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The Extraction of Heavy Oil from Trinidad Tar Sands Using Supercritical Carbon Dioxide

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Abstract: *The work described in this paper promotes the use of supercritical fluid extraction as an environmentally friendly alternative to the current hot water/steam process for the extraction of heavy oil from tar sand. An experimental programme was carried out on tar sand from the Parrylands district in South Trinidad, using a bench scale unit with supercritical carbon dioxide as the basic extraction fluid. In initially characterising the tar sand, Soxhlet extraction using toluene gave a bitumen content of 14.7% in the deposit and SARA (Saturate, Aromatic, Resin, Asphaltene) analysis showed the deposit to be mainly of resins, but with an asphaltene content of 12.6%. The experimental programme examined the effects of pressure 100 to 500bar, temperature 30 to 60ºC, particle size >20mm to <1mm, as well as the use of entrainers (pentane, hexane, heptane, and octane) to enhance recovery. The results showed the maximum extraction yield using carbon dioxide alone to be 4.5% by mass of the original charge in ~3hours, but this could be increased by at least another 1% by removing the charge and subjecting it to a second extraction. Pentane was the most effective entrainer, the yield increasing to 6.4% when using 45% pentane. Microscopic analysis showed the raw material to be a conglomerate mass initially, but breaking down to the individual sand particles with small amounts of oil cover after extraction. The final extracted sand could be subjected to bioremediation prior to charging back to the mine as an environmentally friendly disposal mechanism.*

Keywords: *Tar Sands, Supercritical Fluid Extraction, Carbon Dioxide, Entrainers, Environmentally Friendly Process*