Development of Zwitterionic Poly(ethylene terephthalate)-derivatives That Have Antifouling and Facile Recycling Properties

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[Abstract]

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Zwitterionic polymers show high hydrophilicity, biocompatibility, and oil repellency in water. Although most zwitterionic polymers were synthesized by radical polymerization of (meth)acrylate, few studies have been conducted on the synthesis of zwitterionic polymers by polycondensation. Polyester, one of the polymers synthesized by polycondensation, can be depolymerized by alkali treatment owing to the hydrolysis of ester bonds in the polymer backbone to reproduce the starting monomers. Therefore, polyesters are promising candidates for contributing the upcoming recycling-oriented society. In this study, an aromatic polyester having a zwitterionic structure was synthesized by a post-polymerization reaction. Poly(*N*-methyldiethylamino terephthalate) (PMDAT) having tertiary amino groups on their main chain was synthesized by polycondensation of terephthaloyl chloride and 2,2'-methyliminodiethanol. The zwitterionic polyester, poly(diethylsulfobetaine terephthalate) (PDSBT), was obtained by ring-opening addition of 1,3-propanesultone onto the tertiary amino groups of PMDAT. By changing the amount of 1,3-propanesultone concentration in the feed solution, the zwitterion contents in the resulting PDSBT were controlled between 0 to 98 mol%. The contact angle of hexadecane onto the PDSBT in water increased with increasing the zwitterion content in PDSBT. In addition, hexadecane did not adsorb onto the PDSBT containing 95 and 98 mol% of zwitterion content in water. The chili oil droplet adsorbed on the PDSBT film was easily washed out with only water. The coated PDSBT thin film was easily removed by immersing the coated substrate into an aqueous acidic solution. These results indicate that the PDSBT is a promising coating agent that can be easily removed from the coated substrates and both substrate and PDSBT can be reused. Interestingly, the PDSBT adhered polycarbonate substrates through the hot-melting process. The adhesion stress of the PDSBT was comparable to the commercially available epoxy glue. In addition, the adhered polycarbonate substrates were detached by acidic water treatment owing to the dissolution of PDSBT acting as an adhesive. These results indicate that the zwitterionic polyester is a good candidate for constructing dismantlable adhesives.

[References]

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