

Method For additive Manufacturing of Organic Neem Oil- Based Polymer Resin

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ABSTRACT

The invention introduces a novel method for additive manufacturing of a 3D printable polymer resin derived from organic neem oil. This process involves a two-step procedure where neem oil is first epoxidized using a biphasic system with methyltrioxorhenium (MTO) and hydrogen peroxide (H_2O_2) at room temperature, followed by acrylation with acrylic acid. The resulting acrylate is then converted into a resin by adding photoinitiators, specifically Irgacure 819 (Bis (2,4,6-trimethylbenzoyl)-phenylphosphine oxide) and Curcumin (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), making it suitable for digital light processing (DLP) 3D printing. This method eliminates the need for toxic chemicals, aligns with sustainability goals, and enhances environmental safety. The neem oil-based resin is versatile for use in pharmaceutical, medical, biomedical, oral healthcare, and packaging sectors, leveraging neem oil's medicinal properties, and offering a sustainable, non-hazardous, non-toxic alternative to the materials which are petroleum based and are obtained from synthetic routes.

KEY APPLICATION AREAS

- 1.Additive Manufacturing (3D Printing).
- 2.Bio-based & Sustainable Materials.
- 3.Biomedical & Healthcare Devices.
- 4.Pharmaceutical & Tissue Engineering.
- 5.Dental & Oral Healthcare.
- 6.Eco-friendly Packaging & Consumer Products.

POTENTIAL USE

1. 3D printing of biodegradable and biocompatible medical devices, scaffolds, and tissue engineering patches.
2. Manufacturing of dental devices, prosthetics, and oral healthcare products using neem oil-based resin.
3. Production of antimicrobial food packaging and sustainable packaging materials.
4. Fabrication of drug delivery systems, biosensors, and wearable biomedical devices.
5. Eco-friendly 3D printing of architectural models, consumer goods, and customized wearables.
6. UV-curable bio-based resins for SLA, DLP, LCD, CLIP, and other vat photopolymerization 3D printing technologies.
7. Sustainable replacement for petroleum-based 3D printing resins with biodegradable, biocompatible, and antimicrobial properties.