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Treatment of Oily Wastes by Agglomeration Techniques to Produce an Auxiliary Carbonaceous Fuel with Low SO_2 Emissions

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Oily sludges and organic wastes are produced by a number of industries, particularly those related to the recovery and processing of petroleum. Traditional sludge disposal methods, involving concentration by impoundment followed by land filling or land farming, are meeting with increasingly stringent regulations. Further treatment of the wastes and reduction of volume and recycle are being encouraged and legislated. Such treatment may range from separation of constituents into higher value products, such as the separation of oil or other organic components from mineral (ash forming) impurities and water, to stabilization of impurities to prevent leaching or to reduce emissions during combustion.

Liquid phase agglomeration (LPA) has the potential to play a major role in oily waste treatment processes (Capes, 1989; Sparks et al, 1989). It can be adapted to separate finely divided solids or liquids from immiscible liquid suspensions or emulsions. This process, under development at the Institute for Environmental Chemistry of NRC, relies on selective wettability between mixtures of liquids and solids of different hydrophobic/hydrophillic character to effect a separation of the components. Normally a hydrophobic solid, such as ground coal or coke, would be agitated vigorously with the oily sludge. During this process the contaminated oil is selectively adsorbed by the coal or coke to form liquid films of oil on the particle surfaces. Continued agitation of the mixture brings the oiled adsorbent particles into repeated contact with each other, resulting in the formation of interparticle, liquid pendular bonds. Agglomerates comprised of oil and adsorbent may then be separated from the aqueous phase by using screens, cyclones or by degree of avidity for air bubble attachment, as in flotation. The type of separation scheme selected is governed by the degree of agglomeration achieved; this may range from weak floccules to densified, spherical agglomerates in which the voids are essentially saturated with oil.

Where water and hydrophillic solids are the contaminating phases in an oil based waste, then a hydrophillic solid adsorbent such as fine sand or gravel can be used as a collector for these components, leaving a clean oil (Capes et al, 1978). Similarly, emulsions can also be treated depending on whether they are water-in-oil or oil-in-water. It is usually more desirable to select an adsorbent which will preferentially collect the minor component in the material to be treated. As well as collecting insoluble contaminants the agglomerating solid will also adsorb most (80-90%) of the soluble organic species in a water based sludge. Consequently such sludges can be cleaned effectively enough to allow direct sewerage of the treated water.

The cleaning of oily sludges by liquid phase agglomeration using hydrophobic solid collectors such as ground coal or coke, has an added advantage that not only is the oil adsorbed by the collector, but the beneficiation of the collector , with respect to non-carbonaceous matter and pyrite also occurs during the process.

The agglomerates obtained from the treatment of oily wastes by liquid phase agglomeratio have potential use as an ancillary fuel. However, the heavy oils bitumens, petroleum cokes an coals used in their preparation are often high in sulphur. Thus, on combustion the emissions c sulphur dioxide may be above acceptable levels. However, it has been found possible t incorporate sulphur dioxide adsorbents such as finely divided limestone, directly into th agglomerates during their formation from the sludge, (Majid et al, 1987, 1988, 1989a, 1989b, 1989 and 1990). This is made possible by the powerful collecting properties of heavy oils and bitumen This technique allows the advantageous use of very small and active sulphur sorbent particles i fluid bed combustion by binding them tightly within larger coal agglomerates. This approac reduces the possibility of elutriation of the SO_2 sorbent particles from the bed and consequentl higher sorbent utilization efficiencies can be obtained for the coagglomerated fuel when compare to those systems in which a coarser sorbent is added separately to the fluid bed. When burnt a the optimum temperature (~ 850°C) this coagglomerated material emits significantly less sulphu dioxide than comparable agglomerates without additives.

A number of process applications have been examined at NRC, in order to demonstrate th this technology can be successfully applied to the clean-up of a variety of wastes. Some of the applications, such as: solvent extraction and agglomeration of oil sands, recovery of coal washe wastes, treatment of storage tank sludge, coke oven wastes, emulsions treatment and recyclab collector systems have been reviewed recently (Sparks et al, 1989). This paper will be limited the applications relating to the reductions in sulphur emissions.

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