

Effect of Caustic Addition on the Processing of Oil Sands

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In the oil sand extraction process caustic addition is often favoured to improve bitumen recovery. Addition of sodium hydroxide increases slurry pH which promotes the release of natural surfactants (naphthenic acids) from bitumen and decreases divalent cation concentration. In the current study, the role of sodium hydroxide addition on bitumen recovery for poor and good ores is investigated. The poor ores attain maximum bitumen recovery in the pH range 8.5 – 9.0, while the good ores show insensitivity to caustic addition. Such behaviour is better understood from measuring the naphthenic acid concentration in the laboratory extracted tailings water and decoupling the elemental processes of recovery: bitumen liberation and aeration.

Changes in bitumen recoveries from poor ores are influenced by the leaching of natural surfactants from bitumen. The concentration of naphthenic acids in tailings water is quantified using FTIR. A near linear relationship is observed between pH and concentration of naphthenic acids. Reduced recovery at high pH corresponds to a greater accumulation of surfactant molecules at the air-water and bitumen-water interfaces, thereby reducing the efficiency of bitumen-air attachment, while the froth quality improves due to repulsive forces between the bitumen and solids. In addition, the effective interaction potential between bitumen and sand (liberation) is studied, as well as the interaction between bitumen and clays (slime coating). The role of each interaction on the processing of oil sands is considered, with emphasis on optimizing bitumen recovery.