PERMANENTLY ANTIMICROBIAL WATERBORNE COATINGS BASED ON THE DUAL ROLE OF MODIFIED POLY(STYRENE-CO-MALEIC ANHYDRIDE)

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ABSTRACT

Biocides are widely used in the coatings industry to prevent or inhibit bacterial growth in storage containers as well as after application of coatings on substrate surfaces. Low molar mass biocides are a source of major concern since they leach out of the final products or substrate films and result in residual toxicity in fresh water systems such as rivers, dams and ground water sources. It would be ideal to have polymeric biocides that strongly adsorb to individual particles and upon film formation remain distributed throughout the entire film. In this study we show that the incorporation of amine-functionalized poly(styrene-*alt*-maleic anhydride) (SMA) in a synthetic latex leads to (1) latexes with inherent antimicrobial and antifungal properties that remain stable over time and (2) that the amine-functionalized SMA can replace low molar mass surfactants in ab initio emulsion polymerization systems.

SMA was successfully (partially) modified with *N*,*N*-dimethylaminopropylamine to yield the corresponding *N*-substituted maleimide with dangling tertiary amine functionality. The remaining maleic anhydride units were ammonolyzed to create a water-soluble polymer. This polymer was used as a polymeric surfactant in the emulsion copolymerization of styrene and *n*-butyl acrylate. The tertiary amine-functional polymer was further shown to possess antibacterial and antifungal properties. When post-added to a poly(styrene-*co*-butyl acrylate) latex, the antimicrobial activity was not homogeneously present on a coating film made from the latex. However, when the tertiary amine-functional polymer was used as surfactant in the preparation of the latex, the antimicrobial activity was homogeneous and consistent over the entire coating surface as shown in Figure 1.

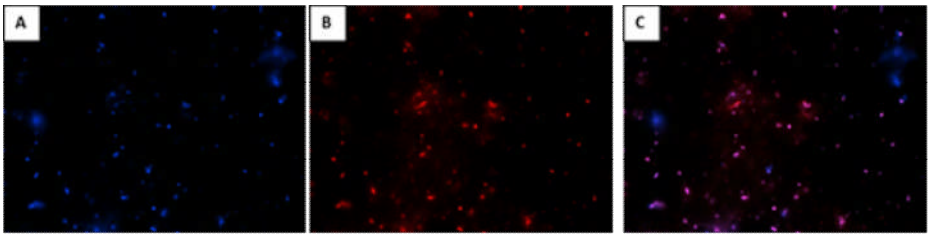

Figure 1: Fluorescence microscopy images of STY/BuA latex film produced with modified SMA as polymeric surfactant. Blue indicates presence of all bacterial cells (alive or dead) and red indicates presence of dead cells only, (c) is an overlay of alive and dead cells

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