Journal of Novel Applied Sciences
Available online at www.jnasci.org
©2013 JNAS Journal-2013-2-10/541-545
ISSN 2322-5149 ©2013 JNAS

Determination trace amounts of cationic surfactants cethyle tri methyl ammonium bromide (CTAB) by method of spectrophotometry extraction

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ABSTRACT: In this project a method of simple spectrophotometric extraction for determination trace amounts of surfactant cationic cethyl tri methyl ammonium bromide (cetermide) has been provided. Cetermide is a fungicide factor and has detergent property, includes a vast range of antibacterial agents .This composition is a component and has property of destroying cellular processes of micro-organisms and as fungicide factor, prevents bacterial growth and other micro-organisms of pathogenic and is used for hair and mucous membranes.

***Keywords*:** surfactant extraction couple ion, concentration, volume.

INTRODUCTION

Liquid-liquid extraction is a process in which transfer of solute from a solution liquid (usually aqueous) to other solution (usually organic) for purpose of separation or purification of compounds has been used and mostly is basis of extraction difference in chemical or physical properties of compounds. In liquid-liquid extraction second solvent necessarily with first solvent is becoming insoluble and so one or more substances solute from first solution is transferred to second solution. Components of mixture, distribute between two phase which these two phases can be separated mechanically .As much as distribution ratio in two phase has more difference, separation will be more practical .Usually one of solvents is polar and in most cases is water and other solvent, is an organic liquid with low polarity which is used as extractor. By this method separation of trace amounts and also very much amounts of substances is used. Liquid-liquid extraction system for separation different types of organic compounds has been used and aim of this action is separation or concentrating desired substance and or in some cases abator of them. Separation substances in this process is simple, clean, quick and suitable.

In this article determination amounts of (CTAB) by method of forming ion couple with orange (II) and liquid-liquid extraction have been studied .For creation best conditions of forming ion couple (-CTA+RSO3)and in fact obtaining most sensitivity in surfactant extraction CTBA all factors affecting on extraction have been reviewed.

Method of changing one variable in time, is most general method of optimization which by Friedman and Savage has been provided .In this method all factors affecting on extraction ,except one factor, were kept fixed and then by changing this factor its effects have been studied ,for finding best condition (concentration or optimized parameter) with maximum sensitivity. Performance of each changing must be independent of each other and must not have mutual effect on each other.

OBJECTIVES OF THE PAPER

- Study effect of PH of aqueous solution on rate of extraction ion couple
- Study volume effect of buffer on rate of extraction ion couple
- Study NaCl effect on rate of extraction ion couple
- Study anionic color concentration on rate of extraction ion couple

- Study agitation time on rate of extraction ion couple
- Study effect of extractor organic solvent volume on rate of extraction ion couple

Experimental part

Equipment

1-Spectrophotometer VIS-UV mono ray model- (6505) JENWAY
2- Glass cubical one centimeter cells
3- PH meter model HURIBA-(11-F)
4-Four digit digital balance model METTLER COLLEGE 150
5- Glass dishes such as: separating funnel, glass flask, pipette, and ….
6- Water of two times distillate
7- Organic solvents of carbon tetrachloride, dichloromethane and chloroform
8- Cationic surfactants cethyl tri methyl ammonium bromide (CTAB)
9- Acidic and Basic buffer solutions formed by acetic acid, phosphoric acid and ammonium in range of PH (3-11)
10- Sodium chloride salt
11-Anionic colors orange (II), methyl orange and methyl red
All chemicals used have highest purity and manufactured by MERCK Germany.
With attention to basis of extraction cationic surfactant (CTAB), is forming ion pairs between cationic ion of this surfactant and an anionic color, in this research orange (II) anionic color among mentioned colors by having highest rate of absorption and sensitivity has been selected and maximum wavelength of absorption for ion couple (-RSO3 + CTA) has been determined.

Effect of variables

Selection best system of extraction solvent

In order to better extraction ion couple (-RSO3 + CTA) from aqueous phase to organic phase, three organic solvents chloroform, dichloromethane and carbon tetrachloride with consideration four factors of agitation time ,separation time ,repetition results and maximum absorption of sample have been tested. Chloroform organic solvent as best solvent in this test has been selected and in all next steps for extraction has been used.

Study PH effect of aqueous solution on rate of extraction ion couple

Since principle of this research is extraction ion couple (-RSO3 +CTA) cationic surfactant (CTAB) is sensitive to medium PH .So, it is based on reaching to highest rate of extraction ion couple. According to studies made of extraction, action of extraction in buffer environments of acidic and basic in range of PH=3-11 have been studied.

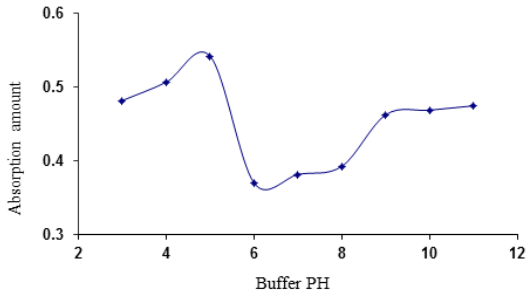

Figure 1. Effect of Buffer PH on rate of absorption ion couple (-RSO3 +CTA) – O3

Addition buffer with PH=0 ,rate of transfer ion couple (-RSO3 +CTA) from aqueous phase to organic phase is increased .Maximum absorption 0.542 relative to initial sample (with absorption 0.520 which had not buffer) has been observed. So, in next steps optimization from buffer with PH=5 in ranges of sample and witness has been used.

Study effect of buffer volume on rate of extraction ion couple

After selection optimized state buffer environment with PH=5, study of volume effect of buffer on rate of extraction and absorption ion couple (-RSO3 + CTA) has been done. Volume increase 2.5 ml from buffer with PH=5 causes maximum rate of extraction and absorption and so in next steps optimization, 2.5 ml of buffer with PH=5 has been added to witness and sample maximum buffer was PH=5

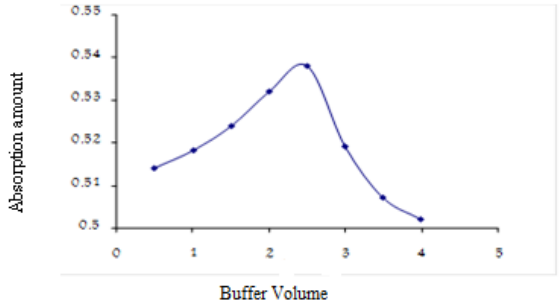

Figure 2. Relation between rate of absorption and buffer volume

Study effect of NaCl salt on rate of extraction ion couple

In order to better and faster separation of aqueous and organic phases from each other NaCl aqueous solution in this step has been used and its effect on rate of extraction has been studied.

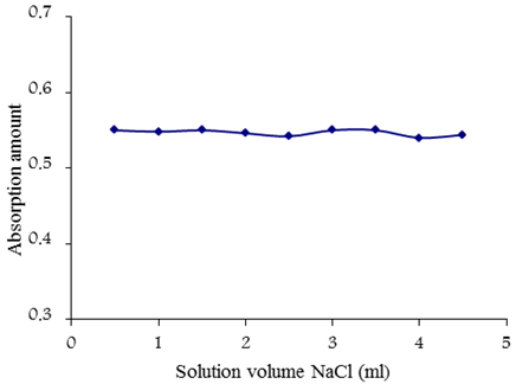

Figure 3. Relation between rate of absorption and NaCl solution volume

Increasing NaCl solution to aqueous solution has not much effect on extraction ion couple to organic phase, but causes separation and dissociation two phase medium faster. So, volume of 0.5 ml of NaCl with concentration 0.1 Mas optimized volume of salt has been selected. Figure (3) shows relation between rate of absorption ion couple (-RSO3 +CTA) in various volumes of NaCl.

Study effect of anionic color orange (II) concentration on rate of extraction ion couple

With increase of anion color amount, absorption is increased linearly.

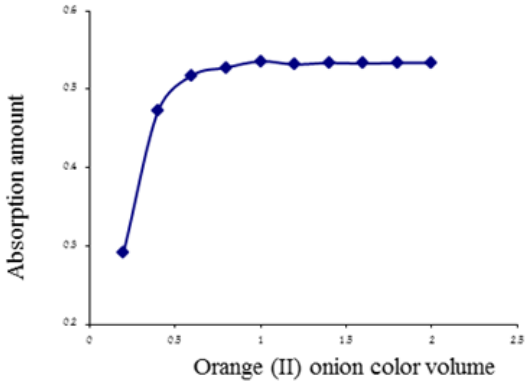

Figure 4. Relation between rate of absorption and orange (II) color solution

This increase from volume 0.2 ml to 1.0 ml is observed and then nearly increasing color solution volume has not any effect on absorption rate and no significant change is observed. So, this volume of 1 ml with maximum

absorption rate of 0.536 for doing next steps of test as optimized volume of anionic color orange(II) with concentration 5x10-1 molar has been selected.

Study effect of agitation time on rate of extraction ion couple

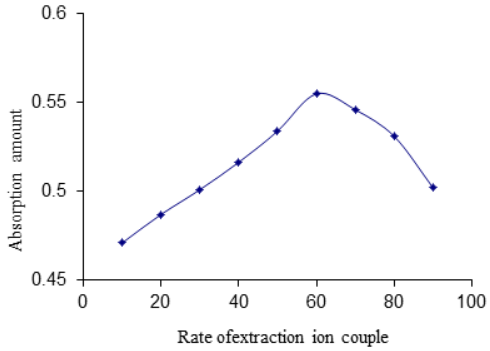

Figure 5. Relation between rate of absorption ion couple and agitation time

In order to optimization extraction ion couple (-RSO3 +CTA) after optimization medium PH, buffer volume, NaCl solution volume and anionic color orange (II) volume in used concentrations, time factor was another important factor which has been studied.

With consideration maximum sample absorption relative to witness ,it was observed that with increasing agitation time of solutions ,absorption until 60 s time is increased and in higher times because of increase of rate of absorption witness solution relative to solvent pure chloroform, rate of absorption sample solution relative to witness solution is decreased. With this study agitation time of 60 s is suitable time for agitation and having highest absorption, has been selected. Relation between rate of absorption ion couple and agitation time has been shown in Figure.

Study effect of organic solvent volume extractor on rate of extraction ion couple

Volume of 3 ml from chloroform organic solvent with maximum absorption of ion couple (-RSO3 +CTA) as optimized volume of extractor solvent has been selected .

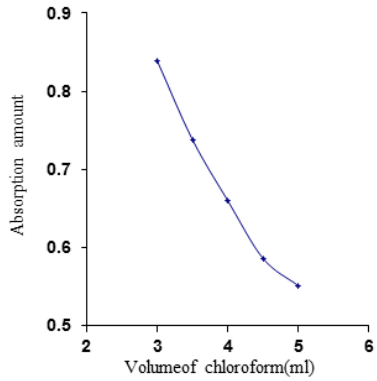

Figure 6. Relation between rate of absorption ion couple and volume of organic solvent chloroform

Rate of absorption ion couple against solvent volume has been shown in Figure.

Study effect of cationic and anionic disturbances on extraction CTAB

In this section effect of probable disturbances types of anionic and cationic 20 types of salts ,on extraction CTAB has been studied and in case of absorption results ,with absorption standard sample is without disturbance type ,equal or having less error percentage of 2 percent ,it will be called non-disturbance and otherwise it will be accounted disturbance. With study effect of disturbance factors which are mostly cationic ions and anionic ions desired in higher concentrations than used concentrations have made disturbances but in lower concentrations in optimized conditions CTAB have not disturbances and only anionic composition of –SO3 is disturbance of system.

CONCULSION

With attention to that principle of extraction surfactants cationic cetyl tri methyl ammonium bromide (CTAB) forms ion couple between cation of this surfactant and anionic color orange (II), contrary to previous methods which for measuring this compound have been used, there is no needs to complicated equipment such as HPLC and is a fast method, sensitive and simple with good repetition. In this research following steps respectively have been studied:

Effect of acidic and basic buffers on extraction rate: Since basis of this research works is on extraction ion couple (-RSO3 +CTA), according to studies made extraction cationic surfactant (CTAB) has become sensitive to medium PH .So, for reaching to highest rate of extraction ion couple, action of extraction in acidic and basic buffer mediums in range of PH=3-11 have been studied and it was observed that optimized PH of reaction medium, has become PH=5. Effect of buffer volume on rate of extraction and absorption ion couple (-RSO3 +CTA) has been reviewed and it was observed that volume increase of 2.5 ml of buffer with PH=5 caused maximum rate of extraction and absorption.

Effect of salt on rate of extraction: In order to better and faster separation of aqueous and organic two phases from each other NaCl salt solution has been used in this test and its effect on rate of extraction has been studied and it was observed that increasing NaCl solution to aqueous solution has not much effect on extraction ion couple to organic phase, but caused faster separation and dissociation of two phase medium. So, volume of 0.5 ml NaCl with concentration 0.1 M as optimized volume of salt has been selected.

Effect of concentration and volume of anionic color orange (II) : In this stage it was observed that with addition some anionic color ,absorption was increased linearly ,this increase from volume 0.2 ml to 1.0 ml was observed and after that nearly volume increase of color solution, has not any effect on rate of absorption and no significant change was seen. So, volume of one ml with having maximum absorption of 0.536 for doing next steps of test as optimized volume of anionic color orange(II) with concentration of 5x10-4 in final volume of 10 ml has been selected.

Effect of agitation time on extraction rate: Effect of agitation time on extraction rate has been studied and was recognized that highest amount of absorption and lowest separation time of two phases in time of 60 seconds agitation was obtained.

Effect of organic solvent volume of chloroform on rate of extraction: Also volume of organic solvent chloroform needed for complete extraction CTAB from 10 ml solution CTAB with concentration 5 microgram/ml has been studied and it was recognized that volume of 3 ml of chloroform solution has been optimized volume.

Study effects of cationic and anionic disturbances: In order to study rate of selectivity method which in fact is performance index in measuring real samples, probable disturbances of 20 types of cationic and anionic on extraction CTAB have been evaluated and was recognized that most of cationic and anionic types up to concentration (600-1000**)** microgram/ml in optimized conditions CTAB had no disturbances and only 2-SO3 anion in higher concentration than 200 micro gr/ml had disturbances.

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