

Cloud point extraction-spectrophotometric method –A review

Dalia. M. Jamil¹, Evon Akram¹, Shaimaa bassim², Alaa Shayea Shubram³

¹Department of Chemistry, Collage of Science, Al-Nahrain University, Iraq

²Department of Applied Sciences, University of Technology, Baghdad- Iraq

³Basic Science, Nursing College, Baghdad University

Abstract

Cloud point extraction (CPE) combined and back extraction (BE) was proposed of favorite's option in contrast to liquid-liquid extraction. Cloud point extraction (CPE) was detachment also fixation technique was impressively equipped follow substance assurance of considerable amount in various models. The large significant points of interest are simple techniques, ease, high pre-fixation factors, natural wellbeing and concurrence with the "green science" standards. The CPE, non-ionic superficial in watery arrangements structure appendix also this arrangement gets muddy to warmed of cloud point heating. Colored products can be effectively separated by a nonionic surfactant Triton Microwave-or ultrasonic-helped BE should be complete then CPE also prior infusion this substance of device examination through gas chromatography-mass spectrometry, uv spectroscopy, gas chromatography or high-per-formance liquid chromatography. This article audits chosen distributed logical researching for the use in CPE-BE of assurance of bases, organophosphorus mixes also antibiotic in a few complexes matrices. The strategy should be raising the level of for use in scientific learning.

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1. Introduction

In legal sciences, novel surfactant science utilizing surfactant totals should be equipped to separate different polar also non-polar parts [1]. The cloud point extraction strategy of assurance of follow measures of phenol is described by spectrophotometry. Procedure was depend on color interaction of C₆H₅OH to diazotized p-nitroaniline a basic media also CBE of azo color item utilizing in nonionic superficial Triton X-114. This impacts of response also extraction measurements are contemplated with ideal measurements are set up [2]. The coupling reaction of phenol with diazotized p-nitroaniline produces the colored azo dye product as shown in fig.1.

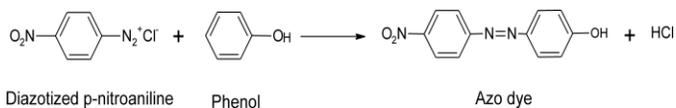


Figure 1: Coupling reaction of phenol with diazotized p-nitroaniline [2]

The azo product is a non-ionic dye and that is extracted into the non-ionic surfactant, Triton X-114, hence this is a suitable method for the separation and pre-concentration of phenol by CPE. Partition also pre-focus, in view of cloud point extraction (CPE), is turning out to be significant and handy application in analysis chemistry, utilizing surfactant, were developed. CPE is green technique of accompanying causes it utilize sasan concentrate or media weaken devastation delicate he surfactant that are cheap, bringing about economy of reagents also obstetrics of not many research center deposits, and surfactants are not poisonous, not unstable, and not effectively combustible [3].

Two spectrophotometric procedures are evolved of appreciation of cefdinir (CFD). The first method depends on the conversion of cefdinir to diazonium salt of cefdinir, and then coupled with the 2, 5-Dimethylphenol (2, 5-DMP) reagent in the alkaline medium. The formed azo dye has a purple color with absorption intensity at λ_{max} 510 nm [4]. The examination of follow measures of natural mixes in various ecological and organic examples might be considered as a troublesome diagnostic strategic, because of their low fixation and complex example framework, which needs

Corresponding author: Dalia M Jamil

Email Address: daliamahmood34@yahoo.com

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progressed instrumental procedures or a pre-focus technique like cloud point extraction (CPE). The cloud point extraction strategy has produced across the board enthusiasm as an option in contrast to customary extraction [5]. The ergosterol was detected in rat plasma, urine, and faeces samples collected from 0 to 36 h after an oral administration. The results indicate that the ergosterol levels in faeces are much higher than those in plasma and urine of the rat (Fig. 2a). Almost 62.5% of loading dose is cumulative in the faeces within 36 h after an oral dose with a dosage of 100 mg/kg (Figure 4(a)), but the lower level of ergosterol was found in urine as shown in fig.2b [5].

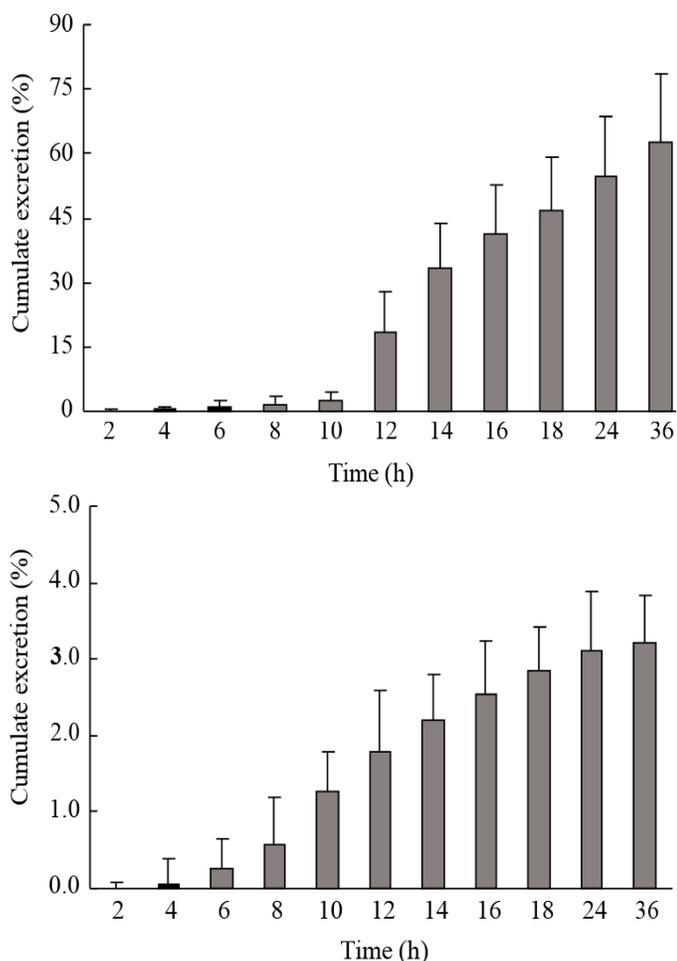


Figure 2: Cumulative excretion of ergosterol in faeces (a) and urine (b) of rats after an oral dose with a dosage of 100 mg/kg. Faeces were collected after administration in different periods (0–2, 2–4, 4–6, 6–8, 8–10, 10–12, 12–14, 14–16, 16–18, 18–24, and 24–36 h) [5]

In aqueous solution for surfactants micellar frameworks, temperature at which arrangement gets turbid before partition into two stages (a surfactant-rich phase also a watery stage) known as cloud point [6]. Cloud point extraction (CPE) was division also pre focus strategy that has been impressively equipped follow substance assurance of considerable amount of various lattices. Its most significant points of interest are basic trial systems, ease, high pre - focus factors, natural wellbeing and concurrence with the "green science" standards. In this technique utilized a TritonX-114 as a surfactants of division two stages fluid and

natural stages. Spectrofluorometric assurance at that point utilized for assurance of Cu(II) at $\lambda_{ex} = 366$ nm also $\lambda_{em} = 447$ nm to improvement response with Amoxicillin medicate. The concoction factors influencing the partition and assurance system were enhanced. In ideal conditions Beer's law is equipped in range 0.01–1.1 $\mu\text{g} \cdot \text{mL}^{-1}$. Proposed technique was applied effectively for assurance Cu (II) of normal also waste water [7]. Group also cloud point spectrophotometric strategies were created for estimation of catecholamine drugs. Clump strategy depends on diazotization of 2-aminothizole also together to adrenaline and dopamine separately. The came about color gives medium violet hue and adrenaline is showing most extreme ingestion at λ_{max} (565) nm, also black out damage hue to dopamine this show greatest assimilation at λ_{max} (555) nm. The cloud point extraction technique depends on partition also pre-concentration of violet color with UV-visible spectrophotometry identifies [8]. CPE extraction of item from oxidative coupling between diminished CLO also phloroglucinol (PHG) utilizing Triton X-114 as surfacial. The item was extricated by micelles of the non-ionic surfacial (TritonX-114) also along these lines recognized spectrophotometrically at explicit 543 nm [9].

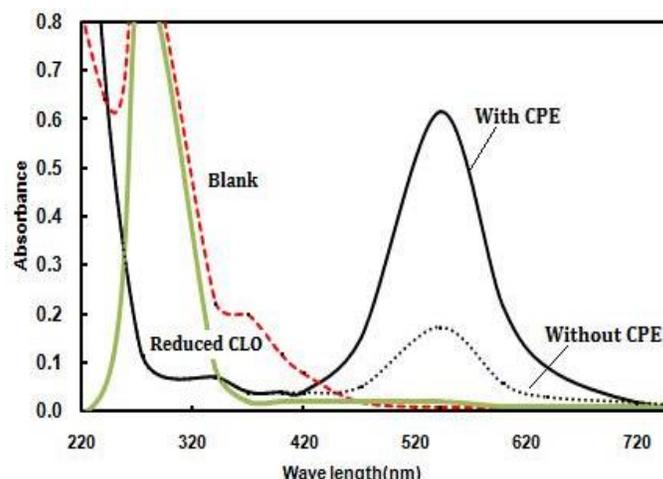


Figure 3: Absorption spectra of 20 $\mu\text{g}/\text{mL}$ of reduced CLO treated as described under procedure (pink product) measured against reagent blank with and without CPE, and the reagent blank and reduced CLO measured against distilled water [9].

Spectrophotometric investigations were carried out to study the formation of coupling product between CLO and PHG in the presence of the NaIO_4 . This reaction was adopted to determine CLO using CPE procedure. The absorption spectra of the colored product and the blank were recorded before and after extraction between 200 and 750 nm as shown in fig. 3. It was observe that there is a significant absorption bands with shoulder occurred at 543 nm, indicating the formation of a complex between CLO drug and PHG reagent. Whilst pure CLO solution gave absorption maximum at 273 nm, therefore, the wavelength maximum of 543 nm for color complex was chosen throughout [9] Spectrophotometric technique combined with cloud point extraction (CPE) is still provided attractive features in routine analyses of metals and organic compounds in many matrices as an alternative of using an expensive instrumentations mentioned

above [10-11]. Cloud point extraction with inductively coupled plasma mass spectrometry (ICPMS) was equipped to examination of zinc oxide nanoparticles (ZnO NPs, mean width ~40 nm) in water also wastewater tests. Five CPE factors, surfactant (Triton X-114 (TX-114)) fixation, pH, ionic quality, hatching heating, and brooding time, were explored and improved by symmetrical cluster structure [12]. To build up another expository strategy for the extraction and pre-convergence of V (IV) also (V) species in genuine examples by cloud point extraction (CPE) combined with spectrophotometry utilizing two recently research facility made chelating reagent [13]. In our recently published paper concerning the speciation analysis of iron by using CPE- Spectrophotometry [14], we have made clear in detail the importance of challenges facing the analysts in the analysis of various oxidation states of metals and we focused on the difficulty of choosing the appropriate analytical method, especially when metal species present at low concentration level and in the complex matrices. However, we have been able to overcome some of the difficulties in the analysis of iron species, since the results were satisfactory and worthwhile, which encouraged the authors to engage in more complicated topic, namely the separation and determination of vanadium species by using the same above methodology.

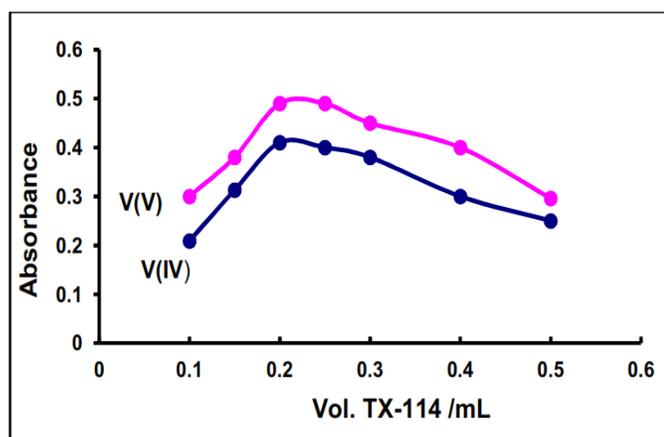


Figure 4: Effect of Triton X-114 amount on the CPE of V (V) and V (IV) complexes [18]

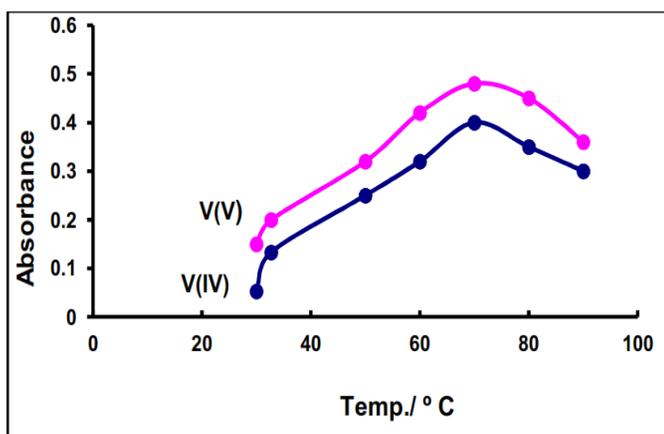


Figure 5: Effect of temperature on the extraction of V (V)/V (IV) complexes by CPE [18]

The main reasons for the choice of vanadium in this work are its analysis difficulty which lies in the possibility of redistribution of vanadium species, particularly when the environment of the sample is changing [15], its biological and environmental importance and the few papers published in chemical literatures related to the use of cloud point extraction as compared to more common elements such as Fe, Hg, As and Se. Vanadium exists in various oxidation states, but the most two common species occurring in environmental and biological systems are vanadium (IV) and vanadium (V) [16-17]. The methods are based on an oxidative coupling reactions of the medicine AMX with oxidized form of 2, 4- dinitrophenylhydrazine (2, 4-DNPH) by sodium periodate in basic medium to give dark purple-colored (method A) and reaction with 4-aminoantipyrine (4-AAP) in presence of sodium periodate in basic medium to give an orange-colored product (method B). The colored products can be easily extracted by a nonionic surfactant Triton X-114 and AMXT determined spectrophotometrically at λ_{max} of 554 nm and 479 nm respectively. All experimental parameters that impact on CPE efficiency of the colored products were thoroughly studied by the using classical optimization [18]. Fig. 4 shows the impact of Triton X-114 amount on extractability of the two complexes within the surfactant volume range of 0.1 – 0.4 mL of 10% (v/v) Triton X-114 at previously established optimum conditions. It can be seen that the absorbance for both ions increased by increasing the Triton X-114 concentration up to 0.2 of 10% (v/v) for V (V) and V (IV) and then suddenly decreased at higher amounts. Thus 0.2 mL of 10% (v/v) Triton X-114 was used as the optimum amount for V (V) and V (IV) for subsequent experiments. Fig. 5 shows the influence of the equilibrium temperature ranged from 30 to 80 at 10 min on extraction of the two complexes by CPE. It was shown that a maximum absorbance signal was achieved when the temperature at 70°C for both species [18]. The Cloud with melt down Point Using ASTM (American Standard Test Method). The paper was action in the LIET (Lords Institute Of Engineering And Technology) Campus (17.341698, 78.368758) using Seta Cloud and melt down Point Bath. We read Cloud with melt down mark Of Normal Paraffine, Diesel, Stanadyne with Mix [19]. Nanotechnology was defined of mood, implosion, with jugglery of materials, instrumental, or systems at the nanometer scale [20]. Nano-materials are usually defined as materials smaller than 100 nm and have unique properties when compared with their macroscale counterparts, due to the high surface to volume ratio and novel physicochemical properties for example color, solubility, with thermodynamics [21-22]. Nano-emulsions were usually kinetically stable with slightly turbid for clear. The weak light scattering of particles in nano-emulsions, they are suitable for incorporation into optically transparent products such as fortified soft drinks with waters, whitening cosmetics, sauces, with soups [23–26]. These current applications of nanotechnology in food science according to flavor control, enhancement of bioavailability to bioactive substances, with detetermine of deleterious samples in foods are presented. Furthermore, this article overviews classification, preparative procedures, and safety issues of nano-materials for food science [27].

2. Conclusion

In this piece of work, a new synthesized applied for complication of mercury less for extraction and detected by mixed CPE/spectrophotometry, was discuss of rise the sensitivity, limit for detection, selectivity with promotion the popularity of UV-Vis spectrophotometry beside the solvent-free extraction of toxic metallic from compound model. Pre-concentration factor of the procedure was higher than other studies. When the processes of the methods are compared, developed method was do shorter extraction time and less operation heat than others. Advanced CPE was useful, simple, environment friendly, reliable with high extraction efficiency, lower cost, fast extraction, and low energy consumption. At last, the procedure may be used for routine applications in routine quality control laboratories which do not have expert analyst with complicated device.

References

- [1] Shivpoojan Kori; Cloud point extraction coupled with back extraction: a green methodology in analytical chemistry; Forensic Sciences Research; ISSN: 2096-1790 (Print) 2471-1411; 2019.
- [2] Ali Reza Zarei, Forouzan Gholamian and Soheila Chalavi; Micelle-Mediated Extraction and Cloud Point Pre-concentration for the Spectrophotometric Determination of Phenol in Water Samples; S. Afr. J. Chem., 2011, 64, 158–162.
- [3] M.A. Bezerra, M.A.Z. Arruda, S.L.C. Ferreira, Appl. Spectrosc. Rev., 2005, 40, 269–299.
- [4] Mohammed Jasim M. Hassan, Omar Qusay Mizher*; Cloud Point Extraction for the Spectrophotometric Determination of Cefdinir; Al-Mustansiriyah Journal of Science; ISSN: 1814-635X (print), ISSN:2521-3520; Volume 30, Issue 1, 2019.
- [5] Y. Zhao, D. Chen, J. An, Y. Feng, and T. Tian, "Cloud-Point Extraction Combined with Liquid Chromatography for the Determination of Ergosterol, A Natural Product with Diuretic Activity in Rat Plasma, Urine, and Faeces Cloud-Point Extraction Combined with Liquid Chromatography for the Determination," vol. 2013, no. April 2016, pp. 6–11, 2013.
- [6] W. J. Zhao, W. Liu, J. B. Chen, Z. M. Zhou, and M. M. Yang, "Use of cloud point extraction with derivatizing reagent for the extraction and determination of isoniazid," J. Chromatogr. Sci., vol. 49, no. 2, pp. 154–158, 2011.
- [7] Ahmed S. Abbas; Hussein Abdulkadhim; Yahya AL- Khafaji; Cloud Point Extraction as a Procedure of Separation and Pre-Concentration for Cupper (II) Determination Using Spectrofluorometric Techniques; August 2018; Journal of Pharmaceutical Sciences and Research 10(7):0975-1459.
- [8] Mohammed_Hassan; Batch and Cloud Point Extraction Spectrophotometric Methods for the Determination of Two Types Catecholamine Drugs; 2017, International Journal of ChemTech Research 10(9).
- [9] Hind Hadi Abdullah; cloud-point extraction and spectrophotometric determination of clonazepam in pharmaceutical dosage forms; bull. Chem. Soc. Ethiop. 2017, 31(3), 373-382; issn 1011-3924 □ 2017 Chemical Society of Ethiopia and The Authors; Printed in Ethiopia.
- [10] Khammas, Z.A.A.; Jawad, S.K.; Ali, I.R. A new approach for extraction and determination of manganese in environmental samples using cloud-point extraction coupled with spectrophotometry. Chem. Sci. Trans. 2014, 3, 255-267.
- [11] Khammas, Z.A.A.; Jawad, S.K.; Ali, I.R. A new spectrophotometric determination of chromium (VI) as CrO₇²⁻ after cloud-point extraction using a laboratory made organic reagent. Global J. Sci. Frontier Res. Chem. 2013, 13, 9-19.
- [12] Seyed Mohammad Majedi,† Hian Kee Lee,*‡, ‡ and Barry C. Kelly; Chemometric analytical approach for the cloud point extraction and inductively coupled plasma mass spectrometric determination of zinc oxide nanoparticles in water samples; Supporting Information.
- [13] Zuhair_Khammas; Khalid_Al-Adilee; Two-Steps Cloud Point Extraction-Spectrophotometric Method for Separation, Pre-concentration and Determination of V (IV) and V (V) Ions in Real Samples Using Laboratory-Made Organic Reagents; January 2015.
- [14] Ibrahim ZT, Khammas ZAA, Khadhim KJ. Determination of micro amounts of Fe (II) and Fe (III) in tea and rice samples by cloud-point extraction-spectrophotometry using a new chelating agent. Int J Chem Sci. 2014; 12 (4):1189-1207.
- [15] Pyrzyńska K. Some Problems in speciation Analysis of Vanadium. Adnan Menderes University, 4th AACD Congress, 29 Sept- 30 Oct. 2004, Kuşadası-Aydın/Turkey Proceedings Book 006.DOC; 2004.
- [16] Crans DC, Bunch RL, Theisen LA. Interaction of trace levels of vanadium (IV) and vanadium (V) in biological systems. J Am Chem. Soc. 1989; 111: 7597-7607.
- [17] Cornelis R, Caruso J, Crews H, Heumann K. Handbook of elemental speciation II– species in the environment, food, medicine and occupational health. John Wiley & Sons Ltd, the Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England; 2005.
- [18] Zuhair A. A. Khammas, Zianab T. Ibrahim1 and Khalid J. Al-adilee; Two-Steps Cloud Point Extraction- Spectrophotometric Method for Separation, Pre-concentration and Determination of V (IV) and V (V) Ions in Real Samples Using Laboratory-Made Organic Reagents; International Research Journal of Pure & Applied Chemistry 8(1): 33-48, 2015, Article no.IRJPAC.2015.072 ISSN: 2231-3443.
- [19] Akhil A G, ,Mohammed Aiman Koya P K, Akhilesh S, Muhammad Ashif C A 1 ,Salman Khan2 ,Dr.Rajesh Kanna3; Determination of Cloud And Pour Point of Various Petroleum Products; International Refereed Journal of Engineering and Science (IRJES) ISSN (Online) 2319-183X, (Print) 2319-1821 Volume 6, Issue 9 (September 2017), PP.01-04 www.irjes.com.
- [20] M. Fathi, M.R. Mozafari, and M. Mohebbi, "Nanoencapsulation of food ingredients using lipid based delivery systems," Trends in Food Science Technology, vol. 23, no. 1, pp. 13–27, 2012.
- [21] M. Zhu, G. Nie, H. Meng, T. Xia, A. Nel, and Y. Zhao, "Physicochemical properties determine nanomaterial cellular uptake, transport, and fate," Accounts of Chemical Research, vol. 46, no. 3, pp. 622–631, 2012.
- [22] T. Singh, S. Shukla, P. Kumar, V. Wahla, V. K. Bajpai, and I. A. Rather, "Application of nanotechnology in food science: perception and overview," Frontiers in Microbiology, vol. 8, p. 1501, 2017.
- [23] T. Wang, S. Soyama, and Y. Luo, "Development of a novel functional drink from all natural ingredients using nanotechnology," LWT-Food Science and Technology, vol. 73, pp. 458–466, 2016.
- [24] P. Boonme, V. B. Junyaprasert, N. Suksawad, and S. Songkro, "Microemulsions and nanoemulsions: novel vehicles for whitening cosmeceuticals," Journal of Biomedical Nanotechnology, vol. 5, no. 4, pp. 373–383, 2009.
- [25] H. D. Silva, M. A. Cerqueira, and A. A. Vicente, "Nano- emulsions for food applications: development and characterization," Food and Bioprocess Technology, vol. 5, no. 3, pp. 854–867, 2012.
- [26] K. Lane, E. Derbyshire, C. Smith, K. Mahadevan, and W. Li, "Sensory evaluation of a yogurt drink containing an omega-3 nanoemulsion with enhanced bioavailability," Proceedings of the Nutrition Society, vol. 72, no. OCE2, p. E99, 2013.
- [27] Hyunjong Yu, Jun-Young Park, Chang Woo Kwon, Sung-Chul Hong, Kyung-Min Park, and Pahn-Shick Chang Nanotechnology in Food Science: Preparative Methods, Practical Applications, and Safety; Journal of Chemistry; 2018; 10; <https://doi.org/10.1155/2018/5427978>.

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