Mechanical Properties of Photocurable Resin with Added Solvents

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Products obtained by VAT photopolymerisation 3D printing have many advantages, such as speed of production, possibility of obtaining complex shapes, high resolution or low price. The masked stereolithography technique (MSLA), one of the VAT 3D printing methods, makes it possible to obtain complex parts in terms of both geometry and chemical composition, thanks to the use of liquid resin. With the selection of suitable substances, it is possible to obtain composite materials [1], including composite elements used in pharmacy with controlled release of an active pharmaceutical ingredient (API) [2]. Due to the diverse properties of available APIs, it is often necessary to use cosolvents to incorporate the API into the resin, such as alcohols or acetone. The presence of cosolvents affects the properties of the finished products, including mechanical properties [3]. The aim of this work was to compare the effects of two different alcohols, ethanol and isopropanol, which can be used as cosolvents on the properties of acrylic-urethane resin, including hardness and tensile strength. For this purpose, samples were prepared from pure resin, with the addition of 10% ethanol and 10% isopropanol. The samples obtained were subjected to a static tensile test, whereby the elastic modulus, tensile strength and relative elongation were determined. Hardness was determined using a Shore D hardness tester. The samples were tested one week after manufacture. The results obtained show a deterioration in the mechanical properties of the samples with solvent addition, but they are still satisfactory in terms of potential applications. It was shown that the properties of samples with ethanol addition are slightly better than those of samples with isopropanol at a solvent content of 10%. The study therefore opens up new avenues of research related to the use of different cosolvents allowing the introduction of a wide range of APIs into photocurable resins to obtain controlled-release composites.

Keywords: Masked Stereolitography, Photopolymerisation, Cosolvent, Solvent, Mechanical Properties, Active Pharmaceutical Ingredient

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References

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