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Removal of PB (II) Ions from Aqueous Solutions Using DSS Surfactant Via Cloud Point Extraction

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Abstract: *One of the most important ways to extract and remove contaminants is to use surfactants. Due to the great convenience and diversity of surfactants, the method of cloud point extraction (CPE) has been considered by researchers. In this research, the cloud point extraction was accomplished for the extraction of Pb (II) ions from aqueous solutions using dioctyl sulfososuccinate (DSS) as a gemini anionic surfactant. The effective parameters such as optimum pH, cation concentration, surfactant concentration were investigated. The best condition of extraction with maximum efficiency (94.0%) was determined at pH=7.5-10, cation concentration (50 mg/L), surfactant concentration (5.0%wt).*

Keywords: *Cloud Point Extraction, Surfactant, DSS*

INTRODUCTION

Cloud point extraction (CPE) can be used to extract cations and anions. Sometimes, an appropriate ligand is used to form the desired cationic chelate. An appropriate amount of aqueous surfactant solution is added to the solution containing the analyte and is taken to a cloudy temperature. In the cloudy temperature, the micelles is formed and the cationic or anionic groups enter the middle hole of the micelles either alone or in combined form and hence seperated from the aqueous phase. Therefore, two phases are formed in solution. (Khenifi et al., 2009; Froschl et al., 1997; Hinze et al., 1993; Candir et al., 2008; Zafar et al., 2007). One of them is a rich phase of surfactant containing the desired species and has more density in respect to surfactant and accumulates at the bottom of the container. Different methods can be used to measure the concentration of analyte in a condensed sample. (Mohana et al., 2009; Rafatullah et al., 2009; Dehnoori et al., 2017; Azizinezhad et al., 2017). In this research, extraction of lead ions was performed using DSS surfactant and effective parameters such as surfactant and Pb^{2+} concentrations and pH were optimized.

Materials and Methods

All of materials such as solvent, surfactant and $Pb(NO_3)_2$ were prepared from Merck.co (Germany), and twice-distilled water was used in all experiments. The instruments were used in this study were atomic absorption spectroscopy (GBC 932 AA model) - pH meter device (LUTRON pH-206 model) - heather (ARE model).

Cloud Point Extraction Procedure

Solutions containing Pb^{2+} ions were prepared at different concentrations (50-300 mg / L). Then a 5.0%wt solution of surfactant (DSS) was prepared in a water-alcohol mixture. Extraction operation was carried out in a water bath at 70 °C for 1hour.

Then, the solution was allowed to rest for a period of 24 hours so as to separate the phases. The diluted phase was sampled by the use of a microsyringe and the absorption was measured in λ_{max} of Pb^{2+}. The λ_{max} value of Pb^{2+} was obtained 217 nm. The following equation was helped to determine the extraction amount.

$$R\% = (C_0 - C_e)/C_0 \times 100 \quad (1)$$

In this equation, C_0 and C_e are the primary and final concentrations, respectively. R% is the percentage of removal or extraction of ion.

Effect of pH in extraction

Firstly, the following buffers were prepared and then, the extraction process was accomplished in the presence of Pb^{2+}(50 mg/L), surfactant(5.0%wt) in water bath at the fixed temperature (70 °C).

HCl (1M) + Sodium acetate (1M)→ (0.5-3.5)
Sodium acetate (1M) + acetic acid (0.2M) → (4.0-7.0)
Ammonium chloride (2M) + NH_4OH (1M) → (7.5-10.0)

The effect of DSS concentration in the extraction

For this aim, Pb^{2+}(50 mg/L) was conducted at the different concentrations of surfactant (2.0-10.0%wt) in the optimum pH.

Pb^{2+} concentration effect

The experiments were accomplished at the various concentrations of Pb^{2+} (50-300mg/ L) at the best condition of surfactant concentration and pH.

Results and Discussion

The effect of pH were investigated in the constant cndition of other variables (Pb^{2+}= 50mg/L, V=20ml, DSS=5%wt). The optimum pH was observed in the alkaline range. This is related to the best interaction of the gemini anionic surfactant and Pb^{2+} ions. Fig3. The appropriate amount of surfactant for extraction was recorded in 5.0%wt DSS.Fig4. In excess of the surfactant, extraction was reduced. This is due to the possibility of micelles accumulation which prevents the proper effect of surfactant. As the concentration of ions and their aggregation increased, extraction operations were reduced. Fig5.

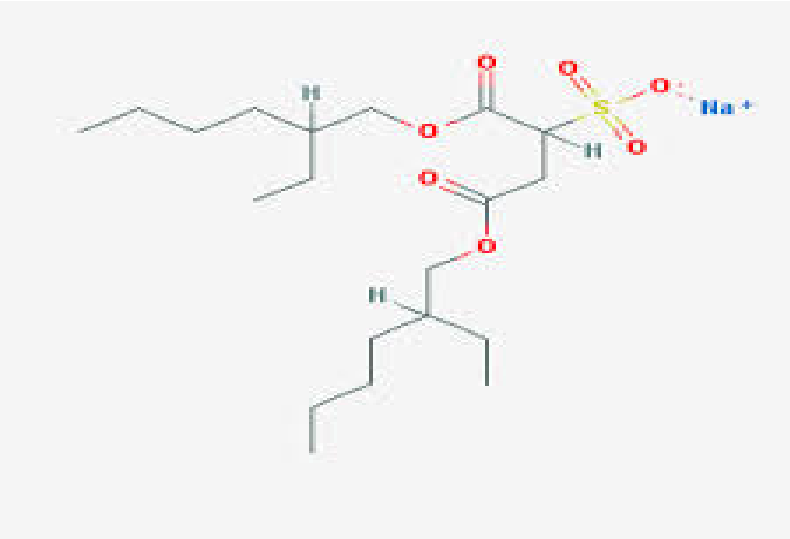

Figure 1: DSS structure

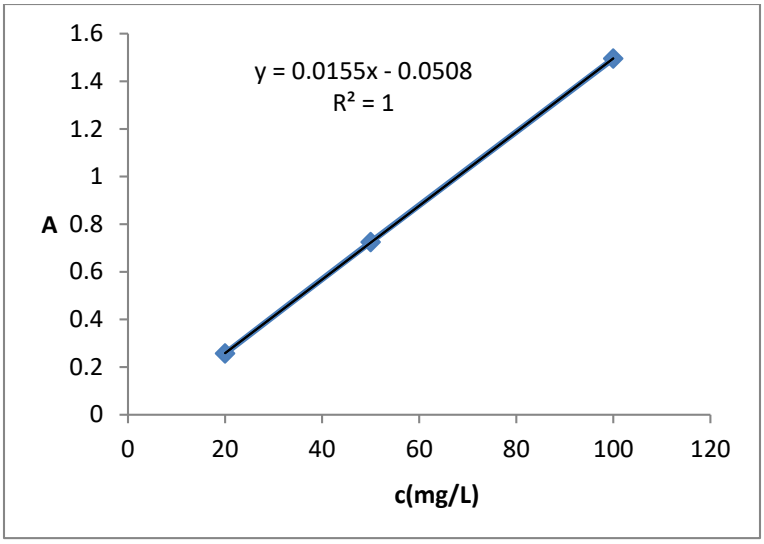

Figure 2: The calibration curve of Pb^{2+}

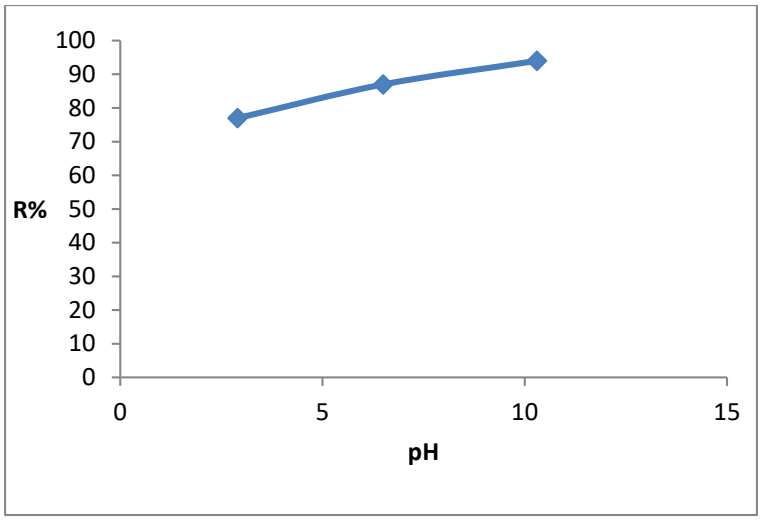

Figure 3: Effect of pH in Pb (II) extraction (C= 50mg/L, V= 20ml, DSS= 5.0%wt)

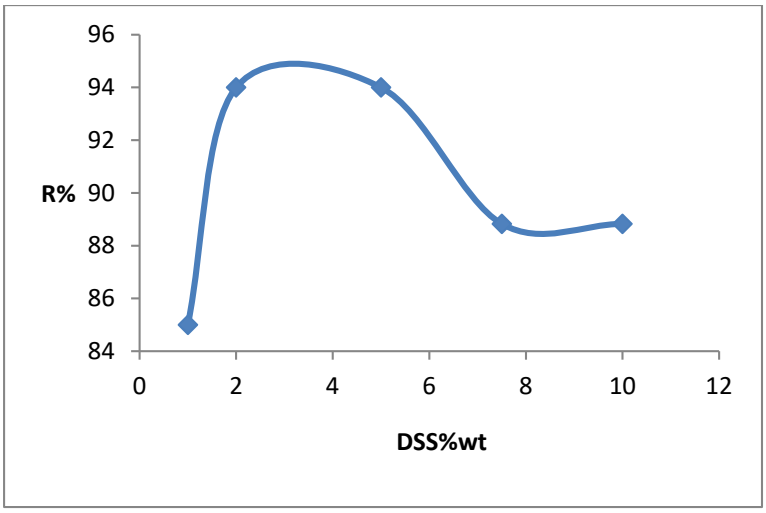

Figure 4: Effect of DSS in extraction (C= 50mg/L, V= 20ml, pH= 10.0)

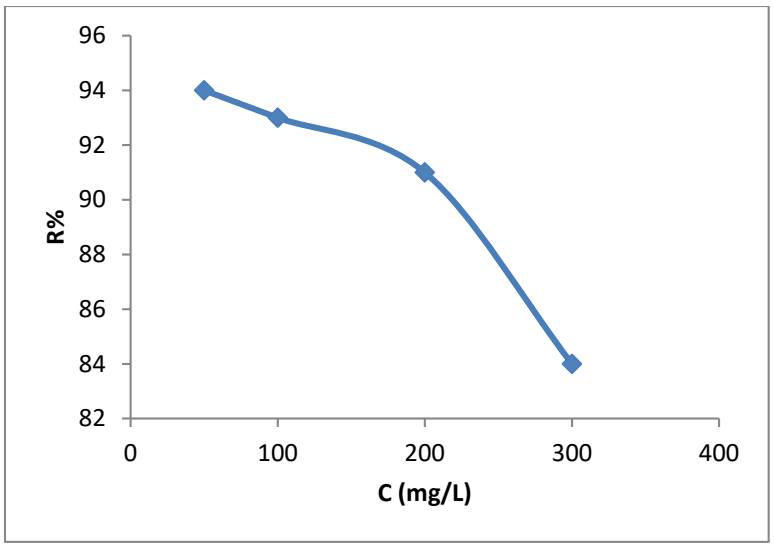

Figure 5: Effect of Pb (II) concentration in extraction (DSS= 5.0%wt, V= 20mL, pH= 10.0)

Conclusion

This research showed that, extraction can be carried out using gemini anionic surfactant. The contamination of this method is low and economic. The best extraction conditions were recrded (pH=7.5-10, cation concentration (50 mg/L), surfactant concentration (5.0%wt). It is suggested that this surfactant be used to extract aromatic pollutants and colors

References

1. Azizinezhad F., Borzou A., (2017), "Cloud Point Extraction of Dyes by the use of Sorbitol and Triton X-100 Surfactants" Pharmacophore.J, 8(6S) e-1173900.
2. Candir S., Narin I., Soylak M., (2008)**,"** Ligandless cloud point extraction of Cr(III), Pb(II), Cu(II), Ni(II), Bi(III), and Cd(II) ions in environmental samples with Tween 80 and flame atomic absorption spectrometric determination", Talanta., (77) (1) 289-293.
3. Dehnoori H.R., Azizinezhad F., Moghimi A., (2017), "Removal of nickel (II) ions from aqueous solutions using OC-30 surfactant via cloud point extraction " Helix.J, (8) ,1274-1278.
4. Froschl B., Stangl G., Niessner R., (1997) "Combination of micellar extraction and GC-ECD for the determination of polychlorinated biphenyls (PCBs) in water", J. Anal. Chem,357 (6), 743-746.
5. Hinze W.L, Pramauro E, (1993),"A Critical Review of Surfactant-Mediated Phase Separations (Cloud-Point Extractions): Theory and Applications", Critic. Rev. Anal. Chem, (24) (2) 133-177.
6. Khenifi A., Zohra B., Kahina B., Houari H., Zoubir D, (2009),"Removal of 2,4-DCP from wastewater by CTAB/bentonite using one-step and two-step methods: A comparative study", Chem.Eng. J,146 (3), 345-354.
7. Mohana S., AcharyaB. K, Madamwar D., (2009),"Distillery spent wash: Treatment technologies and potential applications", J. Hazard. Mater, (163) (1) 12-25.
8. Rafatullah M., Sulaiman O., Hashim R., Ahmad A., (2009), "Adsorption of copper (II), chromium (III), nickel (II) and lead (II) ions from aqueous solutions by meranti sawdust", J. Hazard. Mater, (170) (2-3) 969-977.
9. Zafar N.M., Nadeem R., Hanif M.A., (2007),"Biosorption of nickel from protonated rice bran", J. Hazard.Mater,143(1-2) 478-485.