Proceedings of the 8th International Conference on Environmental Science and Technology
Lemnos Island, Greece, 8 – 10 September 2003
Full paper Vol. B, pp. 596 - 603

TREATMENT OF ACIDIC INDUSTRIAL WASTEWATERS AND SIMULTANEOUS PRODUCTION OF AN EXPLOITABLE SOLID PRODUCT

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EXTENDED ABSTRACT

The wastewaters collected from the production processes of two Greek inorganic industries exhibit high concentrations of sulfates and heavy metals as well as acidic pH values, which exceed the legislation disposal limits. The liquid effluents that are produced during the opening and emptying of used containers as well as the batteries production line in a lead-acid battery recycling plant and those generated from pickling processes of barrel lags are usually subjected to treatment with use of lime, in order to accomplish retention of sulfates and heavy metals and also increase their pH values to such a degree, so that they can meet currently standing legislation limits, in relation to their disposal feasibility. The research team studied a process, through which not only the wastewaters could be sufficiently treated, in terms of pH values increase and reduction of sulfates and heavy metals concentrations, but also it could yield a solid product that could be potentially used for commercial exploitation. The product selected was solid barium sulfate, the formation of which is favoured by its low solubility in water. Moreover, barium sulfate is being used in coating as well as medical applications. In order that the process studied could lead to a solid product of satisfactory purity, two chemical agents were used, sodium hydroxide and barium hydroxide. The addition of the first in the two inorganic wastewaters, under specific stirring conditions, resulted in the retention of metals through a precipitation mechanism without significantly affecting sulfates, due to the increased solubility of sodium sulfate in water. The subsequent addition of the barium hydroxide solution led to the precipitation of sulfates and the production of pure barium sulfate. Three different hydroxide quantities were added to both wastewater samples (stoichiometric quantity against sulfates concentrations in sample, 50 and 100% excess), while only stoichiometric quantity of barium hydroxide was introduced. The measurements conducted in the process liquid effluents proved that significant reduction of the concentrations of sulfates (exceeded 60% for the battery samples and 80% for the pickling samples) and heavy metals takes place, along with increase of the pH values. The high concentrations of sodium and hydroxide ions in the process effluents favoured the recycling of the process liquid effluents, which yielded additional sulfates and heavy metals retentions, while pH values also increased. The use of excess sodium hydroxide appeared to inhibit sulfate losses, which may occur due to the high initial metal content in wastewater samples. The use of stoichiometric quantity of sodium hydroxide with one recycling stage yielded optimum retentions for the battery samples, while the treatment of the pickling samples was optimum with use of excess sodium hydroxide (50%), followed by one recycling stage too.

Key words: sulfates retention, pickling effluents, battery recycling effluents, precipitation, heavy metals retention