A Laboratory Study of Thermal Oil Recovery of Peace River and Athabasca Tar Sand Biutmens

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SAGD (Steam Assisted Gravity Drainage) or CSS(Cyclic steam stimulation) thermal recovery methods, are currently the most popular and effective insitu technologies to recover the more viscous Tar Sand bitumens in the Peace River and Athabasca Area. The injected steam heats the crude oil or bitumen, lowers the viscosity and allows it to flow into the lower wellbore. Operating temperatures can reach up to 300ºC which reduces the viscosity of the oil and increases flows to the production well. Viscosity reduction is not only a physical process but a chemical process as well. Tar Sands sealed in stainless steel tubes where heated under simulated SAGD conditions and analyzed using classical petroleum geochemical approaches.

The goal of this study is to examine high temperature pyrolysis of tar sand bitumens under steam flood conditions to assess chemical changes during thermal recovery. Our laboratory results demonstrate the cracking and depletion of heavy hydrocarbons and the generation of light hydrocarbons after aquathermolysis under different temperatures at up to 3 weeks of run time simulating SAGD conditions. Simdist (Simulated distillation) data shows the distillate fractions increase with differences between Peace River and Athabasca Tar Sand bitumens very noticeable. Thermal degradation of tar sands under SAGD conditions leads to a very small increase in total saturate hydrocarbons (n-alkanes, steranes, hopanes, and diamondoids) and aromatic hydrocarbons (Naphthalenes, Phenanthrenes, Monoaromatic steroids, Triaromatic steroids). Significant variability in results can be seen between the thermal histories involved. Isomerisation, Aromatisation, and Cracking reactions are some of the chemical reactions that contribute to the compositional changes of the heavy oil and tar sands during thermal recovery which in turn do affect flow properties during recovery.