

DNA adsorption studies of poly (4,4'-cyclohexylidene bisphenol oxalate)/silica nanocomposites

ABSTRACT

The present study deals with the synthesis, characterization, and DNA extraction of poly(4,4'-cyclohexylidene bisphenol oxalate)/silica (Si) nanocomposites (NCs). The effects of varying the monomer/Si (3.7%, 7%, and 13%) ratio towards the size and morphology of the resulting NC and its DNA extraction capabilities have also been studied. For the NC synthesis, two different methods were followed, including the direct mixing of poly(4,4'-cyclohexylidene bisphenol oxalate) with fumed Si, and in situ polymerization of the 4,4'-cyclohexylidene bisphenol monomer in the presence of fumed silica (11 nm). The formed NCs were thoroughly investigated by using different techniques such as scanning electron microscopy (SEM), fourier transform infrared (FTIR) spectroscopy, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), powdered X-ray diffraction (XRD), and Brunauer–Emmett–Teller (BET) analysis where the results supported that there was the successful formation of poly(4,4'-cyclohexylidene bisphenol oxalate)/Si NC. Within the three different NC samples, the one with 13% Si was found to maintain a very high surface area of 12.237 m²/g, as compared to the other two samples consisting of 7% Si (3.362 m²/g) and 3.7% Si (1.788 m²/g). Further, the solid phase DNA extraction studies indicated that the efficiency is strongly influenced by the amount of polymer (0.2 g > 0.1 g > 0.02 g) and the type of binding buffer. Among the three binding buffers tested, the guanidine hydrochloride/EtOH buffer produced the most satisfactory results in terms of yield (1,348,000 ng) and extraction efficiency (3370 ng/mL) as compared to the other two buffers of NaCl (2 M) and phosphate buffered silane. Based on our results, it can be indicated that the developed poly(4,4'-cyclohexylidene bisphenol oxalate)/Si NC can serve as one of the suitable candidates for the extraction of DNA in high amounts as compared to other traditional solid phase approaches.

Keyword: Poly(4,4'-cyclohexylidene bisphenol oxalate); Surface modification; Silicon; Nanocomposite; DNA extraction; Polymerization

