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Soda and Aluminum Recovery from Spent Etching Baths by Aqueous Precipitation

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Abstract. The aluminum anodising industry is an important industrial sector that produces great amounts of polluted effluents, which after treatment generate sludge. This fact brings environmental and economical concerns to the companies.

Best way to deal with the problem, according to the "prevention strategy" set by the European Directive on Integrated Pollution Prevention and Control, is to implement preventive techniques and technologies to optimise the use of resources and minimise losses, and in turn waste.

Among the operations of an anodising line, the etching/satinising stage is responsible for the production of a huge quantity of wastewater neutralisation sludge and for the wrong use of caustic soda. "Caustic etch recovery" technology is claimed to drastically reduce the generation of neutralisation sludge and the purchasing of fresh caustic soda by regenerating the exhausted etching/satinising solution, through an aqueous precipitation reaction.

This paper presents the capability of the technology to effectively regenerate the exhausted caustic solution, and investigated the parameters with major effect on the process yield, in order to optimise it. It was demonstrated that the technology effectively recovers the solution, increases its soda content and diminishes the dissolved aluminum content by precipitation. Moreover the conditions that optimise the process are simple and inexpensive. After treatment the solution present the properties to be recycled in the etching/satinising operation.

Introduction

Industrial activities play a central role in the well-being of Europe, contributing to its economical growth and providing high quality jobs. Nevertheless, industrial activities also have a significant impact on the environment [1]. Best way to deal with the problem, according to the "prevention strategy" set by the Council Directive 96/61/EC of the 24th September 1996 concerning Integrated Pollution Prevention and Control (IPPC), is to implement preventive techniques and technologies to optimise the use of resources and minimising losses and waste generation [2-4]. According to waste management policy, prevention is the first priority in order to allow source reduction together with possible gain for the companies as decrease environmental dues and raw materials consumption and increase energy saving [1, 5-7].

The aluminum anodising industry is an important industrial sector [8] that invariably produces great amounts of polluted effluents, which after treatment generate sludge. This fact brings environmental and economical concerns to small and medium companies that operate in the sector [9]. Among the operations of an anodising line, the etching/satinising stage is responsible for the production of a huge quantity of wastewater neutralisation sludge and for the wrong use of caustic soda [10]. A technology claimed to manage efficiently caustic soda usage is called "Caustic etch recovery", in which soda in spent etching baths is regenerated and dissolved aluminum is reduced, resulting savings in chemicals and decreasing sludge generation [11]. Its principle is based on the chemical precipitation of aluminum in the alumina form, regenerating the sodium hydroxide according with the following reaction :