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Discussion

Reply to 'Determination of critical micelle concentration and interactions between cephalosporins and charged surfactants'

Yahya Mrestani[a,*], Reinhard Neubert[a], Hans H. Rüttinger[b]

[a]*Institute of Pharmaceutics and Biopharmaceutics, Martin-Luther-University, Wolfgang-Langenbeck-Strasse 4, D-06120 Halle/S., Germany*

[b]*Institute of Pharmaceutical Chemistry, Martin-Luther-University, Wolfgang-Langenbeck-Strasse 4, D-06120 Halle/S., Germany*

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Capillary electrophoresis offers a new way of characterizing the interaction between surfactants and drugs. In our work [1] a physicochemical model was developed to calculate the aggregation constants (k) and the stoichiometric coefficients (m) between dodecyltrimethylammonium bromide (DTAB) and cephalosporins. The effects of various concentrations of DTAB in the separation buffer on the migration time of cephalosporins were used to obtain a quantitative measure for the strength of interaction between DTAB and cephalosporins. The interaction between cephalosporins and DTAB was investigated below the critical micellar concentration (CMC) of DTAB. The CMC=18.103 mM was determined by conductivity measurements.

Lin and Lin [2] discussed a paper our article [1]. The authors found a considerably lower value of the CMC using conductivity measurements. On the basis of this value they tried to interpret our CZE data as an interaction between the drugs and DTAB micelles. However, it is well known that determination of CMC is strongly dependent on the experimental conditions. When using CZE (i) voltage, (ii) buffer, (iii) kind of capillary have to be standardized in order to obtain comparable results. After the exact standardisation of the experimental conditions we can then interpret the results. Therefore, we carefully repeated the experiments presented by Lin and Lin for the determination of the CMC using a CE method. It was observed that: (1) the CMCs of DTAB were 16.6 mM (Fig. 1), 15.8 mM (Fig. 2) and 17.9 mM (Fig. 3) at 10, 20 and 30 kV (not 12.5 mM). (2) The concentrations of cephalosporins at 50 and 100 μg/ml had no influence on the CMC of DTAB.

The results show clearly that the determination of CMC using CZE depends strongly on the voltage used. Lin et al. [2] used 20 kV and we used 30 kV. They obtained a CMC of 12.5 mM and we found 17.9 mM. Other interactions, such as electrostatic attraction to the positively charged capillary wall and micelles at concentrations above 18 mM may also be involved to a lesser extent. Lin and Lin proposed a combination of complex formation and micellar interaction (Eq. (4) in [2]), but in these equations only a stochiometric factor of 1 is taken into consideration. Generally, the introduction of more and more variables into a fitting function leads to a better fit, but to a loss of significance. However, some very important factors, particularly the interaction between cephalosporins and capillary wall as

*Corresponding author.

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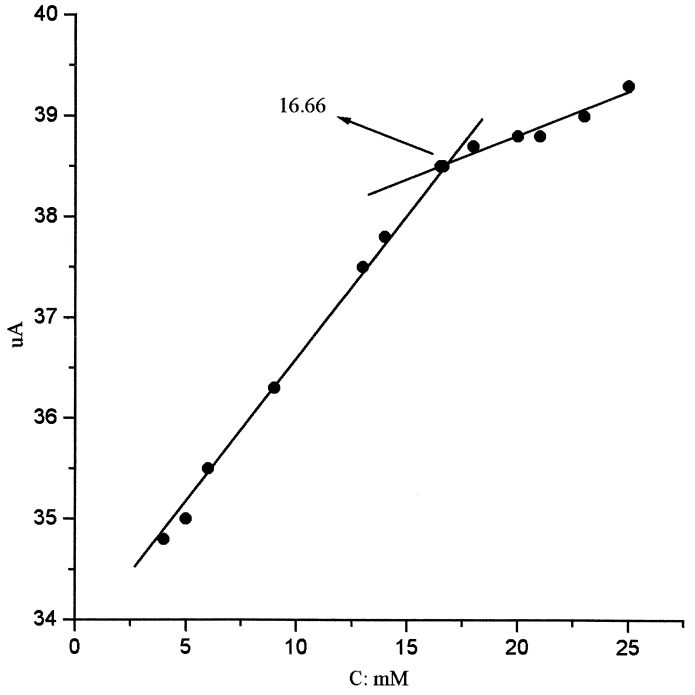

Fig. 1. Determination of the CMC of DTAB at 10 kV. Buffer, 20 m*M* phosphate, pH 7.4; capillary, 48(40 cm to the detector)×50 μm I.D.; temperature, 25°C.

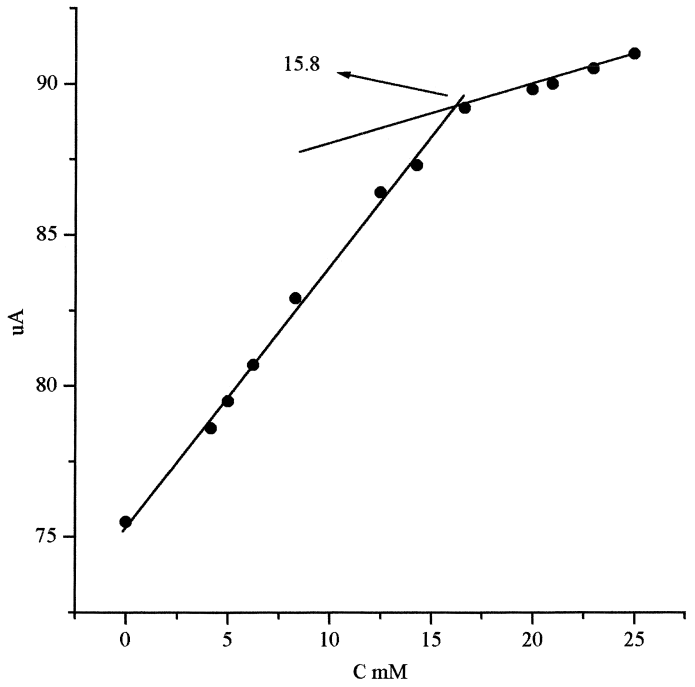

Fig. 2. Determination of the CMC of DTAB at 20 kV. Conditions as in Fig. 1.

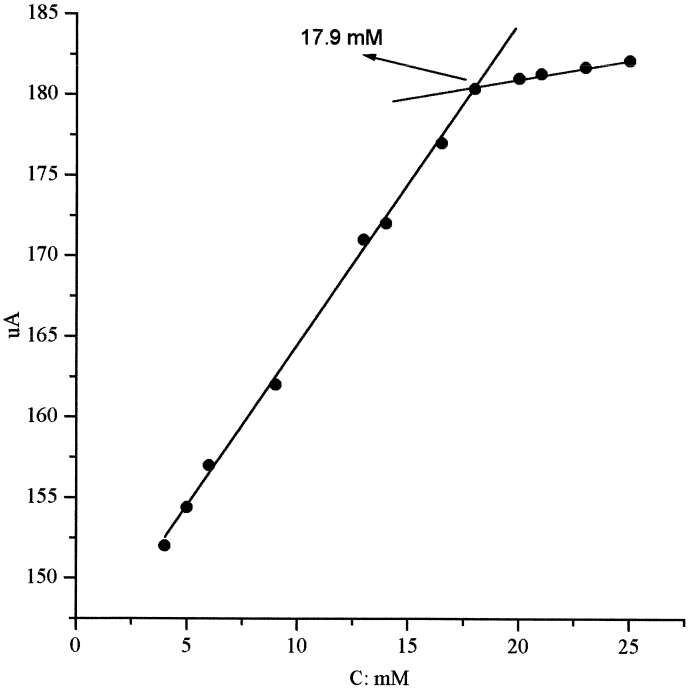

Fig. 3. Determination of the CMC of DTAB at 30 kV. Conditions as in Fig. 1.

a very import factor were also not considered by Lin and Lin. For the determination of aggregation constants (k) above the CMC a model was developed by Schwarz et al. [3,4]. This model was not considered by Lin and Lin either. In conclusion: Lin and Lin did not provide enough information on the experimental conditions (apparatus, chemicals, sample preparation, buffer preparation and analytical conditions). These are very important factors and influence the CMC very strongly. In the paper of Lin and Lin only the CMC was discussed and not the model.

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