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Acid-Base Behavior of Two Isomeric Organ Phosphorus Extractants in a Biphasic Liquid System: Cobalt Extraction Test

Khayra Mersellem[1*], Djamila Bouazza[2], Hafida Miloudi[2], Pedro Maireles-Torres[3]

[1] Laboratory of applied organic synthesis, University of Oran1, Algeria
[2] Materials Chemistry Laboratory, University of Oran1., Algeria
[3]Department of Inorganic Chemistry, Crystallography and Mineralogy, Faculty of Science, University of Malaga, Spain
*Corresponding author's email: kmersellem@gmail.com

ABSTRACT

The effect of the diluents on the acido- basic behavior of two isomeric organophosphorus acids Cyanex 272 (bis (2, 4, 4-trimethylpentyl) phosphinic acid) and DIOPA (diisooctyl phosphinic acid) in a system with two phases was studied separately by potentiometry in different media (sulfate, nitrate, perchlorate). The values of pK_A of these two ligands were calculated and follow the decreasing sequence, regardless of the medium, for : Cyanex 272: Chloroform >dichloromethane >toluene >cyclohexane >1, octanol DIOPA: chloroform > dichloromethane > toluene > cyclohexane >1, octanol. Encouraging results have been obtained for the extraction of cobalt in biphasic medium chloroform-water, by these two ligands.

Keywords: Constant of acidity, Cyanex 272, DIOPA, Liquid-Liquid Extraction Cobalt.

1 Introduction

Liquid-liquid extraction has an important role, it allows different industrial applications such as the purification of concentrated solutions, separation, recovery and concentration of metallic elements. This technique was also optimized and largely used for the recovery and separation of metals due to its efficiency [1]. The choice of high-efficiency extractants is an essential point. Organophosphates agents have been reported as a good choice [2]. The effect of nature of the diluents is also an important parameter; it allows predicting the possible interactions between the solvent and the solute [3], [4]. The aim of this work is to study the effect of the diluent on the acido-basic behavior of Cyanex 272 and DIOPA in a biphasic system and then study the variation in the nature of the diluent on the extraction of cobalt(II) by these two extractants taken separately.

2 Experimental

2.1 Titration of extractant:

In a thermoregulated cell at 25 °C with a combined glass electrode and magnetic stirrer, are placed: 30 ml of aqueous solution with 30 ml of organic solvent containing the ligand. The mixture is titrated with NaOH and its potential is measured at each volume of NaOH poured.

2.2 Extraction of the cobalt

In a thermoregulated cell at 25 °C, 30 ml of an aqueous solution of Cobalt(II) are stirred with 30 ml of organic solvent containing the ligand. The pH variation of the aqueous phase is done by adding of NaOH. The pH is measured by (GLP 21- Crison) pH meter. The metal concentration in the aqueous phase is determined by an atomic emission spectrophotometer ICP-AES (Perkin Elmer).

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3 Results and Discussion

Table1: *pK_A values of Cyanex 272 and DIOPA in different systems and media*

	pK_A					
	$NaNO_3$		Na_2SO_4		$NaClO_4$	
	Diopa	Cyanex272	Diopa	Cyanex272	Diopa	Cyanex272
Chloroform	10.016	10.072	10.072	9.792	9.740	9.904
Dichloromethane	9.620	9.800	9.624	9.792	9.512	9.512
Toluene	9.344	9.404	9.512	9.560	9.620	9.568
Cyclohexane	9.080	9.176	9.044	9.276	9.040	9.176
1, Octanol	7.328	7.720	7.478	7.478	7.400	7.520

Table2: *Liquid - liquid extraction of Co^{2+} at 100ppm by Cyanex 272 and DIOPA in nitrate medium [Cyanex 272]= [DIOPA]= 0.0199M ; T=25°C; [NaOH]= 0.06375M; [HCl]= 0.0033M ; ⍵=1*

E %								
	Cyanex 272					DIOPA		
pH	Chloroform	pH	1-Octanol		pH	Chloroform	pH	1-Octanol
4.63	6.99	**4.57**	4.20		**4.72**	12.59	**4.83**	7.37
5	17.8	**4.91**	2.52		**5.22**	29.345	**5.29**	14.75
5.33	26.50	**5.36**	21.85		**5.45**	43.15	**5.44**	22.95
5.51	48.42	**5.45**	28.58		**5.68**	59.91	**5.51**	34.42

4 Conclusions

A decreasing sequence of the pK_A values obtained is observed in the different systems for the two extractants in the three mediums in the following order: Chloroform >dichloromethane >toluene > cyclohexane >1, octanol. A better extraction of cobalt(II) is obtained in the presence of the non-polar solvent (Chloroform).

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