NOVEL BIODEGRADABLE SOYBEAN OIL-BASED COMPOSITES OBTAINED BY LCD 3D PRINTING

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The interest in developing a circular economy through the adoption of new manufacturing technologies and the use of innovative materials deriving from renewable resources is attracting considerable attention. Additive manufacturing (AM), or 3D printing, is one of the most rapidly growing technologies, as it enables the manufacturing of prototypes or parts with complex geometries in a cost-effective way and with reduced consumption of materials. Among the different AM techniques, VAT-polymerization (VP), allows to realize objects with high complexity and to achieve the highest printing resolution. However, the use of this technique is limited by the low number of sustainable photopolymerizable resins. In fact, the highest number of commercially available 3D printable photopolymers concern acrylates and epoxides derived from fossil-based sources. Due to the increasing environmental concern, vegetable oils have attracted great interest, because they are renewable, biodegradable, and inexpensive. Moreover, they exhibit structural features that make them very attractive for developing a wide range of polymeric products, competitive from academic and industrial point of view, having properties comparable to the conventional fossil-based polymers. In this scenario, the aim of the present work was to prepare novel biodegradable soybean oil-based composites containing two different biofillers, coming from agro-wastes, by means of LCD 3D printing process. Given the great interest in using vegetable oil derivatives as the main component to develop UV printable resins, the study started by an in-depth investigation of the formulations based on AESO alone and in combination with reactive diluents, such as IBOMA and THFA. Once identified the best photocurable formulations in terms of viscosity and processability, bio-based composites were prepared by adding 5 wt.% of biofillers, a corn-derived product (GTF), and a wine-derived product (WPL-DH), respectively. The purpose was to use them as reinforcing agents, and to enhance the value of this bio-renewable feedstock, leading to the realization of 3D printed parts and to environmental benefits. Different biodegradable 3D printed composites were successfully obtained by LCD with increasing complex structure and increased final properties, from thermal to mechanical point of view.

References

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