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# Mixed Micelles of Sodium Decyl Benzene Sulphonate – triton Surfactants in Aqueous Media

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**Abstract: The mixed surfactant system comprising of two surfactants as sodium decyl benzene sulphonate (Anionic Surfactant) and Triton (Nonionic) solution in presence of 1M Nacl concentration. The mole- fraction of the surfactant component in mixed micelle and the Rubingh's interaction parameter β to intercept the nature of interaction between surfactant mixture and factors governing them in aqueous media and control the product performance.**

**Keyword: Surfactant, Triton, Rubingh's interation**

## 1. INTRODUCTION

Adsorption characteristics surfactants from solution on to different interfaces and the propensity of surfactants to for micelles and mesomeric faces are useful in almost all practical applications such as foaming, dispersing, solublizing, wetting, emulsifying and cleaning action[1,2] . Owing to their improved action over single pure surfactants, mixed system like surfactant / surfactant [3,4] or polymer/ surfactant[5] often use in formulations of finished products . It is therefore important to investigate the nature of interactions and factors affecting them in aqueous media so as to understand how these control the product performance. The tendency of different surfactant to foam mixed micelles is governed by their attractive (synergistic) or repulsive (antagonistic) interactions and is often explained from the β parameter estimated using Rubingh's regular solution theory6. Some research works have been carried out various mixed surfactants system like anionic-anionic[7-9], cationic-cationic[10-12], anionic-nonionic[13-15], and cationic-nonionic[16-17] .

## 2. MATERIAL & METHODS

Sodium decyl benzene sulhonate, $CH_3(CH2)_9C_6H_4SO_3Na$,(NaDeBS) was prepared from 1,decanol by first treating it with benzene sulphonic acid the neutralizing by sodium hydroxide. The crude product was purified by washing several times with the quantity of ether and then by repeated crystallization from the mixed solvents consisting of n-hexane and ethanol. NaDeBS showed no minimum in the surface tension curve.

The cationic surfactant Hexa decyl tri methyl ammonium bromide, $CH_3(CH_2)_{15}N(CH_3)_3$Bromine,($C_{16}$TABr) was obtained from Aldrich chemicals was used and nonionic surfactant Triton N-101 With 9-10 ethylene oxide groups was obtained from Rohm & Hass, Philadelphia was used is received.

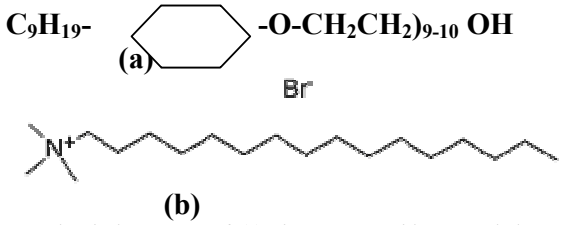


Fig. 1. Chemical structure of (a)Triton N-101 with 9-10 ethylene oxide groups (b) Hexadecyl trimethyl ammonium bromide .

The structures of surfactants used in this study are shown in Fig.1, the critical micelle concentration (CMC) of single and mixed surfactants were determined by surface tension at $25^0$C, surface tension was measured by Wilhelmy plate method using Kruss K 100 tenslometer. Ultra pre water of 18.2MW resistivity (Barntead International) I was used for all experiments. The pure surfactants solutions were prepared by diluting the prepared by mixing two pure solutions and were kept for at least 30 min. for equilibration before measuring the surface tension.

## 3. RESULT AND DISCUISSON

The variation of mixed CMC Values of hexa decyl tri methyl ammonium bromide + Triton N-101 systems as function of mole fraction of tri methyl ammonium bromide are given in fig. 2–4, also show comparisons between the experimental and the calculated mixed CMC values of the systems using equation [4] for the ideal behavior against the

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mole fraction of hexadecyl tri methyl ammonium bromide. It is observed from the figures.

The experimental CMC values are very close to those calculated by assuming the ideal behavior. The interaction parameter ($b_{12}$) and the micellar mole fraction of hexadecyl tri methylammonium bromide for different compositions are calculated are given in Table 1. The data presented in Table 1, shows the values of interaction parameter, $b_{12}$, is almost zero for different composition for different of four hexadecyl trimethyl ammonium bromide and Triton N-101 mixed systems. Variation of micelle mole fraction of cationic surfactant obtained from equation [6] with bulk composition. The micelle mole fraction of the cationic surfactants decreases as the mole fraction of Triton N-101 bulk increases. Which indicate at low mole of the cationic surfactants the mixed micelles micelle is predominately formed by Triton N-101, even, at the same composition, with decreasing the chain length of cationic surfactants the mole fraction of cationic surfactants in micellar phase decrease or the micelle is predominately formed by Triton N-101, there is also difference in 'X' between α NaDeBs and $C_{16}$TABr but the difference is less between NaDeBs as NaDeBs, where the micelle is predominately from with N-101 as discussed above. Fig.1-2 also shows the comparisons of micellar mole fractions calculated from equation [6] and that of ideal (using $b_{12}$=0). In this figure, it is observed that there is a good agreement between the micellar mole fractions calculated from the experimental data and that for the ideal solution.

**Table 1: Sodium decyl benzene sulphonate + Triton N-101 mixed system in water at 25$^0$C**

| α NaDeBs | CMC x $10^{-3}$mol$^{-1}$ | X | β | β |
|---|---|---|---|---|
| 1.0 | 1.3 | - | - | |
| 0.8 | 0.45 | 0.54 | -3.19 | |
| 0.7 | 0.40 | 0.49 | -3.26 | |
| 0.5 | 0.35 | 0.41 | -3.16 | -3.29 |
| 0.3 | 0.3 | 0.34 | -3.26 | |
| 0.0 | 0.50 | - | - | |

**Table 2: Hexadecyltrimethylammonium bromide + Triton -101 mixed system in water at 30$^0$C**

| α NaDeBs | CMC x $10^{-3}$mol$^{-1}$ | X | β | β |
|---|---|---|---|---|
| 1.0 | 3.01 | - | - | |
| 0.9 | 1.00 | 0.54 | -2.80 | |
| 0.8 | 0.80 | 0.46 | -2.54 | |
| 0.5 | 0.50 | 0.32 | -2.92 | -2.66 |
| 0.3 | 0.50 | 0.22 | -2.40 | |
| 0.0 | 0.50 | - | - | |

**Table 3: Hexadecyl trimethyl ammonium bromde + Triton N-101 Mixed system in water at 30$^0$C**

| α $C_{16}$TABr | CMC x $10^{-3}$mol$^{-1}$ Surface Tension | CMC x $10^{-3}$mol$^{-1}$ Conductance |
|---|---|---|
| 1.0 | 3.01 | 3.7 |
| 0.9 | 1.00 | 1.8 |
| 0.8 | 0.80 | 1.4 |
| 0.7 | - | 0.8 |

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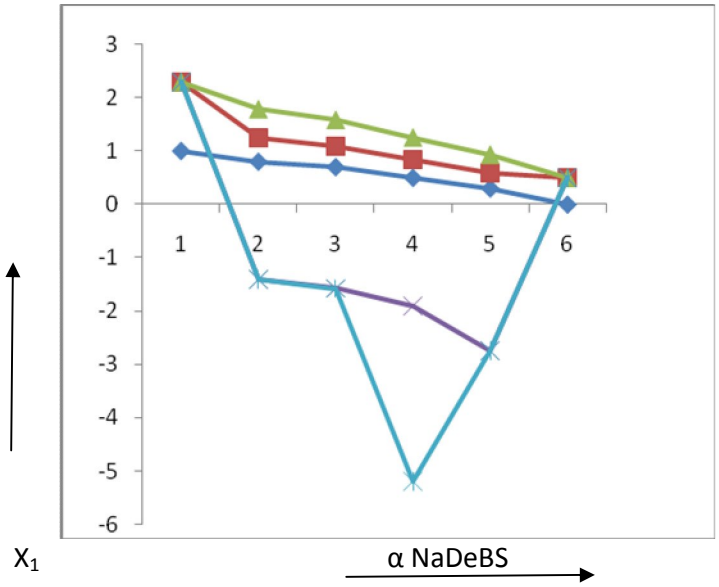


Fig.2: The experimental and predicted CMC's of mixture of NaDeBS-Triton N-101 system at $25^0$C.The plotted points are experimental data. The solid line is the prediction of the non ideal mixed model with β=-3.3 and the straight line is the prediction for ideal mixing.

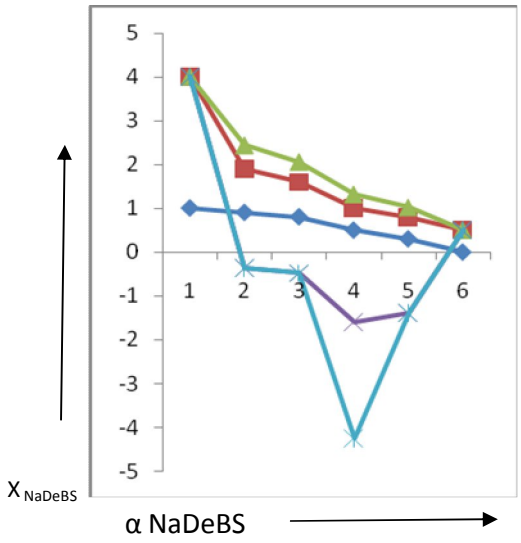


Fig.3: Mole fraction of ionic surfactant in micelles at the CMC($X_1$) versus the bulk mole fraction of ionic surfactant. The solid line represents non ideal behavior straight-line [ ] represents ideal behavior and plotted points represent experimental data for the NaDeBS-Triton N-101 System.

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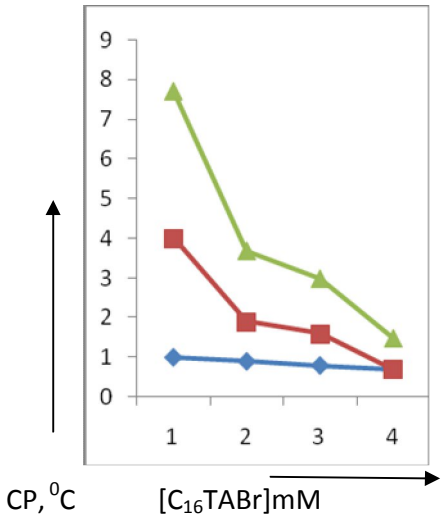


Fig. 4: Plots of scloud point [$C_{16}$TABr] in presence of various amount of added salt (NaCl).The different symbols represents varying amount of NaCl

## 4. CONCLUSION

The variation of mixed CMC Values of hexa decyl tri methyl ammonium bromide + Triton N-101 systems as function of mole fraction of tri methyl ammonium bromide are also show comparisons between the experimental and the calculated mixed CMC values of the systems using equation [4] for the ideal behavior against the mole fraction of hexadecyl tri methyl ammonium bromide.

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