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3,515,526

LIQUID SMUDGE FUEL COMPOSITIONS

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7 Claims

ABSTRACT OF THE DISCLOSURE

Liquid fuel compositions useful as smudge pot fuels comprise bituminous material and an additive. The additive is selected from the group consisting of ethylbenzene, cyclohexane, octene-1, octene-2 and styrene. The fuels may contain as little as 0.1 weight percent additive in the case of styrene or 0.5 weight percent when the other additives are used. The compositions may also contain a naphthalene ignitor and a petroleum solvent spirit.

The present invention relates to novel fuel compositions and more particularly to liquid fuel compositions made from bituminous material.

The compositions of this invention are best utilized as smudge pot fuels. Smudge pots are used for protecting crops from frost damage. The pots are placed at spaced intervals throughout the groves or fields to be protected. When the crops are threatened by frost, the fuel in the pots is ignited. The heat given off by the burning fuel is usually sufficient to prevent frost damage.

Asphalt is defined by the American Society for Testing Materials as "a dark brown to black cementitious material, solid or semisolid in consistency, in which the predominating constituents are bitumens which occur in nature as such or are obtained as residua in refining petroleum." In addition, asphalts characteristically contain a bitumen fraction insoluble in paraffin naphtha. This fraction is called the asphaltenes. The solid or semisolid residues from refining operations are usually called "cracked asphalt," "petroleum pitch," "thermal pitch" or "cracking-coil pitch."

There are four principal types of petroleum asphalts derived from four different types of processes. They are: straight run asphalts, obtained by atmospheric, steam, or vacuum distillation of lower boiling components of the oil and left as asphaltic bottoms; asphalts produced as the bottoms product from a combined distillation process; asphalts separated by solvent extraction, i.e., the propane deasphalting process; and, chemically treated asphalts, such as air blown, oxidized, sulfurized, and chlorinated asphalts.

The term "bitumens" is a more generic term than asphalt and, according to the American Society for Testing Materials, relates to "mixtures of hydrocarbons of natural or pyrogenous origin; or combinations of both, frequently accompanied by their non-metallic derivatives, which may be gaseous, liquid, semisolid, or solid, and which are completely soluble in carbon disulfide." In usual commercial practice the term "bitumens" is restricted to the semisolid or solid bitumens which include asphalts, tars and pitches. These latter two materials are derived from stocks obtained by the action of destructive heat on crude oil fractions, coals or other organic raw materials. In this specification, the term "bitumens" or the like will be restricted to this latter definition.

Bituminous materials, particularly asphalts, alone will not burn or will give poor combustion when ignited at ambient temperatures. It has surprisingly been found that liquid fuels can be made by mixing bituminous materials with about 0.5 weight percent based on the weight of the

total composition of an additive selected from the group consisting of ethylbenzene, cyclohexane, octene-1, octene-2 and styrene. The preferred embodiment of the present invention relates to fuel compositions comprising bituminous material and styrene since surprisingly this combination results in liquid fuels when as little as 0.1 percent by weight of the total composition of styrene is incorporated into some asphalts.

The fuel compositions of this invention are prepared by simply admixing the additive with the bituminous material. The resulting compositions when cooled, are surprisingly liquid and are readily ignitable. When ignited, the compositions burn slowly, giving off significant amounts of heat for a sufficient period of time to make them quite suitable as fuels for the prevention of frost in orchards. Furthermore, because the fuels are liquids they can be easily transported and stored.

It is generally known that asphalts contain approximately 2 to 20 percent of asphaltenes by weight. Asphaltenes are of such a character that they tend to agglomerate into larger particles, particularly at decreasing temperatures. According to this invention it has been discovered that the agglomeration of asphaltenes, or in any case the flow properties of the asphalt, may be controlled by the addition of small amounts of ethylbenzene, cyclohexane, benzene, octene-1, octene-2 or styrene.

Bituminous materials containing polystyrene or rigid polyurethane and used as smudge pot fuels are disclosed and claimed in U.S. Pat. 3,362,800, Belak et al. issued Jan. 9, 1968. However, these fuels are non-flowable at ambient or lower temperatures or flow only very slowly (creep) in contrast to the liquid fuels encompassed by the present invention. Also U.S. Pat. 2,580,035 teaches asphaltic compositions of improved flow properties containing alpha-nitro-naphthalene, but these compositions are used as paving materials and are quite unlike the bituminous fuels of the present invention.

The compositions of this invention may be prepared by simply blending the asphalt and the additive together. However, this method requires long periods of mixing. The more usual method involves heating the asphalt to a temperature at which it is fairly fluid, usually in the range of 85° to 175° F., adding the additive and agitating the contents with air until a material of substantially uniform viscosity is obtained. Actually the additive may be introduced into the asphalt at any convenient time before the fuel is to be used, employing any suitable mixing means which will insure even distribution.

In order to gain the advantages of this invention, i.e., providing a combustible fluid fuel from a low cost semisolid bituminous material with poor combustion characteristics, at least 0.1 percent by weight based on the weight of the asphalt of styrene must be used. In the case of the other additives, at least 0.5 weight percent of the total composition of the additive must be added. Up to compositions containing more than 50 weight percent there is no upper limit to the amount of styrene or other additive, but amounts over 5 percent by weight usually cannot be justified economically. A preferred range for the additives, including styrene is from 1 to 3 percent by weight of the total fuel composition.

The compositions can be stored indefinitely in suitable containers and transported and applied as liquid fuels. For example, the compositions may be stored in tanks at some central location on farms with delicate crops. When the temperature decreases and frost threatens damage to the crops, the fuel of this invention could be simply pumped to suitable burners throughout the orchards or fields and ignited.

The liquid fuel compositions may contain ignition aids such as naphthalene as disclosed in Pat. No. 3,362,800. Also the fuels may be placed in containers and capped

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with suitable tops such as a wax layer, a wax-rosin or asphalt-rosin mixture, a polyethylene disc or an asphalt-polystyrene or asphalt-polyurethane top which has been formed by forming polystyrene beads or polyurethane in place with the asphalt. These latter two tops can serve both as caps and as ignitors for the fuel.

Particularly useful compositions for use as liquid smudge pot fuels comprise asphalt, the additive and up to 10 weight percent solvent spirits. This weight percent solvent spirits is based on the total weight of the resulting composition. These fuels can be ignited and burned at 35° F. Solvent spirits are not necessary to prepare the novel fuel compositions of this invention, but the spirits are helpful for lowering the flash point of asphalts of high asphaltene content. The following table gives characteristics of some typical petroleum solvent spirits which may be used.

TABLE I

	1	2	3
Specific gravity at 60° F.	0.864	0.760	0.704
Distillation:			
Initial boiling point (° C.)	185	110	45
10% distilling to (° C.)	193	117	62
50% distilling to (° C.)	196	123	80
90% distilling to (° C.)	201	137	95
Final boiling point (° C.)	210	160	115
Flash-point (closed) (° F.)	154	Below 73	Below 73
Aromatics (percent by weight)	60	12	7
Kauri butanol number	56	37	32
Dilution ratio (butyl acetate)	1:65	1:25	1:22

The following table gives the characteristics of some typical bituminous materials which may be used in the compositions of the invention.

TABLE II

	Bituminous material		
	A	B	C
Conradson carbon, percent.	15	8.5	11.0
Flash point (COC*), °F.	690	540	230
Fire point (COC*), °F.	700	620	-----
Melt point, °F.	128	-----	-----
Viscosity at 210° F. (SFS*)	2,000	125	-----
Viscosity at 122° F. (SFS*)	-----	-----	122
Density (lbs./gal.)	7.5	7.5	-----
Sulfur percent.	1.2	0.75	2.5

* COC—Cleveland Open Cup D92. SFS—Saybolt Furoi Seconds.

The following examples illustrate the invention.

EXAMPLE I

A bituminous material with properties as given in column A of Table II and containing 5 percent by weight solvent spirits was heated until slightly molten. Styrene was added to the heated bituminous material to give a composition containing 2 percent by weight styrene. On cooling, the composition remained liquid. The composition was ignited at 35° F. and burned with a warm flame.

EXAMPLES II to V

Compositions 2 to 5 of Table III were prepared according to the procedure of Example I. All of the resulting fuels were liquids.

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TABLE III

Compositions	Bituminous material	Weight percent spirits	Additive	Weight percent additive
2	A	5	Ethylbenzene...	2
3	A	5	Cyclohexane...	2
4	A	5	Octene-1.....	2
5	A	5	Octene-2.....	2

Samples of the above compositions were ignited at room temperature and at 35° F. In all cases the compositions proved to be suitable as smudge pot fuels. Some of the fuels were better than others. For example, composition containing octene-1 or -2 exhibited excellent properties making them particularly suitable as fuels.

The above examples show that smudge pot fuels can be made from asphalt and any of the indicated additives. Other additives related in chemical properties to those used in the above examples were tested as components in smudge pot fuels but gave unsatisfactory results. For example, benzene added to bituminous material A resulted in a poor fuel.

What is claimed is:

1. A liquid smudge fuel composition comprising a major portion of bituminous material and a minor portion of an additive selected from the group consisting of cyclohexane, octene-1, octene-2 and between 1 to 3 percent by weight of the total composition of ethylbenzene.
2. A fuel composition of claim 1 in which the additive is present in quantities between 0.5 to 5 percent by weight of the total composition.
3. The fuel composition of claim 2 containing up to 10 weight percent based on the weight of the total composition of a petroleum solvent spirit.
4. The fuel composition of claim 3 in which the fuel contains a naphthalene ignitor.
5. The fuel composition according to claim 1 in which the additive is ethylbenzene.
6. The fuel composition according to claim 1 in which the additive is cyclohexane.
7. The fuel composition according to claim 1 in which the additive is selected from the group consisting of octene-1 and octene-2.

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