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Effect of urea on the aggregation behavior of gemini surfactants and their mixed micelles with Pluronic L64

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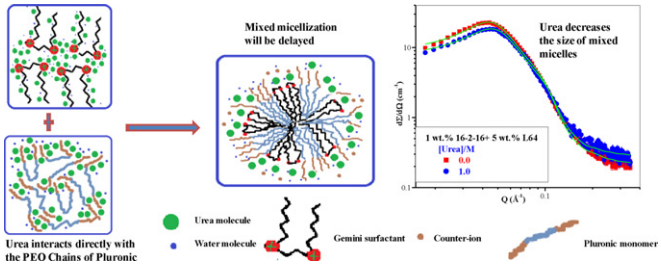
HIGHLIGHTS

- *Cmc* of 14-2-14 and 16-2-16 decreases with increase in concentration of urea.
- Urea decreases the size of micelles and hydrodynamic diameter (D_h) of 12-2-12.
- Urea has no effect on the size of vesicles of 16-2-16.
- Degree of counter-ion binding decreases with increase in urea concentration.
- Various thermodynamic parameters have been evaluated to support the results.

GRAPHICAL ABSTRACT



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ABSTRACT

The effect of urea on the perturbation of the molecular assembly of gemini surfactants viz. 12-2-12, 14-2-14, 16-2-16 and their mixed micelles with Pluronic L64 has been investigated using various experimental techniques, namely, surface tension, conductivity, small angle neutron scattering (SANS), dynamic light scattering (DLS), and cloud point measurements. Significant differences do exist between the three gemini surfactants: *cmc* of 12-2-12 increases whereas that of 14-2-14 and 16-2-16 decreases with increase in the concentration of urea. This behavior has been explained on the basis of various factors such as hydrophobic interactions, monomer stability in aqueous urea solution, solvation of head groups. The SANS and DLS data analysis has been employed to determine the effect of urea on the size and shapes of different aggregates formed. For further insights on the action of urea, various thermodynamic parameters such as the standard Gibbs free energy of micellization (ΔG°_{mic}), Gibbs free energy of adsorption (ΔG°_{ads}) and standard Gibbs energy change of solubilization (ΔG°_{s}) from surface tension and cloud point measurements have been evaluated. A direct mechanism for the action of urea has been accepted depending upon the inferences drawn from all the studies.

1. Introduction

The field of surfactants attracts a keen research interest due to their ability to self-assemble in aqueous solution exhibiting superior micellar morphologies such as spherical micelles, vesicles, lamellar structures [1,2]. Such aggregates once formed create sharp polarity gradients at the interface and define clear hydrophobic regions. Various physicochemical properties of surfactants have been reported to be much sensitive to molecular architecture and environmental conditions such as temperature and additives [3–5]. Micellar association in the presence of different organic additives has been extensively studied due to their enhanced use in industrial applications.

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