CHEMICAL ENGINEERING

First commercial process for K_2SO_4 from polyhalite completes pilot

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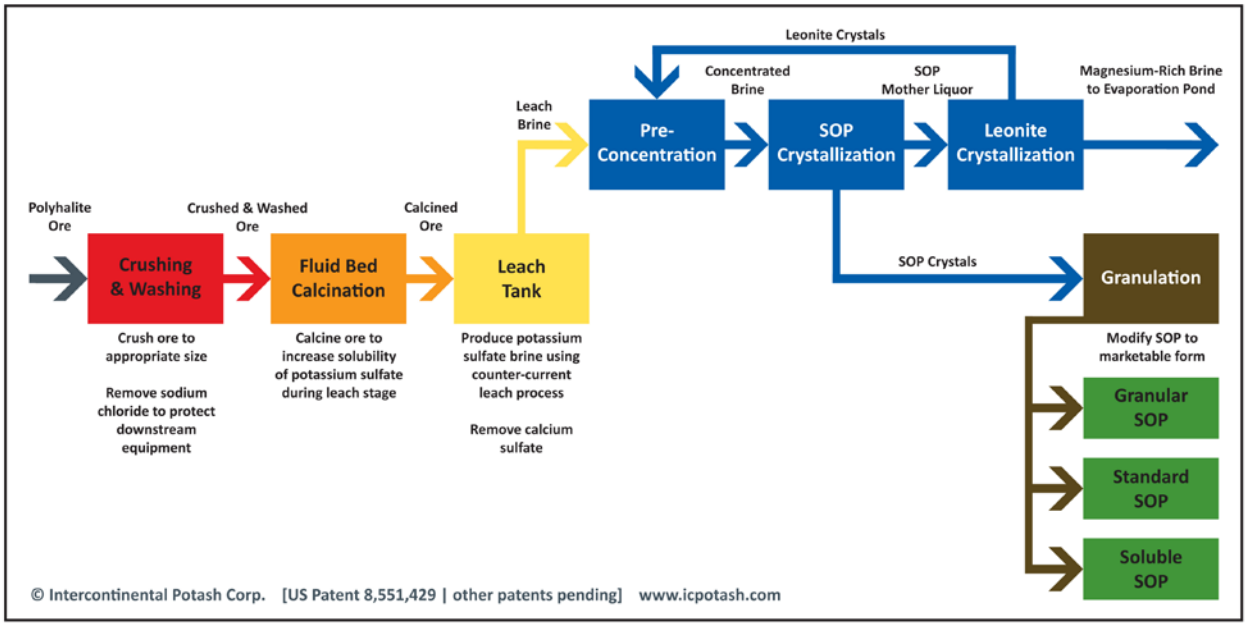
Pilot plant operation has been completed for a process that produces the fertilizer potassium sulfate (K_2SO_4) from the mineral polyhalite, a hydrated sulfate of potassium, magnesium and calcium. The process, developed by Intercontinental Potash Corp. (ICP; Golden, Colo.; www.icpotash.com), resurrects a route to K_2SO_4 that was first explored in a push to develop a domestic source of potash after a German embargo in World War I.

"Although it was evaluated decades ago, but not pursued, our process represents the first commercially viable potassium sulfate process using mined polyhalite as a feedstock," says Randy Foote, chief operating officer at ICP. "After validating the decades-old data, ICP developed a patented hybrid crystallization system designed to maximize production of K_2SO_4," explains ICP process engineer Mike Morrison.

The ICP process avoids the cost fluctuations of conventional potassium sulfate production, where feedstocks potassium chloride and sulfuric acid must be purchased. ICP's polyhalite route is less expensive than using mined sylvite, a naturally occurring mineral composed of KCl, Foote says.



The process (flowsheet) begins with a crushing and washing stage to remove sodium chloride, then enters a calcination step in a fluidized bed reactor, where the polyhalite undergoes changes to its crystal structure that dramatically increase solubility. The calcined solids then enter a countercurrent leaching process that removes potassium and magnesium sulfate from the mineral, forming a brine.

The next stage of the process involves a hybrid crystallization system that combines mechanical vapor recompression (MVR) and multiple effect evaporation (MEE). The patented circuit features a leonite dissolver, which takes a potassium- and magnesium-containing mineral (leonite) from later in the process and uses it to increase production of potassium sulfate. An MVR evaporator removes water until the K_2SO_4 crystallizes, recovering 90% of the material. The mother liquor then enters a series of MEEs, which produce the leonite that is then recirculated.

The final stage of the process is a drying and granulation step, where three potassium sulfate products are produced — standard, granular and soluble-grade. (US Patent 8,551,429 | other patents pending)