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Solution behavior of anionic polymer sodium carboxymethylcellulose (NaCMC) in presence of cationic gemini/conventional surfactants

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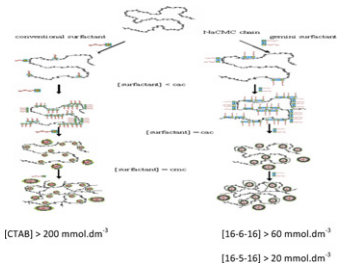
HIGHLIGHTS

- The cmc values for geminis are 10–14 times smaller than of CTAB.
- The order of interaction of the surfactants 16-5-16 > 16-6-16 > CTAB.
- The N_{agg} in presence of NaCMC is the same as those for the corresponding free micelles (conventional as well as geminis).
- Increase in relative viscosity is more for gemini surfactant with shorter spacer.

GRAPHICAL ABSTRACT



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ABSTRACT

The interaction of sodium carboxymethylcellulose (NaCMC) and cationic gemini surfactants (16-*s*-16, *s* = 5, 6)/conventional surfactant (CTAB) in aqueous solutions is investigated by conductivity, fluorescence and viscosity techniques. Electrostatic and hydrophobic interactions play a dominant role in such systems. The conductivity results showed that the geminis interact strongly with NaCMC as compared to CTAB. Fluorescence measurements were used to calculate aggregation number for the three combinations which were found about the same as those for the corresponding free micelles. Addition of surfactants leads to an increase in relative viscosity after certain concentration of the surfactants. Further increase in relative viscosity is significant in case of geminis and this increase is ascribed to the physical cross-linking of surfactant micelles with NaCMC chains.

1. Introduction

Along with fundamental interest in intermolecular interactions and aggregation phenomena, as polymer/surfactant mixtures posses properties of varied nature (of course, due to availability of molecular structure variations in both the constituents), the interest in investigating such systems is continuing since long. It is pertinent to mention here that polymer/surfactant mixtures have found, as a result of significant research, use in a wide range of domestic, industrial and technological applications. A mixture in which the polymer and surfactant bear opposite charges is of special interest because association in these systems is strong due to very strong force of electrical attractions. Alkyl chain aggregation of the bound/adsorbed surfactant molecules provides further reinforcement [1]. There is growing interest in associated polymer–surfactant systems based on environmentally friendly biodegradable natural polymers. Among ionic derivatives of cellulose, sodium carboxymethylcellulose (NaCMC), an anionic polymer as shown in Fig. 1 and is most widely used in paints, food, and cosmetic industry, pharmaceuticals, oilfield and paper industries due to its superior properties such as binding, thickening and stabilizing agent in these end uses. The application field of NaCMC can be extended further by chemical modifications such as by its interaction with oppositely charged surfactant micelles [2–9]. The mixture

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