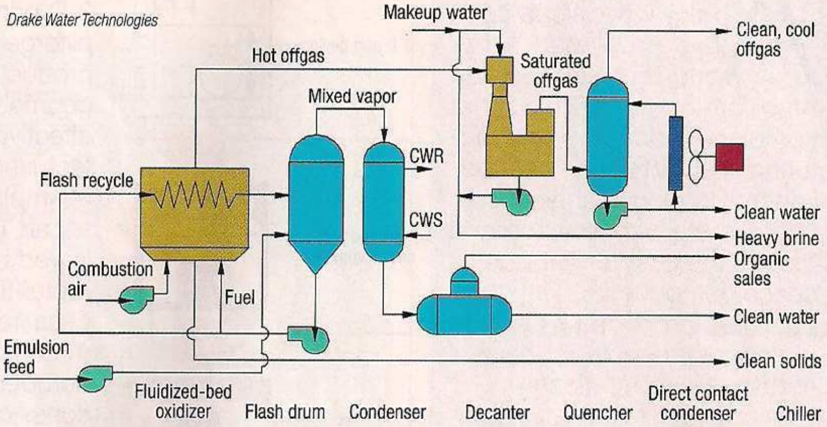
A process to treat tight emulsions and intractable oily wastes

Edited by:
Gerald Ondrey



Spent invert drilling fluids, slop oil, rag layers, and tank bottoms often present as very tight emulsions having high brine and solids fractions that render them difficult and economically unfeasible to break and separate by traditional means, says Ron Drake, CEO at Drake Water Technologies, Inc. (DWT; Helena, Mont.; www.drakewater.com). Conventional demulsification schemes using heater-treaters, demulsifying chemicals, electrostatic grids, centrifuges, and so on often exhibit limited separation efficiency and merely produce a more concentrated and intractable residue requiring stabilization, transport and landfill disposal, explains Drake. Likewise, high moisture and solids content of tight emulsions greatly reduces throughput and organic recovery when they are subject to thermal desorption, he adds. To overcome these problems, DWT has developed a single-load, high-throughput, mobile treatment system to provide complete, on-site, resource recovery and disposal of pumpable emulsions and oily wastes.

In the process (flowsheet), a recirculating stream of feed emulsion is heated at moderate pressure (15–30 psig) and flashed to produce a mixed vapor stream of light organic compounds and water. The mixed vapor stream is condensed and separated using a coalescing decanter to produce merchantable streams of dry, solids-free oil and clean water.

Energy for heating the feed emulsion is provided by a low-temperature (800°C) fluidized-bed (FB) catalytic oxidizer that is fueled using a side stream of the flash-drum bottoms — negligible amounts of oxides of nitrogen (NOx) and CO are produced at this low temperature. Off-gas from the oxidizer is quenched in a high-temperature (80°C), high-energy scrubber, producing a low-volume dense-brine blowdown stream that can be sold or injected. Solids discharged from the oxidizer are dry and free of organic contaminants. Saturated, warm off-gas from the quencher is chilled to produce water with low (less than 100 parts per million) total dissolved solids (TDS), and a clean, cooled, offgas.

The FB catalytic oxidizer has been demonstrated at commercial scale for thermal desorption applications, says Drake. Pilot testing of the emulsion flash system on spent invert drilling fluid (21 wt.% solids, 48 wt.% moisture and 31 wt.% organic content) yielded recovery of about 70% of the organic material as merchantable oil. The balance (30%) of the organic fraction was designated as fuel for the FB catalytic oxidizer. Based on pilot-test results, the commercial unit is expected to produce about 97 barrels per day (bbl/d) of light (specific gravity = 0.84) oil plus 81 bbl/d of low-TDS water, while processing 325 bbl/d of emulsion feed, he says.

CO_2 in biomass pre-treatment

Ionic liquids are being investigated as a way to break down cellulosic plant material in biofuels-production processes. A significant hurdle to their use is the fact that ionic liquids are toxic to the microbes used in biofuel production.

Researchers from Lawrence Berkeley and Sandia National Laboratories, working at the Joint Bioenergy Institute (JBEI; Emeryville, Calif.; www.jbei.org), have found that adding CO_2 during the pretreatment step can neutralize the toxicity of the ionic liquids by adjusting the alkaline pH. Because the use of CO_2 as a reversible method to adjust pH could eliminate the need to separate and purify the biomass after pretreatment, the researchers say the CO_2-enhanced process could reduce costs by 50% or more compared to traditional biomass-pretreatment techniques.

Li-ION BATTERIES

Over the course of several battery charge/discharge cycles, microscopic fibers of lithium, called dendrites, sprout from the surface of the lithium electrode and spread across the electrolyte until they reach the other electrode. An electrical current passing through those dendrites can short-circuit the battery, causing it to rapidly overheat and even catch fire.

In an effort to suppress dendrite formation, scientists from CSIRO (Melbourne; www.csiro.au), in collaboration with RMIT University (Melbourne; www.rmit.edu.au) and Queensland University of Technology (Brisbane; all Australia; www.qut.edu.au), believe they have solved the problem with a new pre-treatment process.

The pre-treatment involves immersing lithium metal electrodes into an electrolytic bath containing a mixture of ionic liquids and lithium salts prior to the battery's assembly. This creates a durable and lithium-ion-permeable, solid-electrolyte interphase that allows safe charge/discharge cycling of commercial Li/electrolyte/$LiFePO_4$ batteries for 1,000 cycles with coulombic efficiencies better than 99.5%.

The interphase is prepared using a variety of electrolytes based on the N-propyl-N-methylpyrrolidinium bis(fluorosulfonyl)imide room-temperature, ionic liquid containing lithium salts (LiFSI, $LiPF_6$, and $LiAsF_6$). When optimized, it prevents dendrite formation and consumption of electrolyte during cycling. As an added benefit, batteries that have undergone the process can spend up to one year on the shelf without loss of performance, say the scientists. They are now developing batteries

(Continues on p. 8)

Note: For more information, circle the 56-digit number on p. 98, or use the website designation.