

材料化学工程与纳米技术

兼有离子和疏水缔合两种结构特性的聚丙烯酰胺的缔合性能

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摘要

合成了新型的表面活性单体二甲基十四烷基(2-丙烯酰胺基丙基)溴化铵(DTAB),并将该单体与丙烯酰胺在水溶液中自由基均相共聚得到了兼具离子基团和疏水基团的阳离子疏水缔合聚丙烯酰胺共聚物 p(DTAB-co-AM)。通过表观黏度法和苝荧光探针法研究了DTAB含量、NaCl、十二烷基硫酸钠(SDS)和十六烷基三甲基氯化铵(CTAB)对共聚物缔合性能的影响。结果表明:当DTAB含量为0.3%(摩尔)时,共聚物呈盐增黏特性,在1%(质量)的盐溶液中,其临界缔合浓度由纯水中的 $0.15 \text{ g} \cdot \text{dL}^{-1}$ 降至 $0.11 \text{ g} \cdot \text{dL}^{-1}$;当DTAB含量小于0.3%(摩尔)时,仅在浓度大于5%(质量)的盐溶液中具有盐增黏特性。该共聚物与SDS作用,在疏水缔合和静电吸引两种作用下,缔合后体系的黏度最大可增加136倍,由缔合前的 $12 \text{ mPa} \cdot \text{s}$ 增加到 $1634 \text{ mPa} \cdot \text{s}$,而与CTAB作用,由于只有疏水缔合作用,缔合强度较弱黏度增加不大。

关键词

[表面活性单体](#) [疏水缔合](#) [聚丙烯酰胺](#) [均相共聚](#)

分类号

Association behavior of polyacrylamide with ionic and hydrophobic groups

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Abstract

A novel cationic and acrylamide-type surface-active monomer, dimethyltetradecyl (2-acrylamidopropyl) ammoniumbromide (DTAB), was successfully synthesized, and cationic DTAB-co-acrylamide (AM) copolymer p(DTAB-co-AM) with hydrophobically associative property was prepared by free radical homogeneous copolymerization of DTAB and AM in aqueous solution, which had both ionic and hydrophobic groups. The effects of the hydrophobe content in the polymer chains, inorganic salts (NaCl), sodium dodecyl sulfate (SDS) and cetyltrimethylammonium bromide (CTAB) on the hydrophobic association behavior were studied by viscosimetry and fluorescence probe method. It was found the copolymer with 0.3% (mole) hydrophobic units exhibited pronounced positive salinity sensitivity because of strong hydrophobic association. The critical association concentration (CAC) decreased from $0.15 \text{ g} \cdot \text{dL}^{-1}$ in pure water to $0.11 \text{ g} \cdot \text{dL}^{-1}$ in 1% (mass) NaCl solution. When the content of hydrophobic units was below 0.3% (mole), the copolymer solution showed positive salinity sensitivity in aqueous solutions only at concentrations of NaCl above 5% (mass) because hydrophobic association was largely enhanced by the strong polarity of solution. SDS could significantly increase the viscosity of copolymer solution by two orders of magnitude (from $12 \text{ mPa} \cdot \text{s}$ to $1634 \text{ mPa} \cdot \text{s}$) compared with that of their corresponding aqueous solutions, which was attributed to both hydrophobic association and electrostatic interactions. However, the viscosity of copolymer solution with the addition of CTAB was only slightly enhanced due to weak hydrophobic association.

Key words

[surface-active monomer](#) [hydrophobic association](#) [polyacrylamide](#) [homogeneous copolymerization](#)

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