

Recovering of zinc(II) from spent pickling solutions by liquid-liquid extraction

D. Bascone^a, V. Caruso^a, A. Cipollina^b, M. Morreale^a, S. Randazzo^a, G. Micale^b

^a *Facoltà di Ingegneria e Architettura, Università degli Studi di Enna "Kore" – Cittadella Universitaria, 94100 Enna, Italy.*

^b *Dipartimento di Ingegneria Chimica, Gestionale, Informatica, Meccanica, Università di Palermo – Viale delle Scienze ed.6, 90128 Palermo, Italy.*

*Corresponding Author. E-mail: marco.morreale@unikore.it

Abstract

Hydrochloric acid can be successfully recovered from spent pickling liquors with high efficiencies via pyrohydrolysis techniques. In the pickling solution feed, other metallic ions are typically present besides iron (mainly Fe²⁺) such as zinc(II). In order to avoid undesirable effects, zinc(II) has to be removed, because zinc chloride evaporates and sticks to the reactor walls, as well as it contaminates iron oxides product¹. Moreover, zinc recovery is economically affordable because it allows the marketing of some products such as ZnCl₂ and ZnSO₄.

In the present work, liquid-liquid extraction process has been selected to recover zinc(II) from pickling liquors, using suitable extractant agents. Co-extraction of other metals has also been considered, thus several extraction steps have been performed to regenerate the extractant besides to extract zinc. Mainly ferrous ions are recovered in these last steps in an aqueous solution that can be added to the spent liquor feed in the pyrohydrolysis plant. In particular, the influence of several parameters on the extraction process has been studied in order to determine the favourable conditions to achieve high extraction efficiencies of zinc(II) from the spent pickling liquor and high extractant recovery. Experimental design has been developed with the assistance of a statistical analyses software.

Furthermore, liquid-liquid equilibrium data obtained experimentally in this work have been used to develop a numerical model in order to predict the phase behaviour of iron and zinc to design and optimise the zinc(II) removal units.

¹M. Regel-Rosocka, A review on methods of regeneration of spent pickling solutions from steel processing, *Journal of Hazardous Material*. 177 (2010) 57-69

Keywords

Spent pickling liquor; zinc(II) removal; liquid-liquid extraction.