

UNITED STATES PATENT OFFICE

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WELL DRILLING COMPOSITION

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The present invention relates generally to compositions having utility in well drilling. More specifically, the present invention relates to compositions particularly adaptable for use in the boring of wells through rocky and sandy strata and shales, for example, in the drilling of oil or gas wells.

It is customary, particularly in rotary drilling, to drill with the aid of a circulating drilling fluid or "mud" which carries away the chips of loosened material or cuttings which cools and lubricates the drill; and which, because of its hydrostatic pressure in the drill hole, serves as a means for controlling high pressure gas, oil, or water flows. In addition, the mud desirably forms a thin cake about the walls of the hole which minimizes the flow of liquid (drilling mud, oil, etc.) from the hole into the strata which is being drilled.

The object of this invention is to provide an improved well drilling composition which is operable, over a wide range of pH, to control certain of the physical properties of drilling muds. Other objects of the present invention will be apparent as the description proceeds hereinafter.

In carrying out our invention, redwood tree bark or its components (redwood bark fibrous materials and redwood bark dust) is treated with an alkali metal sulfite to produce a product or composition having particular utility as a well drilling mud additive. Bark from the California redwood, i. e. a soft wood or conifer known as *Sequoia sempervirens*, has for the most part been considered a waste material of little economic value. The bark contains a relatively high percentage of complex chemicals (as evidenced by the resistance of redwood tree to decay) and is made up of about equal proportions of redwood bark fibrous material and redwood bark dust containing unique, high molecular weight phenolic acids characterized by their relatively high content of acidic carboxyl groups and negligible content of methoxyl groups.

The process preferably employed comprises cooking the redwood bark, preferably in the form of chips or other comminuted form, in an aqueous alkali sulfite (e. g. sodium sulfite or bisulfite) cooking liquor until the complex bark acids are solubilized and separating the resulting insoluble fibrous material from the cooking liquor. The fibrous material which is removed from the cooking liquor is made up of the bark fibers, lignin, and a pectin-like material which has been modified by the sulfite cooking treatment, as well as other insoluble chemicals. The separated cook-

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ing liquor contains the soluble chemicals which have been modified by sulfite cooking treatment including alkali metal salts of sulfonated redwood bark organic acids. These alkali metal sulfite digested redwood bark solubles are particularly adapted for use in producing an improved drilling fluid or mud. While concentrates of the cooking liquor may be used in a well drilling mud additive under most conditions, it is preferred to isolate the solubles as a solid material by evaporating the cooking liquor and then drying.

The following example of a preferred method of operation will serve to illustrate the present invention.

Example

About 100 parts by weight of redwood bark chips is first placed in a digester. About 500 parts of cooking liquor made up of water containing about 15 parts of sodium sulfite in solution is then added to the bark. The resulting mixture is then cooked at a temperature of about 160° C. of about 1.5 hours. At the end of the cooking period the digester is discharged into a blow pit where the sodium sulfite digested redwood bark pulp is separated from the cooking liquor. The cooking liquor containing the sodium sulfite digested redwood bark solubles and made up for the most part of sodium salts of the sulfonated redwood bark acids, is evaporated to a solids content of about 20-25 per cent and then spray dried. Before use, the fibrous pulp is preferably washed with water and the washing recovered and used to make up the liquor for the next cooking operation.

It will be understood in the above example, where the ratio of liquors to solids is about 5:1, that other ratios may be employed. Sufficient water should, of course, be used to bring the cooking liquor containing the sulfite salt into contact with the bark. It will also be understood in the above example, where the ratio of bark to the sulfite salt is around 6.6:1, that other ratios may be employed. Investigations, however, show that this ratio should not be greater than 20:1, i. e. that at least about 5 per cent sulfite salt should be used based on the weight of the bark. In most cases the use of 10-20 per cent sodium sulfite based on the weight of the bark is preferred. Larger amounts of sulfite salt, however, may be used if desired, although the use of excessive material over and above about 25 per cent sulfite salt based on the weight of the bark does not result in an improvement in the properties of the reaction products.

The cooking temperatures and times may be varied with the lower cooking temperatures requiring longer cooking periods and the higher cooking temperatures requiring shorter cooking periods. Investigations in this connection show that for most commercial operations a temperature range of about 90–170° C. is satisfactory for carrying out the cooking operations. The use of temperatures below 90° C. requires relatively long cooking periods before the chemicals to be solubilized are solubilized (at which time the bark structure disintegrates upon working), while the use of temperatures above 170° C. tends to deleteriously affect desired properties of the reaction products.

In place of sodium sulfite in the above example, other alkali sulfite salts such as the potassium and ammonium sulfites or bisulfites may be used. When a bisulfite salt is used as the alkali metal sulfite salt in place of a salt such as sodium sulfite, more salt is required to sulfonate and solubilize the bark chemicals, i. e. achieve the same degree of cooking. The solubility of the alkali metal salts in water is an essential characteristic of the sulfite reaction product. The alkali metal sulfite salts may also be used in combination with alkali metal hydroxides, one of the preferred mixtures being made up of 5 per cent sodium hydroxide and 20 per cent sodium sulfite based on the weight of the bark.

The soluble material in the cooking liquor can be added to drilling mud in solid form after evaporation and spray drying, or as a concentrate containing about 50 per cent or less of water to produce compositions having a desired combination of physical properties. Preferably, the redwood bark reaction mixture is added in the incompletely dry state, i. e. without wholly removing the water component of the sulfite solution which is employed to react with the bark. The reason for this is that investigations indicate that the alkali metal sulfite-bark complex may be modified (e. g. has a tendency to undergo degradation) if water is completely eliminated during the drying. However, the advantages obtained by using a relatively dilute alkali metal sulfite-bark reaction mixture or concentrate thereof, may be out-weighted by the advantages of handling and shipping a dry product. Under most normal operations it is preferred to add a 5–10 per cent aqueous solution of the alkali metal sulfite-bark reaction product to the mud stream, although the concentrated reaction liquor, or dried reaction product itself, may be added to the mud stream if desired.

The soluble, alkali metal sulfite redwood-bark reaction product, in accordance with the invention, is combined with a drilling mud selected in accordance with existing conditions and desired result. For example, the mud component employed may be a clay, known in the art as Ventura gray clay, which is derived from clay found in the Ventura, California region. Another excellent clay for use with the products of the present invention is the Frazier Mountain clay. Still other muds or clays suitable for use with the alkali metal sulfite-bark reaction mixture are the Alvin, Texas shale mud, and drilling mud, as well as Texas surface deposit clays, such as Baroco and Ezmix; also the California Rosecrans and Brea-Olinda shale muds, etc. Other clay material (aluminum, oxide-silicon dioxide complex) such as the bentonite clays, may also be employed in the present invention.

The optimum amount of alkali metal sulfite-

redwood bark reaction product added to the mud also varies with existing conditions and desired result, although it is ordinarily employed in relatively small amounts based on the proportions of clay employed to make the complete drilling mud. Based on the dry material, the sulfite-bark product usually is added in amounts of from about ½ to 1 pound per barrel of drilling mud, but smaller or larger ratios may be used for specific clays or purposes. For example, the use of from 2–4 or more pounds of the sulfite-bark product per barrel of mud is common practice in Texas for making so-called "red muds." In the case of certain muds, less than ½ pound of the sulfite-bark reaction products per barrel of mud may suffice to obtain the desired result. A homogeneous mixture of the alkali metal sulfite-bark product in an aqueous suspension of clay may be prepared prior to its introduction into the drilling hole, but in any event a homogeneous mixture should result.

Investigations carried out in accordance with the Standard American Petroleum Institute (A. P. I.) procedures and drilling operations have demonstrated that the sulfite-alkali metal products or compositions of the present invention are characterized by physical and chemical properties making them particularly adaptable for use in the drilling mud field. The mud which contains the alkali metal sulfite-redwood bark reaction product has certain desired properties which produce unique and unexpected results. The mud containing the reaction product has a reduced viscosity which makes it readily pumpable. Larger proportions of the reaction products in the mud markedly decrease the viscosity. The gel-strength of the mud is reduced by the addition of minute amount of the reaction product so that the mud does not "set up" or gel if its circulation is interrupted. Moreover, this reduced gel-strength makes possible the ready separation of chips and cutting from the mud after it has been pumped from the drilling hole.

The improved mud is usable at various pH values ranging to as high as 11 or 12. This latter characteristic is unexpected, as quebracho is not adaptable for use in lime-base muds and redwood bark chemicals which have not been sulfonated, i. e. subjected to the sulfite cooking treatment, are not generally adaptable at pH values above 10.

The composition of the present invention may be used alone or in combination with other additives including protective colloids, such as starch, pectin, Irish moss, gums such as tragacanth, also sodium carboxymethylcellulose, etc. They may also be used with other additives as for example, quebracho extract and the alkali metal phosphates.

Instead of making the additive from a whole bark extract as described above, the fiber can be mechanically separated from the bark and the remaining bark dust which makes up 50 per cent of the bark, may be cooked in the alkali sulfite cooking liquor as described in the above example. The preferred cooking conditions (160° C. for about 1.5 hours) are the same except that about 20 per cent sodium sulfite based on the weight of the dust is employed due to the relatively high concentration of chemicals (phenolic acids) in the dust. The cooking liquor obtained is substantially the same as the liquor obtained on cooking the whole bark and may be used as indicated above in the drilling mud additive field. As in the example, after the bark dust chemicals are solubilized, the cooking liquor is separated

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from any insoluble material and then preferably evaporated to a solid content of about 20-25 per cent and spray dried.

It will be understood that the present invention is not limited to the above preferred compositions which are given for illustrative purposes only.

This application is a continuation in part of our co-pending application, Serial No. 114,459, filed September 7, 1949.

We claim:

1. An aqueous drilling mud made up of a major proportion of water insoluble clay material and characterized by the presence of a minor proportion of alkali metal sulfite-digested redwood bark solubles sufficient to reduce the viscosity, gel-strength and/or water losses of said aqueous drilling mud.

2. An aqueous drilling mud made up of a major proportion of water insoluble clay material and characterized by the presence of a minor proportion of sodium sulfite-digested redwood bark solubles sufficient to reduce the viscosity, gel-strength and/or water losses of said aqueous drilling mud.

3. A drilling mud comprising an aqueous sus-

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pension of clay and characterized by the presence of about 0.5 to 4.0 pounds of alkali metal sulfite-digested redwood bark reaction product solubles per barrel of mud, said proportion of said reaction product solubles being sufficient to reduce the viscosity, gel-strength and/or water losses of said drilling mud.

4. A drilling mud comprising an aqueous suspension of clay and characterized by the presence of about 0.5 to 4.0 pounds of sodium sulfite-digested redwood bark reaction product solubles per barrel of mud, said proportion of said reaction product solubles being sufficient to reduce the viscosity, gel-strength and/or water losses of said drilling muds.

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