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EXPLORING THE POTENTIAL OF A MODIFIED NANO-DENTAL EGGSHELL-TITANIUM DIOXIDE MATERIAL AGAINST EROSIVE ACIDS

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Objective: This paper reports on the buffering and acid-resistant properties of a modified eggshell-titanium composite against erosive acids.

Materials & Methods: Eggshell-titanium EB-TiO₂ was prepared by ball milling eggshell powder and titanium dioxide. Fourier transform infrared spectroscopy (FTIR), x-ray diffraction (XRD), transmission electron microscopy (TEM), were used to characterize EB-TiO₂. The buffering property against lactic and citric acid at pH 2, 4, and 5 were measured using pH meter. Five brands of toothpastes (Colgate, Colgate Sensitive, Aquafresh, Oralwise, and Sensodyne) were used to assess the acid-resistant properties of EB-TiO₂. Enamel model were simulated by dissolving each brand of toothpastes with eggshell (control) and EB-TiO₂. The samples were exposed to citric and lactic acid of pH 2. The average slope (kPa/s) was measured using a pressure sensor. ANOVA was used to analyze the kPa/s values ($\alpha=0.05$).

Results: The FTIR, XRD analysis suggests the surface modification of EB-TiO₂. The TEM image revealed nonhomogeneous shaped particles with an average size of 13 nm. The pH test results showed that the buffering properties of eggshell and EB-TiO₂ were comparable. Significant differences were observed in the

acid resistance properties of the samples exposed to both citric and lactic acids ($P<0.05$). The colgate toothpaste infused with eggshell powder had the highest mean kPa/s values, whereas EB-TiO₂ had the lowest kPa/s values.

Conclusion: The salient features of this study indicate that modification of eggshell with titanium dioxide does not affect its carbonate buffering properties. Connecting the kPa/s values to acid resistant properties, EB-TiO₂ effectively reduces erosive attacks when added to toothpaste.

Biography

Stanley C Onwubu has graduated his Master's degree at the Durban University of Technology cum laude in 2016. He is currently in his third year studying towards his PhD at Durban University of Technology. He has published articles and book chapters in reputed journals. He strongly has passion in the development of new dental materials from recycled materials. He has previously worked on new abrasive materials using waste eggshells for polishing poly methyl methacrylate resin dentures. His current doctoral research focus on remineralization of damaged teeth using nano-sized titanium dioxide modified eggshell powder with a view of developing a mathematical model to predict dentine remineralization.

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