

## INTERACTION BETWEEN CHLORHEXIDINE DIGLUCONATE AND ALKYLTRIMETHYL-AMMONIUM BROMIDES IN AQUEOUS SOLUTION

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Chlorhexidine digluconate (I) is used in combination with alkyltrimethylammonium bromides in commercial antiseptic solutions. Our studies show that I forms small aggregates (3-4 monomers per aggregate) in aqueous solution at a critical micelle concentration (CMC) of  $0.04 \text{ mol kg}^{-1}$  (3.59%w/v). Consequently, solutions of I and the cationic surfactants, dodecyl-, tetradecyl- and hexadecyl- trimethylammonium bromides (DTAB, TTAB and HTAB respectively) will constitute mixed micellar systems. This study examines the interaction between components in the micelles of such solutions and illustrates how the composition of the mixed micelles may be determined from measurements of the CMCs of the binary mixtures. The CMCs of the aqueous mixtures of I with DTAB, TTAB and HTAB have been measured at 298K using a continuous dilution conductivity technique employing a Wayne Kerr Autobalance Universal Bridge interfaced to a microcomputer. CMCs were determined from inflections in plots of molar conductivity against molality<sup>2</sup>.

The data have been analysed using a recent treatment of mixed micellar systems (Motomura and coworkers 1984) which is applicable to binary systems such as these, with no common counterion. Experimental data for the I/TTAB system are plotted in Fig. 1 as CMC against  $\hat{X}_2$  (curve 1) where  $\widehat{CMC} = (v_1 X_1 + v_2 X_2) CMC$  and  $\hat{X}_2 = v_2 X_2 / v_1 X_1 + v_2 X_2$  with  $v_1$  and  $v_2$  = number of ions produced on dissociation of TTAB and I respectively and  $X_1$  and  $X_2$  = mole fractions of these respective components in the binary mixture. Curve 2 which is derived from analysis of these data represents the variation of CMC with the mole fraction,  $\hat{X}_2^M$ , of I in the mixed micelle. Plots similar to those of Fig. 1 were obtained for I/DTAB and I/HTAB systems and permit a detailed analysis of the composition of the solutions.

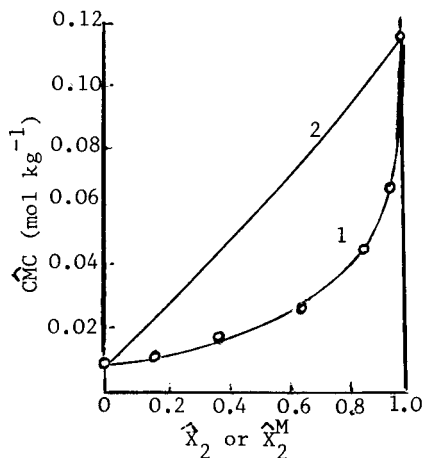


Fig. 1. Critical micelle concentration against composition curves of the I/TTAB system at 298K. Curve 1. CMC vs mole fraction of I in the system,  $\hat{X}_2$ . Curve 2. CMC vs mole fraction of I in the mixed micelle,  $\hat{X}_2^M$ .

Inspection of Fig. 1 shows that in these mixtures the mole fraction of I in the micellar phase is always significantly less than that of the binary mixture, that is, a high proportion of the chlorhexidine is present in solution as free monomer. The divergence between the two curves indicates significant nonideality of mixing of the two components in the mixed micelle which might be anticipated in view of the differing structures of the hydrophobic moieties of these two surfactants.