Evaluation of the performance of the Cyclomag counter-current planar magnetic separator

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ABSTRACT

At present, Australia is the largest exporter of iron ore, exporting 53% of the global iron ore in 2017. The largest source of iron ore exported from Australia is from hematite deposits in the Pilbara regions of Western Australia. As high grade hematite reserves continue to decline, magnetite provides alternative source of iron ore to sustain current and future production capacity. About 90% of iron ore reserves in South Australia, estimated at 14 billion tonnes are magnetite iron ore. The major challenges facing the magnetite industry in South Australia and other remote areas of the world are huge energy and water requirements, and large environmental footprint for process and tailings storage. A recently developed (by Christopher Kelsey of Kelsey Jig fame) novel planar low-intensity magnetic separator provides dry processing alternative for magnetite beneficiation. In this study, the effects of the control parameters of the Cyclomag planar magnetic separator (PMS - counter-current model) on its performance have been investigated using a magnetite-quartz model feed. In addition, the performance of the PMS for beneficiating various size distributions of magnetite ore sourced from South Australia has been evaluated and compared with that of a Davis Tube Recovery (DTR) magnetic separator. Chemical and mineralogical composition were analysed using X-ray fluorescence (XRF) and Quantitative Evaluation of Minerals by scanning electron microscopy (QEMSCAN), respectively. The study showed that, inlet air and magnetic disc velocities have substantial influence on the performance of the PMS. The PMS performance compares favourably with DTR as a measure of ultimate Fe recovery as a function of particle grind size. The PMS shows promise for enhanced silica removal. Given the potential of the PMS as a unit operation in magnetite concentrators, its potential as competitor to DTR is discussed.

Keywords: Magnetite, dry magnetic separation, planar magnetic separator, Davis Tube Recovery test