MICROPOROUS ORGANIC–INORGANIC NANOCOMPOSITE COATING ON STAINLESS STEEL *VIA* EPD FOR BIOMEDICAL APPLICATIONS

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Stainless steel implants generally have a bioinert surface which does not integrate with bone tissue easily and thus hinders the formation of permanent orthopedic implants. The present work aims to tackle this issue by coating stainless steel AISI 316L substrates with a microporous organic-inorganic nanocomposite (chitosan/gelatin/halloysite) which is bioactive. This composite coating has the capacity for enhancing the surface functionalisation and improving the biocompatibility and interaction with bone tissue. For fabricating the coating, chitosan (6.0 g/L) and gelatin (14.0 g/L) based suspensions were prepared and then dissolved in HCl solution (0.04 M); to this, varying amounts of nanotube halloysite (0.3-12.0 g/L) were added. A simple electrophoretic deposition (EPD) method was used at room temperature with low applied voltages (3-10 V) and short deposition times (1-5 min). Dense microporous coatings were fabricated and these were characterised using optical microscopy, field emission scanning electron microscopy (FESEM) and Fourier transform infrared spectroscopy (FTIR). Mechanical properties were determined by bending test. In vitro studies were performed in simulated body fluid (SBF) for 3 and 7 days in order to evaluate the formation of apatite on the coating surface. The microporous coating was found to increase in the extent of porosity with increase in the applied voltage owing to the occurrence of bubbles at the interface between the suspension and substrate. There was good adhesion between the coating and substrate for all halloysite contents for an applied voltage of 5 V. The microporous coating was also observed to be flexible since no fracture was observed even after the plate was bent until 180°. However, the coating thickness increased at the highest voltage (10 V) and this resulted in cracking during the bending test. Interestingly, the halloysite nanotubes were observed to have stimulated the growth of apatite after immersion in SBF solution. Furthermore, apatite growth was extensive with increase in the halloysite content. This occurrence is attributed to the presence of silane (Si-O-Si) groups on the surface of halloysite which contributed to apatite formation. The results show that the fabricated coating can enhance the bioactivity of stainless steel implant surfaces.