Trace element partitioning in density fractions of a Highveld (#4) coal, South Africa

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Coal production in South Africa has traditionally been concentrated in the Highveld region of Mpumalanga Province where the contiguous Witbank/Highveld coals supply Eskom power stations and other industries. Low-ash washed coals are generally produced for export whereas the remaining fractions comprise feed coals utilized by Eskom. If the export yield is low, run-of-mine coal, or a de-stoned product in which a discard fraction has been removed, are burned. Under a cooperative agreement between the United Nations Environment Programme and the U.S. Geological Survey, we compared density separates of a #4 coal, an important coal used for power generation in South Africa, to determine the impact of the washing process on mercury and trace element contents.

Trace element contents were determined for 8 density separates having ash contents ranging from 15.5 to 71.2% (dry basis). The separation process is effective in concentrating pyrite in the high-ash, higher density fractions. Bulk Hg content is well correlated with the amount of pyrite (as pyritic sulphur) present, and with ash yield. The density separates predict mercury contents ranging from ≤50 ppb for export material to 344 ppb for material that is discarded. Laser ablation ICP-MS confirms residence of Hg in pyrite at ppm levels, together with variable enrichment of Pb, Mo, As, and Tl. Unlike Hg, Cl is partitioned into the low-ash fractions. Results illustrate differences in the quality of coals produced for export and those used for domestic power generation in South Africa.