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Acid-Responsive Polymer Conjugates as a New Generation of Corrosion Protecting Materials

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Abstract : Protection of metals is a critical issue in industry. The annual cost of corrosion in the world is estimated to be about 2.5 trillion dollars and continuously increases. Therefore, there is a need for developing novel protection approaches to improve corrosion protection. We designed and synthesized smart polymer/corrosion inhibitor conjugates as new generations of corrosion protecting materials. Firstly, a polymerizable acrylate derivative of 8-hydroxyquinoline (8HQ), an effective corrosion inhibitor, containing acid-labile β-thiopropionate linkage was prepared in three steps. Then, it was copolymerized with ethyl acrylate in the presence of 1,1′-azobis(cyclohexanecarbonitrile) (ABCN) by radical polymerization. Nanoparticles with an average diameter of 140 nm were prepared from the polymer conjugate by the miniemulsion-solvent evaporation process. The release behavior of 8HQ from the the nanoparticles was studied in acidic (pH 3.5) and neutral media (pH 7.0). The release profile showed a faster release of 8HQ in acidic medium in comparison with neutral medium. Indeed 100% of 8HQ was released after 14 days in acidic medium whereas only around 15% of 8HQ was released during the same period at neutral pH. Therefore, the polymer conjugate nanoparticles are suitable materials as additives or to form coatings on metal substrates for corrosion protection.

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