Metals recovery from waste pickling solutions by reactive precipitation

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Abstract

Pickling is one of the most important step in steel manufacturing industry. During the process, acid reacts to dissolve surface oxides and metals ions are accumulated in the solution, mainly Fe and Zn [1]. Waste acid disposal is a critical issue for the hot-dip galvanizing industry in terms of environmental damage and high costs. For this reason, a continuous regeneration of industrial pickling solutions and recovery of valuable materials was proposed, by integrating cutting-edge membrane technologies, to recover the HCl, and reactive precipitation, to recover metal ions. In this way, minimizing of waste streams generation and using of a circular approach leads to an environmental and economic sustainable process within hot-dip galvanizing industry. Reactive precipitation process reliability was proved through lab-scale experiments in order to tune the process simulator [2] used for designing the pilot-plant to be installed in the real industrial environment of the Tecnozinco SrL (Carini, Italy) hot-dip galvanizing plant. Tests were conducted in a CSTR by continuously feeding the acidic metals rich feed, the alkaline reactant and the oxidant. Fe and Zn amounts were relieved in the solution and in the precipitate to evaluate the efficiency of the process. Some key parameters, such as temperature and pH, were studied by varying inlet streams flow rates. A significant metals separation was obtained, obtaining Fe(III) hydroxide with a purity of 99%. The Zn was successfully kept in the solution to generate a stream of zinc/ammonium chloride solution, to be reused in the fluxing baths of the hot-dip galvanizing plant.

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References

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