A cleaner process for heavy oil extraction from oil sand using a bio-based solvent

Feng Lin
Natural Resources Canada, CanmetENERGY Research Centre
One Oil Patch Drive, Devon, Alberta, Canada
feng.lin@canada.ca

Abstract

Non-aqueous extraction (NAE) at ambient conditions provides many advantages over the current commercial hot water method for processing mined oil sand, but several challenges remain largely due to the use of a hazardous conventional organic solvent (COS) such as toluene or heptane. In this work, a cleaner, more sustainable NAE process using a low-cost, eco-friendly, bio-based solvent, was developed. Results indicate that the bio-solvent extraction could achieve oil recoveries of close to 100% for different grades of ores, the highest yield compared to those often obtained using a COS (toluene or heptane). The total water and solids contents in the supernatant of the extract were very low and as comparable to those extracted using toluene. Importantly, the quantity of residual bio-solvent in the sand after simple evaporation was limited to a level significantly below the regulation target for a COS. The application of bio-based solvent in NAE could dramatically reduce the safety, environmental, and health concerns associated with the use of a COS. Equally important, this bio-solvent extraction inherits all the advantages of NAE, e.g., dry tailings, ready for land reclamation, lower carbon footprint, and ability to efficiently recover low-grade and oil-wetted ores.

Keywords: *Bio-based solvent, Solubility, Oil recovery, Advanced separation, Sustainability*

Short biography

Dr. Feng Lin obtained Ph.D. and M.Sc. degrees, both in Chemical Engineering, from the University of Alberta and the University of Waterloo, Canada, respectively. He is currently a Research Scientist at CanmetENERGY research centre in Devon within the department of Natural Resources Canada. His research expertise covers interfacial transport phenomena, colloids, wetting and adhesion, heavy petroleum production, minerals processing, polymers and nanomaterials synthesis, and renewable energy engineering. To date, Dr. Lin has managed 10 projects with more than 2 million dollars funding, supervised 8 technologists and postgraduate students, and authored about 40 referred journal publications and government-wide scientific reports, in relation to the fundamental research and scale up of cleaner oil recovery and minerals processing technologies. His passion to research and technology development is to be one of many contributors for searching cleaner solutions and materials to fuel our homes, societies, and economies.

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