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Bioactivity and mechanical characterization of porous glass scaffold derived from sand

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Alkoxysilanes such as Tetraethyl orthosilicate (TEOS) and trimethyl orthosilicate (TMOS) are expensive precursors to silicate-based sol-gel-derived bioactive glasses. Facile approaches involving low cost substitutes are desirable for bioactive glass implants in bone regeneration therapy. Quaternary system SiO2-Na_2O-CaO-P_2O_5 bioactive glass was prepared by the sol-gel method from sand as precursor. The glass monolith was sintered at 950 °C, before carrying out immersion studies in simulated body fluid (SBF) for 28 days. The monolith was characterized by SEM-EDX, FTIR, XRD and compression testing. The surface morphology of the sintered monolith from SEM revealed prominent macropores with interconnected micropores and evidently dense pore struts. Porosity determined was about 82 %. After immersion the surface became heterogeneous showing agglomeration of hydroxyapatite. EDX analysis determined before and after immersion in SBF indicated an increase in Ca, P and C concentration with immersion time, attributed to the formation of carbonated hydroxyapatite (HCA). The Ca/P atomic ratio reached a value of 1.56 after immersion in SBF for 14 days tending towards 1.67 for non-stoichiometric hydroxyapatite. pH of the SBF gradually increased from 7.4 to 8.7 over the first 9 days. Result of the FTIR analysis gave bands at 872, 604 and 554 cm^{-1} diagnostic for HCA. Compression test indicated strength of 0.37 MPa which falls in range for cancellous bone. XRD analysis further confirmed presence of (HCA). The bioactive material obtained from locally sourced precursor in this study shows promising properties that can be explored as porous scaffold for bone repair.

Biography

Luqman A. Adams completed his Ph.D. in Organic Chemistry in 1996 from the University of Lagos, with most of the lab experiments carried out at the Institut National des Sciences Appliqués (INSA), France, as a World Bank Scholar. Thereafter he did postdoctoral research both at the Institute de Recherche en Chimie Organique Fine (IRCOF), France, and the Northern Illinois University, DeKalb USA. He has worked as a Research Fellow also at the Prairie View A & M University, USA. He has published more than 24 papers in peer reviewed reputable journals.

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