

Patented May 1, 1934

1,957,134

UNITED STATES PATENT OFFICE

1,957,134

STABILIZED MOTOR FUEL

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No Drawing. Application August 24, 1932,
Serial No. 630,246

15 Claims. (Cl. 44-9)

This invention relates to improvements in compositions for use as motor fuels and more particularly to motor fuels containing substances for inhibiting the formation of insoluble and gummy products therein during storage and use.

Gasolines and the like, as generally produced, comprise extremely complicated mixtures. When produced by the modern cracking methods they comprise normal and branched chain hydrocarbons, substantial percentages of aromatic hydrocarbons and unsaturated hydrocarbons such as olefines and diolefines. These gasolines tend to form insoluble gummy and resinous products on standing and in use. Accordingly, it has, in many cases, been considered necessary to treat these gasolines with sulfuric acid or fuller's earth in the vapor phase process to remove many of the gum forming constituents. However, such constituents are of high fuel value and are valuable constituents to have in the gasoline provided that they can be prevented from forming insoluble gummy and resinous products. Some of these constituents, particularly the unsaturated compounds, have been added to gasolines which did not contain them for the purpose of improving the gasoline. Other motor fuels, such as motor benzol, normally contain such gum forming constituents. The value of these gum forming constituents has been widely recognized as well as the disadvantageous features of the products formed thereby. Accordingly, it has been proposed to add to motor fuel, containing such constituents, various substances which tend to inhibit the formation of the gummy products.

Among the substances, which have been added to motor fuels for this purpose, are para-aminophenol, N-substituted aminophenols and the like. However, these substances have not proved to be entirely satisfactory and particularly para-aminophenol has been found to be impractical because of its low solubility in the motor fuels and its tendency to discolor the fuel.

An object of the present invention is to provide a new class of substances which, when added to motor fuels normally tending to form gum, inhibit the formation of such gum. A further object is to provide substances of the above type which do not discolor the motor fuel to an objectionable extent. A further object is to make it possible to employ motor fuels containing larger amounts of gum forming constituents than commercially used at present. A still further object is to provide motor fuels at lower cost by making it possible to employ, as a motor fuel, gasolines and the like which have been less highly refined. Other objects are to provide a new composition of matter and to advance the art. Still other objects will appear hereinafter.

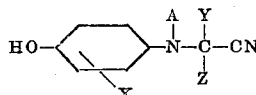
These objects are accomplished according to

the following invention which comprises adding to a motor fuel, which normally tends to form gum, a para-hydroxy-anilido-acetonitrile or its alkyl or aralkyl substituted derivatives. We have found that para-hydroxy-phenylglycine is a very effective gum inhibitor when employed in motor fuels and in addition does not cause any objectionable discoloration thereof. However, its solubility is so low in the motor fuels as to render its commercial use very difficult. We have further found that the nitrile of para-hydroxy-phenylglycine is considerably more soluble in motor fuels and is also an excellent gum inhibitor. These properties are also possessed in a very high degree by the alkyl and aralkyl substituted derivatives of the nitrile.

The term "alkyl" as used in the specification and claims is to be understood to include unsaturated and cyclic aliphatic radicals as well as the saturated compounds.

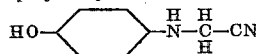
The term "aralkyl" as used in the specification and claims is to be understood to mean alkyl radicals having aromatic radicals substituted therein.

The compounds forming the subject matter of our invention may be represented by the formula:

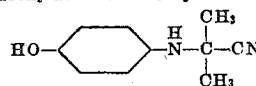


wherein A, X, Y, and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups. Among the compounds which we have found to be particularly satisfactory for our purpose are the following:

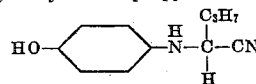
p-hydroxy-anilido-acetonitrile



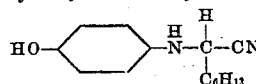
p-hydroxy-anilido-dimethyl-acetonitrile



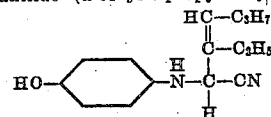
p-hydroxy-anilido-propyl-acetonitrile



p-hydroxy-anilido-hexyl-acetonitrile



p-hydroxy-anilido (a-ethyl-b-propyl-vinyl) acetonitrile



The compounds of our invention were tested for their value as gum inhibitors according to the "Oxygen Bomb Test" proposed by Voorhees and Essinger, in the Proc. Am. Pet. Inst., 10, (II), 169 (1929). In accordance with this test, 25 cc. of the motor fuel containing the inhibitor was heated in a rubber-stoppered glass flask under an oxygen atmosphere at 100° C. The gum content of the motor fuel was then determined at the completion of the test by evaporation at 100° C. in a tared dish in an inert atmosphere. The effectiveness of the inhibitor is measured by the difference between the gum content of the motor fuel containing the inhibitor and the gum content of a control sample of the same fuel containing no inhibitor after subjecting the samples to exactly the same treatment. The length of the heating period is determined by the nature of the motor fuel, which determines its tendency to oxidation.

As is well known to those skilled in the art, p-aminophenol gives excellent results when tested by the above procedure. However, it has not been possible to use it commercially, for the amount which will dissolve in most motor fuels, at ordinary atmospheric temperatures, is insufficient to prevent the formation of gum during ageing. For example, when p-aminophenol is incorporated into a gum-free unsaturated gasoline to the extent of 0.005% of the gasoline, a mixture of solution and crystals results. Moreover, when p-aminophenol is used as the gum inhibiting agent, considerable discoloration of the motor fuel occurs with the formation of a flocculent precipitate, during ageing. Our compounds, on the other hand, are more readily soluble in the motor fuels and moreover, do not cause any appreciable discoloration thereof.

In order to more clearly illustrate our invention and particularly the effectiveness of our compounds, the results of tests of some of these compounds are given in the following examples:

Example 1.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyphenylglycine was heated in an oxygen bomb for 3½ hours, at the end of which time, it showed 4 mg. gum per 25 cc. A control sample of the same gasoline containing no inhibitor showed 174 mg. gum per 25 cc.

Example 2.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyanilido-acetonitrile gave, by the above test, 15 mg. gum per 25 cc. while the control sample gave 255 mg. gum per 25 cc.

Example 3.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyanilido-dimethyl-acetonitrile gave 11 mg. gum per 25 cc. after 3½ hours in the above test. The same gasoline containing no inhibitor gave 153 mg. gum per 25 cc.

Example 4.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyanilido-propyl-acetonitrile gave 10 mg. gum per 25 cc. by the 3½ hour oxygen bomb test. A control sample of the uninhibited gasoline gave 214 mg. gum per 25 cc. under the same conditions of test.

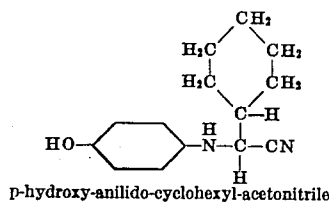
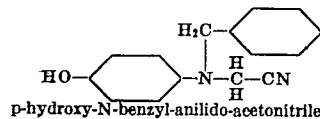
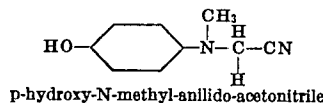
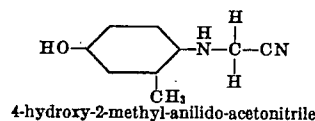
Example 5.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyanilido-hexyl-acetonitrile gave 9 mg. gum per 25 cc. after 3½ hours in the bomb test. A control sample of the same gasoline gave 222 mg. gum per 25 cc.

Example 6.—A gum-free unsaturated gasoline containing 0.005% by weight of para-hydroxyanilido (a-ethyl-b-propyl-vinyl) acetonitrile gave

9 mg. gum per 25 cc. by the standard test. The control sample gave 214 mg. gum per 25 cc.

The amounts of the gum inhibitors which it is necessary to employ, will vary with the degree of the unsaturation of the motor fuel. In general, however, the concentration of the inhibitor in the motor fuel will be substantially less than 1% by weight.

Other important compounds of this class are:



Other compounds which deserve special mention are those in which the hydrogen of the NH group is substituted by ethyl, propyl, b-phenylethyl, b-phenyl propyl, and xylol groups.

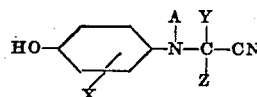
The compounds forming the subject matter of our invention may be readily prepared by the interaction of the appropriate aminophenol, potassium cyanide and the appropriate aldehyde as will be readily understood by those skilled in the art.

As will be seen from the above examples, the compounds of our invention are effective gum inhibitors for motor fuels, are sufficiently soluble in the motor fuels to be commercially successful, and do not cause noticeable discoloration of the motor fuel on ageing.

While we have disclosed specific compounds employed in specific amounts, it is to be understood that various changes in the compounds and proportions employed may be made without departing from the spirit of our invention. Accordingly, the scope of our invention is to be limited solely by the appended claims construed as broadly as is permissible in view of the prior art.

We claim:

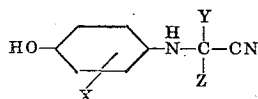
1. The method of inhibiting the formation of gum in cracked gasolines which normally tend to form gum in use which comprises adding thereto a small amount of a compound of the type:



wherein A, X, Y, and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

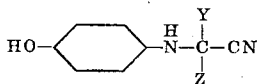
2. The method of inhibiting the formation of gum in cracked gasolines which normally tend to form gum in use which comprises adding

thereto a small amount of a compound of the type:



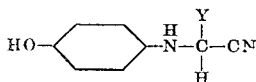
wherein X, Y, and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

3. The method of inhibiting the formation of gum in cracked gasolines which normally tend to form gum in use which comprises adding thereto a small amount of a compound of the type:



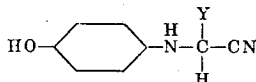
wherein Y and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

4. The method of inhibiting the formation of gum in cracked gasolines which normally tend to form gum in use which comprises adding thereto a small amount of a compound of the type:



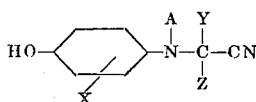
wherein Y represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

5. The method of inhibiting the formation of gum in cracked gasolines which normally tend to form gum in use which comprises adding thereto a small amount of a compound of the type:



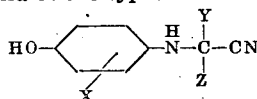
wherein Y represents a member of the group consisting of alkyl and aralkyl groups.

6. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added as a gum inhibitor a small amount of a compound of the type:



wherein A, X, Y, and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

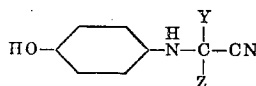
7. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added as a gum inhibitor a small amount of a compound of the type:



wherein X, Y, and Z each represents a member

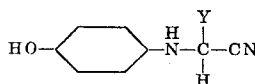
of the group consisting of hydrogen and alkyl and aralkyl groups.

8. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added as a gum inhibitor a small amount of a compound of the type:



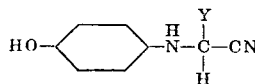
wherein Y and Z each represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

9. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added as a gum inhibitor a small amount of a compound of the type:



wherein Y represents a member of the group consisting of hydrogen and alkyl and aralkyl groups.

10. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added as a gum inhibitor a small amount of a compound of the type:



wherein Y represents a member of the group consisting of alkyl and aralkyl groups.

11. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added p-hydroxy-anilido-acetonitrile in an amount sufficient to inhibit the formation of gum.

12. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added p-hydroxy-anilido-dimethyl acetonitrile in an amount sufficient to inhibit the formation of gum.

13. Motor fuel, comprising cracked hydrocarbon spirits normally tending to form gum, to which has been added p-hydroxy-anilido-hexyl acetonitrile in an amount sufficient to inhibit the formation of gum.

14. Cracked gasoline normally tending to form gum, to which has been added p-hydroxy-anilido-acetonitrile in an amount sufficient to inhibit the formation of gum.

15. Cracked gasoline normally tending to form gum, to which has been added p-hydroxy-anilido-dimethyl acetonitrile in an amount sufficient to inhibit the formation of gum.

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