Cellulose Nanocrystals as reinforcement to improve shape fidelity of PCL/PEG based polyurethane-urea ink for direct ink writing 3D-printing

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Direct ink writing 3D printing (DIW) has gained increasing interest due to the possibility of design complex devices overcoming drawbacks of the classic 3D printing such as the use of volatile organic compounds or crosslinkers [1-3].

In this context, the design of suitable inks for this technology results a crucial challenge owing to the requirements that the inks must fulfil in order to be suitable for this novel technology.

Thus, in this work, waterborne polyurethane-urea (WBPUU) hydrogels with different amounts of cellulose nanocrystals (CNC) have been synthesized. Rheological analysis has been performed to analyse the effect of the addition of CNC to the hydrogels, which have been printed subsequently with a cylinder form in order to study their printed performance from the rheological analysis viewpoint.

The results showed that the addition of CNC to the WBPUU based ink modified rheological parameters such as viscosity and storage modulus, and improve the structure recovery, leading to inks with better printing performance and shape fidelity when small amounts of CNC are added (Figure 1).

Hence, using the rheological analysis it is possible to establish a relationship between the structure of the gels, their rheological properties and the printability so as to design inks suitable for DIW 3D printing.

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References

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Figures

Figure 1: Printing performance of WBPUU based inks with increasing CNC content