

UNITED STATES PATENT OFFICE

2,675,355

METHOD FOR INHIBITING CORROSION

Melba L. Lytle, Houston, Tex., assignor, by mesne assignments, to Standard Oil Development Company, Elizabeth, N. J., a corporation of Delaware

No Drawing. Application July 7, 1951,
Serial No. 235,671

6 Claims. (Cl. 252—8.55)

1

The present invention is directed to a method for inhibiting the corrosiveness to corrodible metal surfaces of corrosive fluids produced from subsurface formations. More particularly, the invention relates to a method for inhibiting the corrosivity of petroliferous well fluids containing carbon dioxide or hydrogen sulfide brines to corrodible metal conduits and attendant equipment through which the fluids are flowed and processed.

In many oil fields and gas-condensate fields the production of fluids from subsurface formations is accompanied by extremely severe corrosion of the conduits and attendant equipment which is contacted by the fluid mixture being produced. In some instances it is found that the fluid mixture contains substantial amounts of carbon dioxide, a portion of which dissolves in the water present in the fluid mixture to form carbonic acid. In other cases it is found that the fluid includes sulfide brine which may contain alkali metal sulfides, alkaline earth metal sulfides, acid sulfides such as hydrogen sulfides, and/or organic sulfides. Those brines containing hydrogen sulfide are especially corrosive to iron and steel equipment, the hydrogen sulfide attacking the metal to form iron sulfide. Since these corrosive metals occur in or are introduced into the fluids originating in the subsurface formations, corrosion may occur throughout the conduits and attendant equipment through which the fluids are flowed and produced. In other instances the corrosion may be more or less localized to a limited portion or portions of the conduits through which the fluids are produced. Corrosion, whether intensive or extensive, if permitted to continue unabated, will damage conduits and attendant equipment through which the corrosive fluid is flowed and may damage this equipment to such an extent as to require replacement. Such replacements can be, and often are, extremely expensive. The expense involved is not limited merely to the cost of replacing the corroded equipment but may also involve killing the well in order to make necessary repairs and to replace the corroded equipment. Even more important than the high cost incurred as a result of corrosion is the danger that a well will flow wild as a result of the failure of the conduit or attendant equipment due to corrosion. Enormous losses may be incurred in such an eventuality.

The main object of the present invention is to provide a method of substantially eliminating or inhibiting corrosion of corrodible ferrous metal surfaces by corrosive well fluids.

2

In accordance with the present invention the corrosion to corrodible ferrous metal surfaces by corrosive petroliferous well fluids including brine and carbon dioxide or sulfides is eliminated or substantially reduced by incorporating in the corrosive well fluids a corrosion inhibiting amount of the reaction product of "Ebony Fat" and "triethanolamine bottoms." This reaction product is prepared by reacting the aforementioned reactants at a temperature in the range of 320° F. to 400° F.

The term "Ebony Fat" as used in this specification and in the appended claims shall mean a fraction secured from cotton seed oil by subjecting cotton seed oil to fractionation with a light hydrocarbon solvent, such as propane, the "Ebony Fat" comprising not more than 5% of the cotton seed oil and consisting principally of color bodies, gums, resins, and phosphatides. The "Ebony Fat" used in preparing the reaction product employed in the present method may be made in the manner taught in U. S. Patent 2,521,234, issued to W. M. Leaders. The term "Ebony Fat" has been disclosed and defined in the patent literature, for example, in U. S. Patent 2,596,065 issued to Robert I. Brabets.

"Triethanolamine bottoms" as used in this specification and in the appended claims shall mean the residue remaining after "triethanolamine" has been removed by distillation at a reduced pressure in the neighborhood of 150 millimeters Hg. from a reaction product resulting from the reaction of ethylene oxide and ammonia or from the reaction of ethylene chlorohydrin and ammonia. This residue appears to consist largely of polymers, principally dimers and trimers, of triethanolamine. A residue having an average molecular weight in the range of about 300 to about 350 gives satisfactory results.

In preparing the reaction product employed in the present invention, the "Ebony Fat" should be present in the initial reaction mixture in a weight ratio of about 1:1 to about 3:2 as compared to the "triethanolamine bottoms".

Effectiveness of the reaction product as a corrosion inhibitor depends upon the temperature at which the reaction is conducted. The reaction may be carried out at a temperature in the range of about 320° F. to about 400° F. At temperatures below about 320° F. no reaction takes place. As the temperature is raised above 320° F., foaming starts and it increases with increasing temperature. Foaming may be suppressed by adding an antifoaming agent such as octyl alcohol to the reaction mixture. However, the temperature is preferably maintained in the range

of from about 350° F. to about 375° F. to avoid the use of excessive amounts of antifoaming agents.

The extent of the reaction, in addition to depending upon reaction temperature, also depends upon the time during which the reaction is permitted to continue. Ordinarily, an effective reaction product may be prepared when the reactants are heated for a period of time in the range of from one-half to 5 hours although the preferred period is in the range of about 1 to 3 hours.

On completion of the reaction, the reaction product is allowed to cool and may be incorporated as such into the corrosive fluid to be treated for corrosion inhibition or it may be dissolved first in a suitable solvent, such, for example, as an aromatic solvent or kerosene, and the solution incorporated in the corrosive fluid.

The amount of the reaction product employed to inhibit the corrosion of ferrous metal surfaces by corrosive petroliferous fluids containing carbon dioxide or sulfides may be varied over a relatively wide range. However, it has been found that amounts within the range of 0.005% by volume to about 0.1% by volume of the fluid mixture gives satisfactory results. Ordinarily, an amount within the range of 0.005% by volume to 0.01% by volume will be sufficient.

The following example will illustrate the effectiveness of the reaction product hereinbefore described in inhibiting the corrosivity of corrosive petroliferous well fluid:

EXAMPLE I

Sixty parts by weight of "Ebony Fat" and 40 parts by weight of "triethanolamine bottoms" were heated together at a temperature in the range of 345° F. to 370° F. for a period of 2 hours. In order to test the effectiveness of the reaction product thus formed, 0.01 volume per cent and 0.005 volume per cent were added to two different samples of a 50:50 mixture of West Texas crude oil and West Texas brine, the mixture being saturated with hydrogen sulfide. Mild carbon steel coupons were immersed 31 times per minute for a period of 14 days in each of these samples. The extent of the corrosion inhibition obtained was compared with results obtained when similar coupons were exposed under identical conditions to a hydrogen sulfide saturated 50:50 mixture of West Texas crude oil and West Texas brine with no corrosion inhibitor present. The comparative results obtained are shown in the table below.

Table

Inhibitor	Concentration of Inhibitor, Vol. Percent	Corrosion Rate of Coupons: Inch/yr.	Percent Reduction Over Blank
None		0.0252	
Reaction Product of "Ebony Fat" and "Triethanolamine Bottoms"	0.01	0.0001	99
Do.	0.005	0.0031	88

The data in the table above show that the reaction product of "Ebony Fat" and "triethanolamine bottoms" is highly effective in inhibiting corrosion of ferrous metal surfaces, it being ef-

fective even in a concentration as low as 0.005% by volume.

The method disclosed in the present application is an improvement on the method disclosed in application Serial No. 153,767 (now Patent No. 2,614,980) and application Serial No. 153,768, (now Patent No. 2,614,981) both filed on April 3, 1950.

The nature and objects of the present invention having been fully described and illustrated, what is claimed as new and useful and desired to be secured by Letters Patent is:

1. A method for reducing the corrosiveness to corrosive ferrous metal of a corrosive petroliferous well fluid which comprises introducing into said fluid a corrosion-inhibiting amount of the reaction product of Ebony Fat derived from cottonseed oil and triethanolamine bottoms, the reaction product being formed at a temperature in the range of 320° F. to 400° F., the weight ratio of Ebony Fat to triethanolamine bottoms being in the range from about 1:1 to about 3:2.

2. A method for reducing the corrosiveness to corrosible ferrous metal of a corrosive petroliferous well fluid including moisture and a material selected from the group consisting of carbon dioxide and sulfides which comprises introducing into said fluid a corrosion inhibiting amount of the reaction product of Ebony Fat derived from cottonseed oil and triethanolamine bottoms, the reaction product being formed at a temperature in the range of 320° to 400° F., the weight ratio of Ebony Fat to triethanolamine bottoms being in the range of 1:1 to about 3:2.

3. A method for reducing the corrosiveness to corrosible ferrous metal of a corrosive petroliferous well fluid including moisture and a material selected from the group consisting of carbon dioxide and hydrogen sulfide which comprises introducing into said fluid a corrosion inhibiting amount of the reaction product of Ebony Fat derived from cottonseed oil and triethanolamine bottoms, the reaction product being formed by heating said reactants for a period of from 1 to 3 hours at a temperature in the range of 350° to 375° F., the weight ratio of Ebony Fat to triethanolamine bottoms being in the range of 1:1 to about 3:2.

4. A method in accordance with claim 1 in which the reaction product is added to the corrosive well fluid in an amount in the range of 0.005% to 0.1% by volume of the fluid.

5. A method in accordance with claim 2 in which the reaction product is added to the corrosive well fluid in an amount in the range of 0.005% to 0.1% by volume of the fluid.

6. A method in accordance with claim 3 in which the reaction product is added to the corrosive well fluid in an amount in the range of 0.005% to 0.1% by volume of the fluid.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
Re. 23,227	Blair et al.	May 9, 1950
2,466,517	Blair et al.	Apr. 5, 1949
2,505,338	Palmer	Apr. 25, 1950
2,521,234	Leaders et al.	Sept. 5, 1950