

Effect of Various Clay Minerals on non-Aqueous Bitumen Extraction

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The oil sands composition is one of the most important factors affecting non-aqueous bitumen extraction, solvent recovery and waste management. The coarse sands do not present any problems throughout the extraction process, while nano- and microsize minerals (NMM), mainly clay minerals, are the most detrimental. Previous studies have reported kaolinite, illite, smectite, chlorite and mixed layer clay minerals as the main clay constituents of Alberta oil sands. Different types of clay minerals may have differing effects on the processability of oil sands ore during the extraction process. However, due to the highly heterogeneous nature of the clay mineralogy in the oil sands it is difficult to determine the effect of individual clay minerals on bitumen recovery when testing the whole ore sample. The goal of the present study was to determine the effects of individual clay minerals on non-aqueous bitumen extraction. Mixtures of a clay mineral with toluene-diluted-bitumen, extracted from the Alberta oil sands, were prepared and agitated for 24 hours. The mixtures were then stirred at 40°C for 7 days in open bottles to allow the toluene to evaporate. The resulting clay-bitumen mixtures were washed three times each with cyclohexane to extract the bitumen. The clays were separated by centrifugation, and examined by X-ray diffraction, Fourier transform infrared spectroscopy, elemental analysis, cation exchange capacity, layer charge density and specific surface area measurements. The bitumen extraction results from the artificially prepared ores were compared with actual oil sands samples, and the treated clays were compared with the original clays.