Cleaner coal

NRC points the way

The techniques of spherical agglomeration, recently applied to extracting oil from Alberta's tar sands, have been used for some time to purify low grade coal.

Once the mainstay of the industrial revolution, it gradually took a back seat to oil, gas and other, cleaner forms of fuel. Dirty, black and hard to mine, coal had simply become unfashionable in energy circles. But a growing uncertainty in our energy future has changed all that. Today, King Coal is getting a new lease on life.

Recently, NRC's chemical engineers developed an effective way to squeeze extra energy from previously-unusable stockpiles of low grade coal. Owing to high concentrations of sulfur, ash or moisture, such material is normally unsuitable as fuel. However, after treatment by the so-called "spherical agglomeration" method, most of these impurities are removed, leaving behind a clean-burning coal product.

In practice, the low grade coal is first pulverized, then mixed with water and a small amount of light oil. Because of their dissimilar surface properties, coal and the impurities behave differently towards the two liquids. The oil is able to "wet" particles of pure coal, causing them to stick together (or "agglomerate") into tiny round pellets which can be recovered using a fine-mesh screen. Meanwhile, the sulfur, ash and other unwanted inorganic materials stay suspended in the water and pass through the screening stage.

Both the degree of mixing and the quantity of oil used in the separation process determine the nature of the coal product. Vigorous agitation with small quantities of oil yields fine, microagglomerates used in coal-fired power stations. Slower mixing with somewhat more oil produces larger pellets suited to rail transportation. With still greater quantities of oil, the product is recovered as a coal-in-oil paste or slurry, which can be substituted for oil as a fuel in power generating stations.

This "slurry fueling" approach is not new, although use of spherical agglomeration as a purification step in the process has only recently been explored. A test program was begun in 1977 at an oil-fired power station in Chatham, New Brunswick.

The province's Electric Power Commission had been studying slurry fueling as a way of reducing high cost oil consumption (then at 10 million barrels per year) by mixing oil with the province's abundant (and cheaper) coal supply. The major drawback to this scheme, though, was its effect on the environment. New Brunswick coal, in particular, has a high sulfur, high ash content which leads to pollution problems on burning. Treatment by spherical agglomeration was an attempt to counter these effects by providing cleaner coal.

Two agglomeration tanks were used at the Chatham plant to de-ash the impure coal. The product was first recovered as small particles which were then re-suspended in hot water, mixed with heavy fuel oil, then screened off as larger agglomerates, some 2-3 mm in diameter. This purified material was then dispersed in heavy fuel oil to form the coal-in-oil slurry used for combustion.

In the first year of operation, the Chatham station used a 10 per cent by weight coal/oil mixture, later increasing the proportion to 20 per cent. Operators now plan to extend the range of coal contents to 40 per cent by weight.

Another project involving agglomeration technology is under way at the Cape Breton Development Corporation near Sydney, Nova Scotia. There, water used as a wash liquid in a coal cleaning plant is being treated to remove very fine particles of coal which normally interfere with certain stages of the operation. Not only are extra helpings of usable coal recovered quickly but the treated water is also made clean enough for recirculation through the washing step. □

Wally Cherwinski

Last autumn, the spherical agglomeration process was tested at a U.S. coal plant in West Virginia. A portable pilot plant similar to the one shown was built in Ottawa and transported to the site. There, after the coal plant operators had been trained for a brief time by NRC staff, the plant ran for a period of six weeks. The ease of maintaining a conservative recovery rate of 500 kg/h of solid product showed that the spherical agglomeration process could be used to extract low ash coal successfully on a continuous basis. *(Photo: Bruce Kane, NRC)*

L'automne dernier, on a essayé la technique de l'agglomération sphérique dans une usine américaine de nettoyage du charbon dans la Virginie-Occidentale. On y a amené une usine pilote transportable similaire à celle qui apparaît sur cette photo et qui avait été construite à Ottawa. Après avoir suivi un apprentissage de courte durée, donné par le personnel du CNRC, les ouvriers ont fait fonctionner l'usine pilote pendant six semaines. La facilité avec laquelle on peut récupérer, par cette technique, le produit solide à un taux de 500 kg/h a démontré qu'on pourrait tirer profit de l'agglomération sphérique, sur une base permanente, pour obtenir un charbon pauvre en cendres. *(Photo: Bruce Kane, CNRC)*