Power generation: An unknown (re)source of baryte

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Coal-fired power facilities generate a polymetallic effluent (Flue Gas Desulfurization – FGD) rich in sulfate [1]. FGD effluents are currently considered an important secondary resource yielding selenium nanoparticles, biogas and minerals [2]. Furthermore, FGD is produced in large volumes in EU (25% of its energy mix is based on coal combustion), USA, China etc. This paper investigates the recovery of sulfate as baryte ($BaSO_4$), a mineral with high commercial value, listed as a critical raw material by the EU [3]. Using equimolar $BaCl_2$, >99% desulfurization (initial sulfate load ~ 7 g L^{-1}) of an FGD effluent produced by a coal-fired power plant operating in central Poland was achieved, yielding ~16.5 kg high purity baryte m^{-3} of FGD. Baryte recovery also led to the removal of Al (86%), Cu (52%), K (69%), Mo (62%), Se (40%), Sr (91%), and U (75%) from the FGD effluent. Then, the recovered baryte was characterized by XRD, FT-IR, TGA, µXRF, and SEM-EDX, and compared with a commercial reference material. Based on this dataset, complete characterization of the recovered baryte is presented, and the removal mechanism of the elements is proposed and discussed. The study also provides a cost-benefit analysis of the recovery process. Because of its high density (4.48 g cm^{-3}) and low water solubility, baryte has numerous industrial applications auch as i) weighting agent in drilling fluids for oil and gas industry, ii) radiocontrast agent for X-ray imaging, iii) component of white pigment for paints, iv) paper brightener etc. In addition to recoverying an important material, the co-removal of toxic elements from FGD effluents generates a cleaner wastewater (pre-treatment) [4]. This study is the first work showing baryte recovery and metal removal from industrial FGD effluents using an integrated platform.

[1] Staicu et al. (2017) *Chemosphere* 117, 111-119. [2] Cordoba & Staicu (2018) *Fuel* 223, 268-276. [3] http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en. [4] Fernandez-Martinez & Charlet (2009) *Rev. Environ. Sci. Biotechnol.* 8, 81-110.