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EFFICIENCY OF SODIUM DODECYL BENZENE SULFONATE IN REMOVAL OF Pb(II) IONS TROUGH BULK LIQUID MEMBRANE SYSTEMS

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ABSTRACT

- In this paper, the influence of the anionic surfactant, sodium dodecyl benzene sulfonate (SDBS) on the efficiency of Pb(II) ions removal through a bulk liquid membrane system, were investigated.
- Organic solvents (dichloromethane and chloroform) were used as liquid membranes
- Macrocyclic ligands: 18-crown-6, dibenzo-18-crown-6, dicyclohexano-18-crown-6, and benzo-18-crown-6 dissolved in organic solvents were used as carriers for Pb(II) ions.
- Metal ions concentration in aqueous phases was monitored by flame atomic absorption spectrophotometry, after 3 hours of membrane transport.
- Among the applied solvents, the highest efficiency in the role of liquid membrane showed dichloromethane, for all applied macrocyclic ligands.
- From the aspect of the used macrocycle, the addition of an anionic surfactant in the receiving phase with dichloromethane reflected in an increased amount of removed Pb(II) ions from the source phase, following the order: 18C6>B18C6>DCH18C6>DB18C6.
- Chloroform as a liquid membrane reflected also in an increased amount of removed Pb(II) ions from the source phase, following the order: 18C6>DB18C6>DCH18C6>B18C6.
- 18-crown-6 compared to other ligands proved to be a selective and efficient carrier for the transport of Pb(II) ions via BLM, removing 71% of transported Pb (II) ions from the source phase through dichloromethane, while chloroform slightly lower transport rate (63.4%) was achieved for the same used macrocycle.

Key words: sodium dodecyl benzene sulfonate, Pb(II) removal, bulk liquid membrane

INTRODUCTION

In this work, we examined the effect of an anionic surfactant SDBS in the receiving phase on the efficiency removing Pb(II) ions, trough bulk liquid membrane system.

It has been shown that, in the course of the carrier-mediated transport of a metal ion, the use of an anionic surfactant laying at the MP/RP interface can successfully catalyze the exchange process of the metal ion and measurably facilitate its transport .

The addition of these surfactants to the receiving phase leads to a better transport efficiency.

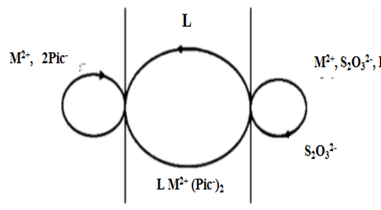
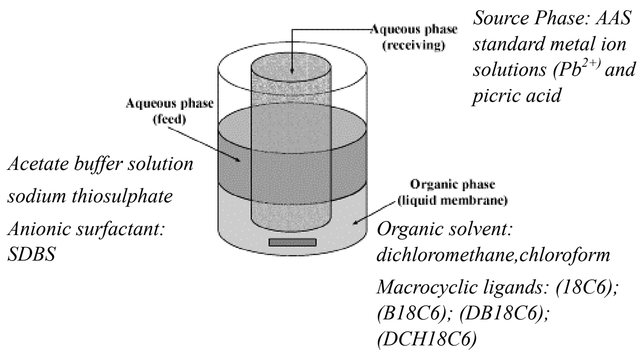


Figure 1. *Proposed mechanism of metal ion transport through an organic liquid membrane containing dissolved ligand (L), from SP (contains: M^{2+} cations and counter ions picrate Pic$^-$)*

MATERIALS AND METHODS



Source Phase: AAS standard metal ion solutions (Pb^{2+}) and picric acid

Acetate buffer solution

sodium thiosulphate

Anionic surfactant: SDBS

Organic solvent: dichloromethane,chloroform

Macrocyclic ligands: (18C6); (B18C6); (DB18C6); (DCH18C6)

Figure 2. "Transport cell" used for the experiment

RESULTS AND DISCUSION

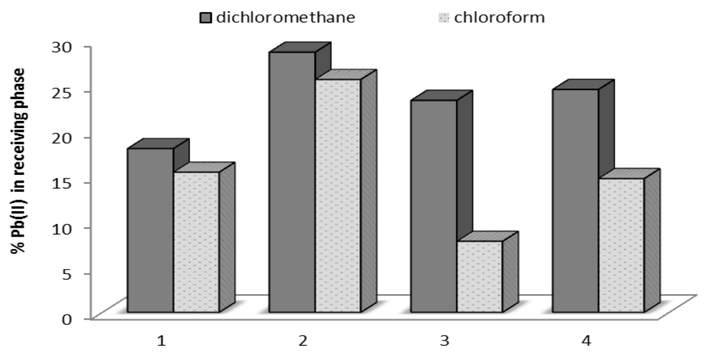


Figure 3. . Influence of the anionic surfactant SDBS on the efficiency transported Pb(II) ions into receiving phase
1-18C6; 2-DB18C6; 3-B18C6; 4-DCH18C6

The efficiency of Sodium Dodecyl Benzene Sulfonate

- The presence of the anionic surfactant SDBS in the receiving phase reduces the content of Pb(II) ions in the source phase and increases the transport rate removed Pb(II) ions to the receiving phase.
- The addition of an anionic surfactant in the receiving phase with dichloromethane reflected in an increased amount of removed Pb(II) ions from the source phase, following the order: 18C6>B18C6>DCH18C6>DB18C6.
- Chloroform as a liquid membrane reflected also in an increased amount of removed Pb(II) ions from the source phase, following the order: 18C6>DB18C6>DCH18C6>B18C6

Table 1. Measured content of Pb(II) ions in aqueous phases of BLM system after 3h of transport for different crown ethers and anionic surfactant (SDBS) in receiving phase

Type of macrocycle in DCM membrane	% Pb(II)			
	SP	MP	RP	REMOVAL
18C6	28.5	53.5	18	71.5
DB18C6	39.7	31.7	28.6	60.3
B18C6	29.7	47	23.3	70.3
DCH18C6	34.3	41.2	24.5	65.7
Type of macrocycle in CH membrane	% Pb(II)			
	SP	MP	RP	REMOVAL
18C6	37.6	48	15.4	63.4
DB18C6	44.7	29.7	25.6	55.3
B18C6	59.3	33	7.7	40.7
DCH18C6	50.3	35	14.7	49.7

Macrocyclic study

- 18-crown-6 (18C6) compared to other ligands proved to be a selective and efficient carrier for the transport of Pb(II) ions via BLM.
- 71% of transported Pb (II) ions from the source phase was removed by using dichloromethan as a liquid membrane.
- 63.4% of transported Pb(II) ions from the source phase was removed through chloroform for the same used macrocycle (18C6).

CONCLUSIONS

- According to the principle of electrostatic attraction, dissociating sodium dodecyl sulfate (SDBS) in aqueous solution, the formed Na (I) ions may replace some exchangeable Pb(II) ions located on the water-organic phase surface and increases transport efficiency.
- Introducing SDBS in the receiving phase to a systems with different macrocycle crown ethers, showed increased transport efficiency for all used ligands
- 18-crown-6 due to its very lipophilic character and its corresponding cavity size for selective complexation with Pb(II) ion, compared to other ligands proved to be a selective and efficient carrier, removing 71.5 % transported Pb(II) ions from source phase through dichloromethan as a liquid membrane after 3 hours of transport experiment.
- Among the applied solvents, the highest efficiency in the role of liquid membrane showed dichloromethane, for all applied macrocyclic ligands

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