This invention relates to powdered fuel briquettes and to methods of making the same and, in particular, to a novel binder for bonding powdered fuel into briquettes.

Powdered fuel briquettes as hitherto made have not been entirely satisfactory due to their tendency towards formation of fly ash and dusting and the inability of the briquette to hold together during burning. These objectionable features are attributable to the binders hitherto employed for bonding the powdered fuel into briquettes. We have noted that many of the known binders used in making briquettes are also objectionable because of their tendency to carbonize and hinder the burning of the briquettes and because of their inability to set or bind together the powdered fuel particles with sufficient rapidity to make their use practicable.

In accordance with our invention the above and other disadvantages in fuel briquettes and in the methods of making the same have been overcome by our use of a novel binder for the powdered fuel. The binder for the powered fuel used in accordance with our invention is a water-soluble tannin-containing extract known as quebracho extract which may be used alone, or in combination with a colloidal clay such as, for example, bentonite.

The quebracho extract is employed, preferably, in association with a carrier, such as water, in sufficient quantity to carry it through the mass of powdered fuel to be formed into the briquette. The commercial quebracho liquid extract may be used as such, if desired, or the dry extract may be employed, as hereinafter indicated. If a carrier is employed, the quebracho extract may be first dissolved therein to form a solution and the solution mixed with the powdered fuel, or the carrier and quebracho extract may be separately added to powdered fuel. The former practice is preferred. The quebracho extract or aqueous solution thereof normally has a pH varying in the order of from about 4 to about 5. While this extract or solution of pH 4 to 5 may be used in accordance with our invention, we prefer to use an extract or solution having a higher pH in the order of from about 6 to about 12. Thus, the hydrogen ion concentration of the extract or solution may be adjusted to the desired pH by means of any suitable alkali such as, for example, sodium hydroxide, sodium carbonate, ammonium or the like, care being exercised to avoid the use of such an excess of alkali as to flocculate the quebracho extractives and/or bentonite. We have found that the best results are obtained when the extract or solution has a pH in the order of about 12.

It appears that there is a relationship between the alkalinity of the extract or solution and its rate of setting when used as a binder for powdered fuel. As the alkalinity of the extract or solution is increased, its rate of oxidation likewise increases and its time of setting is accelerated. We have found that the presence of alkali in a quebracho extract or solution thereof increases its adhesiveness and makes possible the production of powdered fuel briquettes, at normal temperatures, of sufficient hardness and rigidness to be self-sustaining at the time of removal from the briquette machine. The binder sets in air in about 2 to about 4 hours, at normal temperatures, thereby dispensing with the need of costly drying ovens.

The quantity of quebracho extract (on a dry basis) sufficient to bind the particles of powdered fuel into a briquette may vary rather widely, as desired, although for most purposes from about 2% to about 10% by weight of quebracho extract in respect of the weight of the powdered fuel will accomplish the desired result. Larger amounts of the extract in respect of the powdered fuel may be used but this is not necessary. Usually, about 3% to 5% by weight of extract in respect of the powdered fuel is sufficient. The bentonite, when used, may also vary from about 2% to about 10% by weight and higher of the powdered fuel although, usually, good results are obtained when the bentonite varies from about 2.5% to about 6% by weight of the fuel. Briquettes formed by the aid of a binder comprising quebracho extract and bentonite in accordance with our invention are substantially free from any tendency towards formation of fly ash and dusting.

The following are illustrative examples of fuel mixes which may be compounded into briquettes in accordance with our invention. It is to be understood, however, that our invention is not to be construed as limited by the specific details of these examples.

**Example 1**

90 parts by weight of powdered charcoal are mixed in a suitable vessel with a binder consisting of 5 parts by weight of bentonite in 7 parts by weight of a 30% aqueous solution of quebracho extract having a pH of 12 to form a fuel mix.

**Example 2**

90 parts by weight of a mixture of 70 parts by weight of powdered charcoal and 20 parts by weight of powdered coal are mixed in a suitable
vessel with a binder consisting of 5 parts by weight of bentonite in 5 parts by weight of a 50% aqueous solution of a quebracho extract powder to form a fuel mix.

Example 3

90 parts by weight of powdered coal are mixed with 10 parts by weight of a 40% aqueous solution of quebracho extract, in a suitable vessel, to form a fuel mix.

In preparing fuel briquettes, the fuel mix prepared in accordance with our invention as above set forth, is introduced into a briquetting machine in any desirable manner and the briquettes are formed by pressing the fuel mix at a suitably high pressure, in the order of about 2,000 lbs. per square inch and preferably higher. The briquettes, as they are removed from the machine, are self-sustaining and strong enough to handle. They are then permitted to air-dry at normal room temperatures for several hours during which time the binder sets, forming very hard briquettes.

The briquettes produced in accordance with our invention burn very readily and hold together during burning thereof. Due to the binder employed by us, fly ash, soot and dusting are almost entirely eliminated. Moreover, the briquettes are extremely hard and the individual particles of fuel are so strongly held together that the briquettes, when dry, will withstand rather high pressures, in the order of about 175 to about 200 lbs. per square inch. Even the wet strength of the briquettes produced in accordance with our invention is higher than that of any of the heretofore known briquettes. In addition, due to the quick drying tendencies of our briquettes at normal room temperatures, we have materially lessened the usual cost of manufacture thereof since the need for costly drying ovens is eliminated.

By the expression "powdered fuel" as used in the specification and claims, we mean any solid powdered burnable material useful as a fuel such as charcoal, coal, coke, sawdust and the like.

We claim:

1. A fuel briquette comprising powdered fuel bonded together with a binder comprising quebracho extract and bentonite.

2. A fuel briquette comprising powdered fuel bonded together with a binder comprising deflocculated quebracho extractives and deflocculated bentonite.

3. A binder for powdered fuel comprising quebracho extractives and bentonite.

4. A binder for powdered fuel comprising an aqueous solution of quebracho extract and bentonite suspended therein, said solution having a pH of about 6 to about 12.

5. The method of forming fuel briquettes which comprises mixing powdered fuel with a binder comprising an aqueous solution of quebracho extract and bentonite, said solution having a pH of about 6 to about 12, pressing said mixture to form briquettes and drying the briquettes so formed at normal room temperatures.

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