

16.4 **A study on the method of extracting chemical products from oil shale ash**

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Oil shale ash (OSA) is the principle by-product of oil shale processing, which accounts for as much as 90% (by weight) of the raw oil shale. OSA is rich in inorganic elements, such as aluminum and silica, which can be extracted and used to manufacture chemical products by hydrometallurgical methods. We have developed a process for the preparation of nano-sized alumina particles (20-40 nm) using oil shale ash as the raw material and polyethylene glycol (PEG) as the surfactant by an ultrasonic technique followed by azeotropic distillation. Following alumina extraction, the remaining material can be used in the preparation of various silica-based industrial products. The silica residue can produce water glass using a standard hydrometallurgical technique. This water glass can then be used to prepare silica nanoparticles and aerogels under closely controlled reaction conditions. Spherical silica nanoparticles (average size ~10 nm) have been prepared using water glass derived from OSA via ultrasonic processing in the hydrolysis-condensation stage followed by azeotropic distillation. Silica aerogels with high specific surface area and large pore volume can be synthesized from OSA-derived water glass via ambient pressure drying. In summary, a range of valuable chemical products can be made from OSA. These OSA reuse approaches represent an important aspect of comprehensive utilization of oil shale that may be of great economic significance.