Multifunctional HAP nanocomposites for antimicrobial activity

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Contamination of water bodies by chemical and biological pollutants has resulted in shortage of clean and safe drinking water all over the world. Hydroxyapatite based nanocomposites have been identified as promising materials which can be used in water purification as adsorbents due to their versatile adsorption properties. In addition, these materials have a great potential to act as antimicrobial agents. In this work different HAP based nanocomposites which were identified as promising adsorbents in our previous and ongoing work were considered to evaluate and compare their antimicrobial properties. Nanocomposites of HAP were prepared with four biopolymers, (chitosan (CTS), carboxymethylcellulose (CMC), alginate (ALG) and gelatin (GEL)), montmorillonite (MMT) as a nano clay and titanium dioxide (TiO_2) as a nontoxic metal oxide and they were named as HAP-CTS, HAP-CMC, HAP-ALG, HAP-GEL, HAP-MMT and HAP-TiO_2 respectively. All the synthesized materials were characterized using Fourier-Transformed Infrared Spectroscopy (FTIR), Scanning Electron microscopy (SEM) and X-ray Diffractometry (XRD). Antimicrobial activity of these composites were compared using *E.coli* as a gram negative bacteria and *S. aureus* as a gram positive bacteria by measuring the optical density (OD) at 600 nm in the presence of the bacterial samples with 20 mg of each composite in 50 ml of fresh LB broth, for 10 h in 30 minutes time intervals. According to results, antimicrobial properties were amply exhibited by all nanocomposites compared to the control. Of all composites, HAP-TiO_2 showed the highest activity and its activity for *E. coli* and *S. aureus* were 58.9% and 71.1% respectively. Therefore, HAP-TiO_2 was identified as the best HAP based nanocomposites to remove both *E. coli* and *S. aureus* from water.

Key words: Antimicrobial properties, biopolymers, hydroxyapatite, nanocomposites, titanium dioxide

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