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SYNTHESIS OF LIGHT CURING NANOCOMPOSITE RESINS FILLED WITH SURFACE MODIFIED TIO_2 NANOPARTICLES AND THEIR CHARACTERIZATIONS

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The aim of this study is to synthesize nanoTiO_2 fillers for use in the fabrication of experimental dental nano-composites and to evaluate their properties, including surface and mechanical properties. Modern contemporary dentistry has changed drastically in restorative solutions with introduction of resins resulting in ebbing out of silver amalgam. In the evolution of composite materials, their fillers changed fundamentally and led to introducing nano-composites. As an inorganic additive of resin composites, TiO_2 has many promising properties. TiO_2 nanoparticle-reinforced dental resin composites are found to possess improved micro hardness and flexural strength. The conjugation of bisphenol A glycidyl methacrylate (Bis-GMA) onto the surface of nanoTiO_2 contributed to improvement in miscibility between nano-filler and matrix, because the reactive C=C group of GMA participated in curing of the matrix, and hence resulted in the enhancement of mechanical properties. For improving the nanoparticle dispersion and increasing possible interactions between nanoparticles and methacrylate matrix, the surface of the nanoparticles was modified with aminopropyltriethoxysilane (APTES) silane coupling agent. The surface modification of nanoparticles was confirmed by SEM, TEM and FTIR. The functionalized nanoparticles were then inscribed in 0, 1 and 2 weight percentages into resin matrix. The tensile strength of final material was improved by more than 100% upon addition of 2 wt% of modified TiO_2 nanoparticles as compared to neat resin matrix. The composite coatings also have good resistance towards various bacterial and fungal stains as compared to unfilled material. The coatings substantially gain hydrophilic nature symbiotically with TiO_2 content suggesting its potential application as self-cleanable material. TiO_2 nanoparticles are derived from a plant extract and possess the above properties. This green synthesis of nanoparticles is done by using microwave technique instead of using conventional time consuming techniques. The flexural strength and modulus of the nano-composite resin is increased by 20- 30% as compared to the resin without nano-fillers. Enhanced mechanical properties and decreased polymerization shrinkage of nano-composite resin using TiO_2 nanoparticles has a great potential for treating tooth decay or dental carries and its prevention and thus the most available commercial product for dental restorations could be improved by the addition of nanoTiO_2.

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