COAL CLEANING BY GAS AGGLOMERATION

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Abstract

The overall purpose of this project is to demonstrate the technical feasibility of the gas agglomeration method for cleaning coal on a laboratory scale. In this method fine-size coal particles are suspended in water and selectively agglomerated by microscopic gas bubbles which serve as bridges between particles. A small amount of oil or other hydrocarbon liquid such as i-octane may be added to enhance the hydrophobicity of the coal. Since the gas-agglomerated particles tend to float, they can be separated from a suspension by floating and skimming as well as by screening.

Laboratory equipment and experimental procedures have been developed for generating microscopic gas bubbles and for demonstrating gas agglomeration of coal particles. Microscopic gas bubbles are generated in an agitated system by first saturating water with gas either at low temperature or under elevated pressure. Then as the temperature is increased or the pressure reduced, very small bubbles are generated which serve as bonds between particles. In the case of dilute particle suspensions (e.g., 1.0 w/w%), the progress and extent of agglomeration can be monitored by observing and recording changes in the turbidity of the suspension undergoing agglomeration.

Numerous experiments have been conducted to demonstrate the gas agglomeration of finely-ground Pittsburgh No. 8 coal from Belmont County, Ohio. The coal is moderately hydrophobic with an ash content of 28 wt.%. The ground material has a projected mean particle diameter of about 5 μm. It has been shown that the material can be gas agglomerated by employing as little as 1.0 v/w% i-octane (i.e., 1.0 ml/100 g coal). While an increase in i-octane concentration to 2.5 v/w% has produced a significant increase in the rate and extent of agglomeration, further increases in i-octane concentration have had only a small effect. The rate of agglomeration has also been increased significantly either by increasing the initial concentration of dissolved gas or by increasing the agitator speed. Furthermore, the process has been shown to be reversible so that the agglomerates disappear if the gas is redissolved by increasing the pressure.

In the future consideration will be given to the agglomeration of more concentrated suspensions, other types of coal and oil, and the separation and recovery of the agglomerates.

Future Presentations

M. Shen, R. Abbott, and T. D. Wheelock, "Gas Agglomeration of Coal Particles in Aqueous Suspension," 15^{th} Annual Pittsburgh Coal Conference, Pittsburgh, PA, September 14-18, 1998.

Graduate Student Receiving Support

Meiyu Shen, PhD candidate in chemical engineering.