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# Resolution of a Five-Component Mixture of Quaternary Ammonium Surfactants on Silica Gel 60 $F_{254}$ High Performance Thin Layer Chromatographic Plates

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**Abstract** The mutual separation of a mixture of cetyltrimethyl ammonium chloride (CTAC), methyl trioctyl ammonium bromide (MTOB), dodecyltrimethyl ammonium chloride (DTAC), benzyltrimethyl ammonium chloride (BTAC) and tetrabutyl ammonium bromide (TBAB), was achieved on silica high performance thin layer chromatographic plates using dimethyl sulfoxide with aqueous sodium-L-tartrate dibasic dihydrate as the solvent system. The effect of concentration of sodium-L-tartrate dibasic dihydrate on the mobility of all the five quaternaries was examined. The limit of detection of CTAC, MTOB, DTAC, BTAC and TBAB was estimated as 0.6, 0.6, 0.3, 0.6 and 0.3  $\mu\text{g}/\text{zone}$ , respectively. The method developed was utilized to identify these surfactants in different spiked water samples after their preliminary separation.

**Keywords** Thin layer chromatography · Quaternary ammonium surfactants · Separation · Solvent

## Introduction

Quaternary ammonium surfactants (quats) are used as antimicrobial, emulsifying, anticorrosion and softening

agents in pharmaceutical preparations, cosmetic formulations, cleansing products, disinfectants, and other industrial products [1]. The wide applicability of these surfactants in various fields leads to increasing demand in the market. The enormous use of these products causes huge disposal in the environment. Therefore, it is necessary to develop a simple, cost effective, fast and reliable method for monitoring these surfactants in the environment. Previously; several analytical techniques have been used for the separation, identification and quantification of surfactants including thin layer chromatography [2–4], high performance liquid chromatography [5, 6] ion-chromatography [7] and gas chromatography [8, 9]. Thin-layer chromatography (TLC) is currently enjoying popularity as a simple, rapid, inexpensive and highly effective separation technique for analyzing complex mixtures into individual components. Moreover, in thin-layer chromatography, the selectivity and efficiency are not compromised by the needs of the detector. The plate itself also serves to store the components as compared to highly sophisticated and costly techniques. Several stationary phases (polar [10–13] and non-polar [4, 14]) have been used by chromatographers for the analysis of surfactants. The chromatography on polar phase leads to either a group separation of different surfactant classes or to a separation of the different types within one class. However, separation according to alkyl chain lengths can be achieved on nonpolar phases like RP 2, RP 8 or RP 18. As compared to stationary phases, large numbers of solvent systems have been used in different combinations [15]. As compared to methods previously mentioned, the method we have developed is cheaper, faster and very simple for the separation of quaternary ammonium surfactants. The use of 1% aqueous sodium-L-tartrate dibasic dihydrate solution in combination with dimethyl sulfoxide as mobile phase in TLC analysis of surfactants is not found in the literature.

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