# Solvent extraction, separation and recovery of indium from iron using D2EHPA

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## ABSTRACT

The present work investigates separation and recovery of indium from sulfuric acid solutions using solvent extraction process. In this study, Taguchi method was used in extraction process to optimize effective parameters. Indium was extracted from aqueous solution with $D_2EHPA$ diluted in kerosene. Effects of various parameters such as pH of aqueous solution ($pH_e$), $D_2EHPA$ concentration ($C_{D2EHPA}$), time of contact between phases ($t_e$), and volume ratio of aqueous phase to organic phase (A/O) were investigated. The optimum extraction conditions were found to be pH= 0.8, $C_{D2EHPA}$= 30%W, t= 5 min, and A/O=3. Indium was selectively stripped from organic phase with sulfuric acid solution as agent of stripping and optimum values of effective parameters were obtained $C_{H2SO4}$=3 M, $t_s$=5 min and O/A=4.

Key words: Indium, Solvent Extraction, Process optimization, Taguchi methodS.

## 1. Introduction

Indium is an important metal which is extensively employed in electrical and metallurgical industries [1]. Indium is not mined for itself [2]. Sphalerite present in sulfide ores is the main mineral source for the indium production [2]. Commercial grade indium is usually produced as a by-product of leach liquors from zinc plants [3]. The typical traditional process for extracting indium from sphalerite concentrates includes the following steps. Firstly, ferric is removed from leach liquor by the method of jarosite, and indium goes into jarosite. In order to recovery indium, jarosite residue is dissolved using hot sulfuric acid solution [4]. The leach solution contains indium along with other metallic constituents such as iron, zinc etc. depending on source material treated [3]. Therefore, it is necessary to separate indium from the other elements that are usually present in high concentrations [3]. Many authors have studied separation and recovery of indium from leach liquor and suggested the solvent extraction and cementation processes as two of the main techniques used. Authors have studied extraction of indium from the aqueous solutions using different organic extractant such as $D_2EHPA$, Cyanex 301, Cyanex 923, Cyanex 925 and Lix 973N [5, 6, 7, 8, 9, 10 and 11]. From all these extractants, $D_2EHPA$ has the most usage for purification and enrichment of indium from leach liquors [3]. After extraction of indium with $D_2EHPA$ from aqueous solutions, indium is stripped from organic phase with sulfuric or hydrochloric acid solutions. Selection of agent of stripping depends on type of ions extracted along with indium [3]. Finally, indium is cemented from stripping solutions with zinc or aluminum powder that zinc powder is preferred [12].

Lee et al. studied separation of indium and gallium from sulfate solutions using $D_2EHPA$. They observed that in the extraction process, the separation factor between indium and gallium decreased with pH and a maximum value of the separation factor was obtained by extracting metals from the mixed solutions with stoichiometric concentration of $D_2EHPA$ to extract both metals. It was found that aliphatic kerosene was superior to benzene as a diluent in respect of loading capacity [13]. Fortes and Benedetto studied separation of indium and iron using $D_2EHPA$. They studied effect of main factors including: extractant concentration, acidity of the aqueous phase and contact time. Their results showed that $D_2EHPA$ can be effectively used to separate indium and iron from acid solutions. It was possible to obtain an aqueous extract with a high concentration of indium with practically no iron [5]. Afterwards, they studied indium recovery from acidic aqueous solutions by solvent extraction with $D_2EHPA$ using statistical approach. The variables studied in the extraction step were $D_2EHPA$ concentration, acidity of the aqueous phase and time of contact between phases. Different hydrochloric and sulfuric