FORMATION OF BLOCK COPOLYMER MICELLES AND REVERSE MICELLES IN AQUEOUS SOLUTION

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A series of novel tertiary amine methacrylate diblock copolymers, 2-(diethylamino)ethyl methacrylate-block-2-(N-morpholino)ethyl methacrylate, DEA-MEMA have been synthesised using group transfer polymerisation. It is demonstrated for the first time that a diblock copolymer, DEA-MEMA, can aggregate in aqueous media to form either 'DEA-core' micelles or reverse micelles in which the MEMA block forms the core (see Figure 1). In both cases, micellisation is fully reversible. The critical parameters, which affect the solvency, and hence govern the formation of micelles or reverse micelles, are the solution pH, electrolyte concentration, temperature and block symmetry.

Figure 1. Schematic representation of the formation of micelles and reverse micelles for a DEA-MEMA block copolymer.

Light scattering studies confirmed that a 40:60 DEA-MEMA copolymer forms 'MEMA-core' micelles of 26 nm diameter with a micelle aggregation number of 97 at pH 6.5 and in the presence of 1.0 M Na₂SO₄. The same copolymer forms 'DEA-core' micelles of 33 nm with a micelle aggregation number of 73 at pH 8. It is remarkable that this unusual behaviour can be observed at 20°C merely by judicious control of the solution pH and the electrolyte concentration.

Reference: