DiscoveryNews

Liquid Salt Extracts Oil from Sand

By Nic Halverson | Mon Mar 28, 2011 03:00 PM ET

A more eco-friendly method for extracting oil and tar from sand has been developed by a group of researchers at Penn State University. Utilizing ionic liquids to separate heavy viscous oil from sand, the team's technique could help reduce toxic waste from surface-minded oil sands and aid clean-up efforts after oil spills.

Tar sands, also know as bituminous sands or oil sands, constitute approximately two-thirds of the world's estimated oil reserves. Canada is the world's major producer of the unconventional petroleum from tar sands, and the United States imports more than 1 million barrels of oil per day from Canada, nearly twice as much as from Saudi Arabia. An estimated 32 billion barrels of oil could potentially exist in Utah's tar sands.

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Extraction and separation of these deposits are often expensive and harmful to the environment because of they contain complex mixtures of sand, clay, water and bitumen, a "heavy" or highly viscous oil. Processing this mixture to fuel requires significant amounts of water and energy and generates contaminated waste water that is stored in open air ponds. Toxic to aquatic life, this waste water can seep into groundwater, polluting rivers and lakes. Additionally, local fresh water supplies can be depleted as this process requires large amounts of water.

However, the new method developed by the Penn State research team uses very little energy and water, and all solvents are recycled and reused.

Paul Painter, professor of polymer science in the department of materials science and engineering, and his team spent the last 18 months developing this new method using ionic liquids (salt in a liquid state) to facilitate the separation. No waste process water is generated since the separation takes place at room temperature.

"Essentially all of the bitumen is recovered in a very clean form, with no detectable mineral fines, which interact preferentially with the ionic liquid, and no contamination from the ionic liquid," explains Painter on his department's website.

The bitumen, solvents and sand/clay mixtures separate into three distinct parts. They can be removed separately and solvents can be reused.

This method can also be used to extract oil from beach sand after oil spills like the Deepwater Horizon and Exxon Valdez disasters. Using sand polluted by the BP oil spill in one experiment, the team was able to separate hydrocarbons from the sand within seconds. After a small amount of water was used to clean remaining ionic liquids, the sand was so clean could be returned to the beach, instead of landfills.

The ionic liquids researchers work with are based on 1-alkyl-3-methylimidazolium cations, a positively charged material with high chemical and thermal stability, a low degree of flammability, and almost negligible vapor pressure, which makes recovering the ionic liquid relatively easy.

The team has built a functioning bench top model system and is currently reducing their discovery to practice for patenting.

Image: Jupiterimages