

# Membrane electrode sensitive to a cationic surfactant in aquo-organic media

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## Abstract

An electrode originally sensitive to dodecyltrimethylammonium ions (DTA<sup>+</sup>) was proven to be sensitive to tetradecyltrimethylammonium ions (TTA<sup>+</sup>) and was used for determination of critical micelle concentration of tetradecyltrimethylammonium bromide (TTAB) in water. Moreover the response of the electrode was tested in presence of non-aqueous polar solvents i.e. dimethyl formamide (DMF) and dimethyl sulphoxide (DMSO) in water and was observed to be Nernstian within the concentration range studied (up to 40% v/v of DMF and DMSO). The validity of this electrode, for electrochemical measurements, was checked by comparing the critical micelle concentration values of TTAB obtained by using the electrode, with those obtained by conductivity measurements in mixed polar solvents. The effect of solvent on the micellization of TTAB has been discussed.

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## 1. Introduction

Surfactants are important in various phenomena of interfacial science and continue to be critical in many applications in agrochemicals, emulsion polymerization, paper manufacturing, water treatment, oil recovery, fire fighting and plastic manufacturing [1]. Handling of surfactants for use, formulation or production needs simple and reliable analytical technique to determine their quantity in reaction media [2]. Hence ion selective electrodes for surfactants have been developed in the last three decades [3–6] and have been used to study biomolecule–surfactant interactions [7]. The principle of these electrodes is based on a selectively permeable membrane between two electrolyte phases across which only a single ion can penetrate. Polymeric membranes are easy to handle and also prevent rapid loss of expensive electro active material dissolved in a plasticizer. Complexing agents having selectivity towards ions of interest are dissolved in it, and they provide the mechanism for selective charge transport across the boundaries of the membrane. Different associa-

tive behavior of surfactants in water and other solvents have stimulated the interest to elucidate how solvent properties influence aggregation and many studies have been performed to gain information on the role of solvent in the aggregation process [8]. Hence, in order to understand (a) the behavior of polymeric membrane electrodes in aquo-organic medium and (b) the role of solvent on aggregation of surfactant, we determined the critical micelle concentration (CMC) of a cationic surfactant, tetradecyltrimethylammonium bromide (TTAB), in H<sub>2</sub>O/DMF as well as in H<sub>2</sub>O/DMSO medium using the cationic surfactant ion selective electrode (ISE). We have also compared the CMC values of TTAB obtained by electrochemical measurements using ISE with those obtained by conductivity measurements at the same temperature to determine the response nature of surfactant electrode in mixed aquo-organic medium.

## 2. Experimental

### 2.1. Materials

Tetradecyltrimethylammonium bromide procured from Lancaster, UK was recrystallized thrice in acetone prior to

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