

1

2,723,233

METHOD AND COMPOSITION FOR
INHIBITING CORROSION

Melba L. Lytle, Houston, Tex., assignor, by mesne assignments, to Esso Research and Engineering Company, Elizabeth, N. J., a corporation of Delaware

No Drawing. Application December 10, 1952,
Serial No. 325,223

5 Claims. (Cl. 252—8.55)

The present invention is directed to a composition and a method for preventing corrosion. More particularly, the invention is directed to the inhibition of the corrosiveness of moisture-containing fluids to ferrous metals. In its more specific aspects, the invention has to do with the inhibition of corrosive well fluids such as from oil and gas wells and the like in contact with ferrous metal such as wellhead equipment and ferrous tubing strings and the like.

The present invention may be briefly described as a reaction product suitable for use as a corrosion inhibitor. This reaction product is formed by heating together an alkanol amine selected from the group consisting of mono- and triethanol amine and the amber-colored viscous residue containing long-chained polycarboxylic acids, having an acid number between 140 and 165, having an iodine number between thirty and sixty, and being the non-volatile material remaining from vacuum-distilling at 270° C. under four mm. pressure the by-product acids obtained in the preparation of sebacic acid from castor oil by treatment with alkali.

The reaction product is formed by heating the two reactants described above together at a temperature in the range between about 140° to about 225° C. With both these ethanol amines the preferred temperature of heating is within the range from about 150° up to about 200° C.

The alkanol amine and the other reactant may be present in the weight ratio from about 1:3 to about 1:10. With the monoethanol amine a weight ratio of about 1:6 will give satisfactory results whereas with the triethanol amine a weight ratio of about 1:3 results in the formation of a corrosion inhibitor.

The reactants may be heated together for a time from about one-half to about two hours, depending on the temperature of the reaction, the higher the temperature within the limits shown above, the shorter the time required for reaction.

In employing the corrosion inhibitor, it may suitably be introduced into the borehole adjacent the subsurface formation from which the corrosive fluid containing an acid component such as carbon dioxide and hydrogen sulfide is produced. Alternatively, the corrosion inhibitor may be introduced directly into ferrous metal containers which are suffering from corrosion from contact with the corrosive fluid. Thus the corrosion inhibitor may be introduced into a well in the annular space between the casing and the tubing. The corrosion inhibitor may also be introduced into the corrosive fluid by introducing it into the formation from which the corrosive fluid is flowed. Thus the corrosion inhibitor may be introduced into the subsurface reservoir through an adjacent well. Regardless of the way the corrosion inhibitor is introduced into the corrosive fluid it should be present in the corrosive fluid so that the deleterious effects due to corrosion by contact of the corrosive fluid with the ferrous metal may be substantially reduced or entirely eliminated.

2

The corrosion inhibitor is suitably formed by reacting an alkanol amine, such as mono- or triethanol amine, with a product which is obtained in the preparation of sebacic acid from castor oil by treatment with alkali. Description of such a product will be found in the patent to McKeever, 2,471,230; also a description of the material forming one of the reactants of the present invention may be found in the patent to Cheetham et al., 2,267,269, special attention being directed to page 1, column 2, lines 42 to 54.

The invention will be further illustrated by the following examples:

Example I

101 parts of the material such as described by McKeever and Cheetham et al. in the aforementioned United States patents was reacted with 15 parts of monoethanol amine by heating same together at a temperature from 140° up to 192° C. for 1 hour. The product was a dark brown viscous fluid and was obtained in a yield of 94%.

This product was tested as a corrosion inhibitor in concentrations of 0.005% and 0.002% by weight in a 50-50 mixture of West Texas crude oil and West Texas brine which had been saturated with hydrogen sulfide. Mild carbon steel coupons were immersed in the mixture containing the two amounts of the corrosion inhibitor 31 times a minute over a period of 14 days. For comparison, coupons were similarly tested in a corrosive mixture containing no inhibitor. The per cent reduction in corrosion rate was obtained by comparing the corrosion rate of the blank coupons with that of the coupons immersed in the mixture containing the inhibitor. In the blank it was found that the corrosion rate of the coupons in inches per year was 0.0187, whereas in the instance where 0.005 weight per cent of inhibitor was employed the corrosion rate in inches per year was 0.0002 which is a 99% reduction in the corrosion rate. When 0.002% of the corrosion inhibitor was used under the foregoing conditions the corrosion rate of the coupons was 0.0036 inches per year, a reduction over the blank of 82%.

Example II

32 parts of triethanol amine was reacted with 104 parts of the material described by McKeever and Cheetham et al. in the patents supra by heating together at a temperature in the range from 140° C. to 185° C. over a period of 1½ hours; a reaction product similar to that described with the mono-ethanol amine was also obtained in a yield of 95%. This product was also tested as a corrosion inhibitor in a concentration of 0.01% in a 50-50 mixture of West Texas crude and West Texas brine which had been saturated with hydrogen sulfide. Mild steel coupons were immersed 31 times a minute over a period of 14 days in the corrosive fluid which had been inhibited as described. The corrosion rate was also obtained for blanks. It was found that the corrosion rate in inches per year for the inhibited corrosive fluid was 0.0001 as compared with 0.0213 for the uninhibited fluid or a reduction of 99% in corrosion rate for the inhibited fluid.

The reaction product described in the McKeever and Cheetham et al. patents supra does not form a corrosion inhibitor when it is heated with di-ethanol amine. Neither were corrosion inhibitors obtained when several other polycarboxylic acids were heated with mono-ethanol amine. Thus a corrosion inhibitor is obtained only from the ethanol amines when the aforesaid reaction product of McKeever and Cheetham et al. is heated at the temperatures given with mono- and tri-ethanol amine.

The nature and objects of the present invention having

been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. A reaction product suitable for use as a corrosion inhibitor obtained by heating together for a time in the range from about one-half to two hours at a temperature from about 140° to 200° C. reactive amounts of an alkanol amine selected from the group consisting of mono- and triethanol amines and the amber-colored viscous residue containing long-chained polycarboxylic acids, having an acid number between 140 and 165, having an iodine number between thirty and sixty, and being the non-volatile material remaining from vacuum-distilling at 270° C. under four mm. pressure the by-product acids obtained in the preparation of sebacic acid from castor oil by treatment with alkali.

2. A reaction product suitable for use as a corrosion inhibitor obtained by heating together for a time in the range from about one-half to two hours at a temperature from about 140° to 200° C. in an approximate weight ratio in the range from about 1:3 to about 1:10 an alkanol amine selected from the group consisting of mono- and triethanol amine and the amber-colored viscous residue containing long-chained polycarboxylic acids, having an acid number between 140 and 165, having an iodine number between thirty and sixty, and being the non-volatile material remaining from vacuum-distilling at 270° C. under four mm. pressure the by-product acids obtained in the preparation of sebacic acid from castor oil by treatment with alkali.

3. A method for reducing the corrosivity to corrodible ferrous metals of a corrosive fluid including moisture and an acidic component from the group consisting of carbon dioxide and hydrogen sulfide in contact with said ferrous metal which comprises introducing into said fluid a corrosion inhibiting amount of the reaction product obtained by heating together for a time in the range from about one-half to two hours at a temperature from about 140° to 200° C. reactive amounts of an alkanol amine selected from the group consisting of

mono- and triethanol amine and the amber-colored viscous residue containing long-chained polycarboxylic acids, having an acid number between 140 and 165, having an iodine number between thirty and sixty, and being the non-volatile material remaining from vacuum-distilling at 270° C. under four mm. pressure the by-product acids obtained in the preparation of sebacic acid from castor oil by treatment with alkali.

4. A method in accordance with claim 3 in which the reaction product is added in an amount in the range from 0.001% to 0.05% by weight to the corrosive fluid.

5. A method for reducing the corrosiveness to corrodible ferrous metals of a corrosive fluid including moisture and an acidic component selected from the group consisting of carbon dioxide and hydrogen sulfide which comprises introducing into said fluid in contact with said ferrous metal a corrosion inhibiting amount of the reaction product obtained by heating together for a time in the range from about one-half to two hours at a temperature in the range from about 140° to 200° C. in an approximate weight ratio in the range from about 1:3 to about 1:10 an alkanol amine selected from the group consisting of mono- and triethanol amine and the amber-colored viscous residue containing long-chained polycarboxylic acids, having an acid number between 140 and 165, having an iodine number between thirty and sixty, and being the non-volatile material remaining from vacuum-distilling at 270° C. under four mm. pressure the by-product acids obtained in the preparation of sebacic acid from castor oil by treatment with alkali.

References Cited in the file of this patent

UNITED STATES PATENTS

1,992,689	Cox	Feb. 26, 1935
2,267,269	Cheetham et al.	Dec. 23, 1941
2,471,230	McKeever	May 24, 1949
2,604,451	Rocchini	July 22, 1952
2,614,981	Lytle	Oct. 21, 1952
2,646,399	Hughes	July 21, 1953