Carboxyl SAMs mediated modification of Ti6Al4V implant surfaces for biomedical applications

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Biomedical research has led to futuristic biomaterial fabrication. Biomaterials are material mediators that address challenges in life science research. Metals, polymers, ceramics and composites are among the materials used. Implants are intended to help a damaged bodily part regain its usual function. Interfacial interactions at the implant site are highly intricate in the physiological microenvironment. Current implants are prone to deterioration in the body, resulting in the formation of debris that attracts immune agents to the location. Micromotion, biocompatibility, and bone interlocking are crucial factors in osseointegration, hence the implant's long-term success. Biomaterials can be easily modified to solve biocompatibility, osseointegration, bacterial invasion, and biofouling difficulties that various implants are now experiencing. One of the hot subjects of continuing study is biomaterial fabrication to resemble bone or parts.

Various alterations, such as physical and chemical, have been used to improve the properties of implant biomaterials, depending on the desired application of interest. The physical modification necessitates high-end sophisticated instruments for fabrication, which increases the cost and knowledge necessary to operate it. The chemical modification does not necessitate high-end instruments for fabrication, but it does produce numerous harmful by-products. Among the chemical modifications, the silanization procedure does not produce hazardous by-products, making the process environmentally friendly. At ambient temperature and inert nitrogen conditions, we produced octyl terminated silane Self-assembled monolayers (SAMs) molecules on Ti6Al4V model implant surfaces [1-3]. To impart the carboxyl-terminal onto octyl terminated SAMs, we modified the octyl terminated surfaces with acidified $KMnO_4$. We used various percentages of KMnO4 (1%, 2%, 3%, 4%, 5%) at different time intervals (5, 10, 15, 20, 25, and 30 minutes) under static condition and room temperature for the procedure (see Figure 1). After modification, samples were analysed using Fourier Transform Infrared Spectroscopy (FTIR) and Contact Angle Goniometer [4]. Samples were further treated for 60, 90, 120- and 150-minutes. Various carboxyl terminated SAMs were subjected to albumin adsorption, which was studied using FTIR in the amide-I region to determine the change in secondary structure, followed by contact angle measurements to determine the change in surface energy post-adsorption.

References {*Times New Roman, 9 points*}

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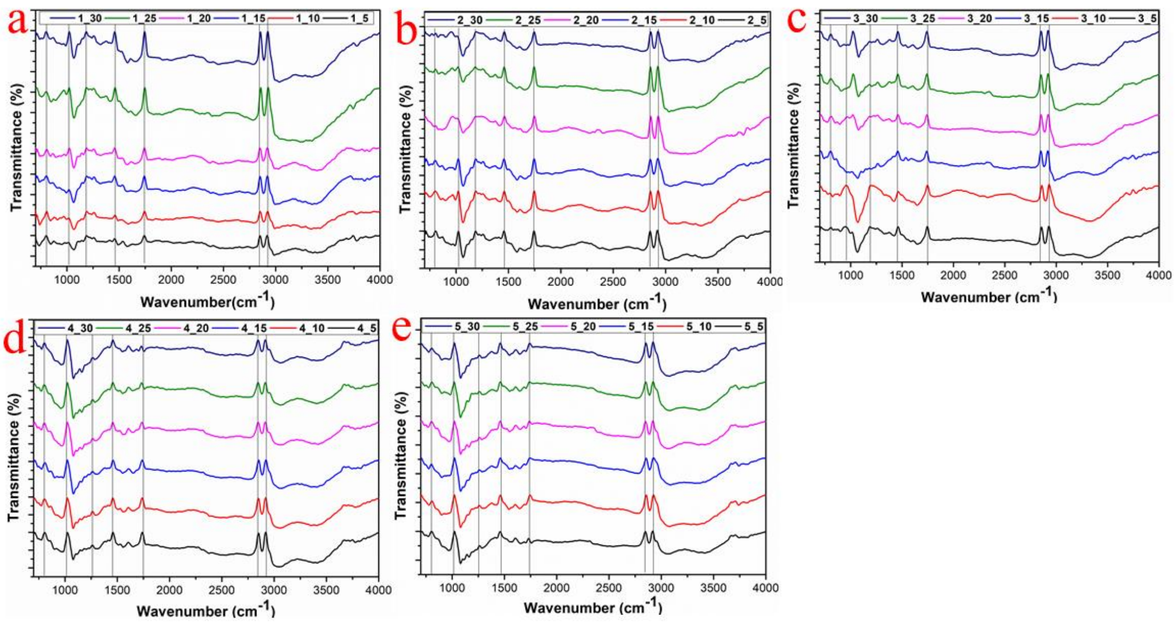

Figure 1 FTIR analysis of the carboxyl modified octyl SAMs modified Ti6Al4V model implant surfaces, (a) at 1% $KMnO_4$, (b) at 2% $KMnO_4$, (c) at 3% $KMnO_4$, (d) at 4% $KMnO_4$, and (e) at 5 % $KMnO_4$ concentration.