
ABSTRACT

The South African Department of Energy has projected that the usable coal reserves will have depleted within 100 years. This research, in response to the problem, investigated the possibility of expanding the coal resource through beneficiation of low-grade discard coal from the Witbank Coalfield. Amenability to beneficiation was investigated using various analytical tools and through sink-float testing, and flotation separation techniques. Sink-float testing showed that the coal is highly difficult to wash through most gravity methods but indicated that it was amenable to separation using dense medium cyclone (DMC) equipment. For a -1.18 to 4.5mm feed size (38.9% Ash), the test showed that at 1.7 SG, a 45.2% yield would be obtained with a minimum grade of 25.8% Ash. Flotation of the low-grade discard coal, milled to a feed size of -300 μ m (52.6% Ash), for a period of 1 min using diesel collector at optimum dosage of 14g/kg Coal produced a 51% yield of grade 33.6% Ash, and a clean coal recovery, $r_c = 65.21\%$. Using the Whitten model to estimate partitioning in a DMC, based on data from the sink-float test, it was predicted that when operating at a cut-point of 1.7 SG, the same 51% yield would have a higher grade (27.9% Ash) but a closely-related clean coal recovery, $r_c = 63.74\%$. The DMC model approach thus helped link analytical work in sink-float testing with real performance in a typical DMC when processing the coal. Based on the conditions set in this research, DMC and flotation equipment have shown a comparable capability to upgrade the coal within the respective size classes suited for each technique. An integrated process utilising both separation equipment at appropriate size classes is recommended.