PRODUCTION OF HIGH-PURITY CALCITE AND RARE EARTH ELEMENTS FROM PHOSPHOGYPSUM

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Phosphogypsum (PG) is a solid waste from phosphoric acid production, and is primarily composed of CaSO_4·2H_2O. It is estimated that about 200 Mt/a of PG is generated globally in the phosphate industry (Parreira et al. 2003). Due to impurities (such as phosphate, fluorides, sulfates, trace metals and radioactive elements) only 15% of the PG is recycled as building material and soil stabilization amendments (Tayibi et al. 2009). Most of the PG is stored in large stacks across the world. The large number of PG stacks is not only occupying land space, but is also an environmental problem (Rutherford et al. 1994, 1996). On the other hand, the PG could be a material resource. For example, research indicates that the content of REE (Rare Earth Elements) in PG is about 112-300 ppm (Zhang 2014) which is a significant REE resource.

Current study for recovery of REE from PG using NH_4Cl dissolution is in progress. In addition, preparation of high purity of CaCO_3 through CO_2 mineralization is included in our research (Figure 1). The processing parameters including dissolution time, temperature, and liquid/solid ratios are being explored to determine the optimum conditions. Fourier-transform infrared spectroscopy (FTIR) is being used to examine the products, and a Ca^{2+} ion selective electrode is being used to observe dissolution and carbonate formation processes. The preliminary results show the feasibility of using the PG dissolution - CO_2 mineralization process to recover REE and produce CaCO_3 from PG. The advantage of this processing is to use the solid waste PG and greenhouse gas CO_2 as feed materials to produce valuable products, REE and CaCO_3. Future research will include extraction of REE from solution.

![Figure 1. CaCO_3 product from phosphogypsum by using PG dissolution - CO_2 mineralization processing.](image1)

References