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Processing of calcium sulphide to calcium carbonate and hydrogen sulphide

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Abstract
The growing problem of industrial solid waste disposal in South Africa and the rest of the world has become a subject of increasing public environmental concern. In South Africa, the neutralization of acid mine water as well as desalination processes using reverse osmosis, ion-exchange or chemical desalination, produce gypsum and metal hydroxide rich sludges. In addition, 12 000 tonnes of industrial solid gypsum waste are produced every day by the fertilizer industry in South Africa. The recent trend in the closure of landfills, as a preferred method for solid industrial waste disposal, has led to the necessity for the development of innovative ways of converting these solid wastes into usable and saleable products. The purpose of this study was to establish conditions for the chemical processing of calcium sulphide, the product of the thermal reduction of gypsum, into calcium carbonate and H_2S.CaS was converted under batch conditions to soluble $Ca(HS)_2$ by contacting it with water and H_2S. In the following step the $Ca(HS)_2$ was contacted with CO_2 to precipitate $CaCO_3$ and liberate H_2S. The following findings were made: (i) CaS has a low solubility of <100 mg/l as CaS; (ii) $Ca(HS)_2$ has a high solubility of >100 g/l (as CaS); (iii) $CaCO_3$ with a purity of 80% was produced when the $Ca(HS)_2$ solution was not filtered and 99% when it was filtered; (iv) the $CaCO_3$ yield amounted to 91% and the H_2S yield to 95%. The following process conditions were found to be suitable: (a) CaS concentrations in the range 100 - 300 g/l; (b) agitation speed of 125 rpm – 500 rpm, and (c) H_2S feed flow-rate had no detectable effect on the dissolution of CaS; (d) CO_2 flow-rate influenced the particle size and structure of the product $CaCO_3$.

Biography
Robert Kimutai Tewo has completed his Bachelor of Technology in Chemical and Process Engineering from Moi University, Kenya and he is a registered graduate chemical engineer with the Engineering Registration Board of Kenya, , and currently pursuing Masters of Technology (Research) at Tshwane University of Technology, South Africa at the department of Environmental, Water and Earth Science.