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METHOD FOR THE PRODUCTION OF
COPPER OXIDE PELLETS

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This invention relates to a method for the production of copper oxide pellets having a high degree of mechanical strength.

Copper oxide has been used for many years as an oxidizing agent and as an oxidizing catalyst for the combustion of organic vapors and of hydrogen. Copper oxide has also served in the production, by reduction, of active metallic copper which has been used in the removal of oxygen from other gases wherein oxygen may occur as an impurity. When used for the foregoing purposes, copper oxide is conveniently employed in the form of pellets, and it is old in the art to form pellets of cupric oxide. Such pellets have been prepared, for example, by pelleting in a conventional apparatus copper oxide having in admixture therewith any of a wide variety of lubricants and binders, and thereafter baking the pellets at an elevated temperature, e. g., 950° C. The unbaked pellets produced are, however, of relatively low mechanical strength, so that they are produced in relatively low yield from the pelleting machine and are relatively easily crushed or fractured in handling.

It is, therefore, the primary object of the present invention to provide a method for the production in high yield of copper oxide pellets having increased mechanical strength as such pellets are produced from the pelleting machine.

It is also an object of this invention to provide a method for the production of firm, hard, self-supporting pellets of copper oxide which are characterized by high chemical activity.

The foregoing and other objects are realized in accordance with the present invention by heating at a relatively low temperature powdered copper oxide having in admixture therewith a relatively small amount of any of certain normal, long-chain, monocarboxylic acids and an ethanolamine. It has been found, in accordance with the present invention, that when the heat-conditioned mixture prepared as just indicated is pelleted in accordance with known procedures the pellets are produced in increased yield and are of increased mechanical strength. The pellets prepared as thus described may, furthermore, be advantageously baked, generally at relatively high temperatures, to provide firm, hard, self-supporting pellets of copper oxide which are characterized by high chemical activity when employed as an oxidizing agent. Furthermore, such baked pellets may be reduced by contacting them with hydrogen at moderate temperatures to provide metallic copper pellets of high reducing activity.

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The following examples illustrate in detail the practice and advantage of the method of the present invention, and are to be considered as not limitative thereof.

Example I

95.85 parts of cupric oxide (powdered so that 100% passed through a 150-mesh per linear inch screen), 2.75 parts of oleic acid and 1.40 parts of triethanolamine were mixed in a ball mill until the mixture was substantially uniform. A portion of the mixture was then pelleted in a commercial pelleting machine fitted with dies to make pellets 0.374 inch in diameter. In this procedure, the yield of pellets was 59.4%, the pellets had an average resistance to crushing of 215 gms. and the average weight per pellet was 0.73 gm.

A second portion of the mixture of copper oxide, oleic acid and triethanolamine was heated at 105° C. for a period of 30 minutes, and a portion thereof was then forced through a 20-mesh per linear inch screen to granulate it to a size appropriate for feeding to the pelleting machine, and this granulated portion was then fed to the pelleting machine as described in the previous paragraph. In this procedure the yield of pellets was 96.9%, the average resistance to crushing of the pellets was 2048 gms., and the average weight per pellet was 0.96 gm.

The heating of the remainder of the mixture of the preceding paragraph was continued for a further period of 90 minutes at 105° C. and, after the mixture had been forced through the 20-mesh screen to place it in proper condition for feeding to the pelleting machine, the mixture was then pelleted. In this procedure the yield of pellets was 82.1%, the average resistance to crushing of the pellets was 1715 gms., and the average weight per pellet was 1.0 gm.

Example II

The procedure of Example I was repeated, using a mixture of 95.72 parts copper oxide, 2.83 parts of stearic acid, and 1.44 parts of triethanolamine. When fed to the pelleting machine, a portion of the mixture which had not been heated before pelleting yielded 98.2% of pellets which had an average resistance to crushing of 1715 gms., and an average weight per pellet of 1.09 gms. After a second portion of the mixture had been heated at 106° C. for a period of 120 minutes, and then sieved to render it suitable for feeding to the pelleting machine, pellets were made therefrom in 100% yield and such pellets had an average resistance to crushing of 3215

gms., and had an average weight per pellet of 1.43 gms.

The foregoing examples illustrate in detail the method of the present invention for the preparation of cupric oxide pellets having high mechanical strength as they are produced in the pelleting machine, and various modifications may be made in the specific details of the examples. Thus, it is not necessary that the cupric oxide used be so finely powered that 100% thereof will pass a 150-mesh per linear inch screen. It is preferred, however, that substantially 100% of the powdered cupric oxide employed pass an 80-mesh screen, although cupric oxide of somewhat larger particle size may be employed. Furthermore, in place of the oleic and stearic acids employed in the examples, there may be substituted any normal, monocarboxylic acid having from 12 to 20 carbon atoms, such as lauric acid, myristic acid, palmitic acid, margaric acid, arachidic acid, etc. In addition, in place of the triethanolamine used in the examples, there may be substituted an equal weight of monoethanolamine or diethanolamine. In general, the mixture should contain from about 0.5 to about 3.5 parts of carboxylic acids per 100 parts of cupric oxide, and should contain from about 0.3 to about 0.7 part of the ethanolamine per part of carboxylic acid.

In the examples the heating of the mixture before the pelleting operation was effected at 105-106° C. Here, again, the method of the present invention is susceptible of considerable variation. In general, heating of the mixture should be conducted at temperatures within the range of from about 95° to about 135° C., with temperatures of from about 100° to about 120° C. being preferred. Heating times of from about one-half to about two and one-half hours have been found to be suitable in producing the desired effect. Heating times of substantially more than about two and one-half hours at 135° C. are to be avoided, since they result in an exceedingly vigorous exothermic reaction in the mixture.

The pellets which have been prepared in accordance with the preceding teachings are valuable both with respect to their properties and their uses. Thus, they are produced in high yield from the pelleting machine and have high mechanical strength. Furthermore, by baking them at temperatures within the range of from about 575° to about 900° C. (preferably from about 575° to about 700° C.) for from about one to about five hours (preferably from about two to about three hours), there are produced pellets of exceedingly high oxidizing activity. Moreover, such baked pellets may be reduced, for example, by contacting them with a rapid stream of hydrogen at temperatures within the range of from about 200° to about 300° C., to provide pellets of high reducing activity.

I claim:

1. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of a normal, monocarboxylic acid having from 12 to 20 carbon atoms and from about 0.3 to about 0.7 parts per part of said monocarboxylic acid of an ethanolamine.

2. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 100° to about 120° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of a normal, monocarboxylic acid having from 12 to 20 carbon atoms and from about 0.3 to about 0.7 parts per part of said monocarboxylic acid of an ethanolamine.

3. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of a normal, monocarboxylic acid having from 12 to 20 carbon atoms and from about 0.3 to about 0.7 parts per part of said monocarboxylic acid of diethanolamine.

4. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of stearic acid and from about 0.3 to about 0.7 parts per part of said acid of diethanolamine.

5. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 100° to about 120° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of stearic acid and from about 0.3 to about 0.7 parts per part of said acid of diethanolamine.

6. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of a normal, monocarboxylic acid having from 12 to 20 carbon atoms and from about 0.3 to about 0.7 parts per part of said monocarboxylic acid of triethanolamine.

7. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of stearic acid and from about 0.3 to about 0.7 part per part of said acid of triethanolamine.

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8. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 100° to about 120° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of stearic acid and from about 0.3 to about 0.7 part per part of said acid of triethanolamine.

9. The method for the preparation of a mixture which may suitably be pelleted to form cupric oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 95° to about 135° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of oleic acid and from about 0.3 to about 0.7 part per part of said acid of triethanolamine.

10. The method for the preparation of a mixture which may suitably be pelleted to form cupric

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oxide pellets of high mechanical strength, the said method comprising heating at a temperature within the range of from about 100° to about 120° C. for a period of from about one-half to about two and one-half hours a mixture which consists essentially of powdered cupric oxide, from about 0.5 to about 3.5 parts per 100 parts of cupric oxide of oleic acid and from about 0.3 to about 0.7 part per part of said acid of triethanolamine.

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