447,918 discloses the use of polybutene substituted succinic acid as a corrosion inhibitor for distillate fuels.

U.S. Patent No. 3,574,574 discloses a motor fuel composition which reduces intake valve and port deposits which contains a polyester or a polymerized carboxylic acid.

Summary of the Invention

The present invention relates to an additive for inhibiting deposit formation in the fuel injectors of diesel fueled engines. The additive is a polyalkenyl succinic acid having a molecular weight (number average) of from about 200 to about 350 and which is represented by the following general structural formula:



wherein R is an alkenyl radical. The alkenyl radical may be straightchained or branch-chained and contains from about 8 to about 20 carbon atoms. Examples of such compounds are tetraethenyl succinic acid, octenyl succinic acid, nonenyl succinic acid, decenyl succinic acid, undecenyl succinic acid, tetrapropenyl succinic acid, dodecenyl succinic acid, 3-butyloctenyl succinic acid, tetrabutenyl succinic acid, hexadecenyl succinic acid, didecenyl succinic acid and the like.

The alkenyl succinic acids used in the present invention are prepared by the simple hydrolysis of the corresponding anhydride, as is conventional and well-known to those skilled in the art. Since relatively pure olefins are difficult to obtain, alkenyl succinic acids are usually prepared as mixtures by reacting mixtures of olefins with moleic acid anhydride. Such mixtures, as well as pure anhydrides, are utilizable herein.

The alkenyl succinic acid additives of the present invention, preferably tetrapropenyl succinic acid, are added to the diesel fuel neat or as a solution of the acid in an appropriate solvent, e.g., a hydrocarbon solvent, and may be used in combination with other diesel fuel additives such as surface active agents, film formers, oxygen scavengers, corrosion inhibitors, dehazers and the like. In actual practice, it is preferred to add the alkenyl succinic acid to the diesel fuel as a fifty percent (50%) solution by weight in xylene. The useful concentration of the additive is from about 30 parts to about 600 parts additive per million parts diesel fuel, preferably from about 75 parts to about 300 parts additive per million parts diesel fuel, especially from about 100 parts to about 200 parts additive per million parts diesel fuel.

Use of the alkenyl succinic acids as described above as additives to diesel fuels has been shown to effectively inhibit the formation of deposits in the fuel injectors of diesel fueled engines.

While the illustrative embodiments of the invention have been described with particularity, it will be understood that various other modifications will be apparent to and can be readily made by those skilled in the art without departing from the spirit and scope of the invention. Accordingly, it is not intended that the scope of the claims appended hereto be limited to the description set forth herein but rather that the claims be construed as encompassing all features of patentable novelty which reside in the present invention, including all features which would be treated as equivalent thereof by those skilled in the art to which the invention pertains.

Claims

1. A composition, for inhibiting the formation of deposits in diesel fuel injection systems, comprising an alkenyl succinic acid or mixtures thereof.

2. Composition of claim 1 wherein said acid is tetrapropenyl succinic acid.

3. Composition of claim 1 which includes a hydrocarbon solvent.

4. Composition of claim 3 wherein said solvent is xylene.

5. Composition comprising a diesel fuel and, in an amount effective to inhibit formation of deposits in injection systems, an alkenyl succinic acid or mixtures thereof.

6. Composition of claim 5 wherein said acid is tetrapropenyl succinic acid.

7. Composition of claim 6 which includes a hydrocarbon solvent for said acid.

8. Composition of claim 7 wherein said solvent is xylene.

9. Method of inhibiting the formation of deposits in fuel injectors of diesel fueled engines which comprises adding to said diesel fuel a composition comprising an alkenyl succinic acid or mixtures thereof in an amount effective to inhibit the formation of deposits.

10. Method of claim 9 wherein said acid is tetrapropenyl succinic acid.

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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 0859

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	FR-A-2 340 993 (DU PONT DE NEMOURS) * Claims 1,4-6,9,10; page 1, lines 1-25; page 4, lines 5-16; page 5, lines 1-16 *	1-8	C 10 L 1/18
Y		10	
A		9	
D,X	US-A-3 346 354 (KAUTSKY et al.) * Whole document *	9	
Y		10	
X	US-A-4 242 099 (MALEC) * Abstract; column 1, lines 1-7; claims 1,4 *	1,2,5,6	
X	US-A-4 448 586 (WEIDIG) * Claims 1,5,10,16; column 1, lines 1-9; column 7, lines 29-55 *	1-8	
D,X	US-A-2 993 772 (STROMBERG) * Whole document *	1,2	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A		3-10	
X	US-A-4 508 637 (HEINTZELMAN et al.) * Whole document *	1,2,5,6	C 10 L
A	US-A-3 635 686 (GEE et al.) * Claims; column 1; column 3, lines 29-35 *	1-10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06-04-1988	DE LA MORINERIE B.M.S.B.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)