Coals Industrial Beneficiation Processes from Santa Catarina, Brazil: Inorganic Components Geochemical

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Abstract

Comparative research of the mineral matter and trace elements in 12 pairs of run-of-mine (ROM) and clean-coal products from beneficiation plants in Santa Catarina, southern Brazil, have been developed out using low-temperature oxygen-plasma ashing, X-ray diffraction and chemical analysis techniques with the aim of estimate the effect of coal preparation on the mineralogy and chemical composition of the final coal products. The results showed that substantial reductions in mineral matter and ash levels are associated with beneficiation of coals mined from the different deposits. These reductions are accompanied by changes in the levels of Fe2O3 in the respective coal ashes, due to the reduction in the proportion of pyrite in the mineral matter, and also by a reduction in the level of Na2O, possibly due to ion exchange within the clay minerals. The relative proportions of quartz, clay minerals, and minor phases such as calcite and feldspar (mainly albite) within the mineral matter are not, however, significantly changed by the beneficiation processes. The concentrations of most trace elements in the beneficiation products are similar to the respective concentrations in the relevant ROM materials, or are reduced to an extent similar to that of the total mineral matter level for the respective coal samples. This indicates an association mainly with the clay-rich mineral matter. The concentrations of As and Pb, however, are reduced to a greater extent for most samples by the beneficiation processes, in accordance with a pyrite association. Concentrations of Ge, U and Zr are higher in many of the clean coals than in the respective run-of-mine materials, indicating the possibility of preferential association, at least for some deposits, with the organic-rich fractions of the coals concerned. Comparison of ROM and clean coal products from Santa Catarina preparation plants shows significant reductions in ash, mineral matter and total sulphur percentages associated with beneficiation, and also in the relative proportions of pyrite within the mineral matter. With the exception of pyrite, the mineral matter of the clean coals, as determined by quantitative X-ray diffraction, is similar to that of the respective ROM materials, with abundant quartz, kaolinite, illite and interstratified illite/smectite, and minor proportions of calcite and other accessory phases, and appears to have been little changed by coal preparation.

Keywords: *mineral matter, X-ray diffraction, coal preparation, pyrite, trace element*