3D-Manufacturing of Novel Biomaterials (3D-BioMat)

Industrial biorefineries are in great role in implementing national bioeconomy strategy and promoting the development towards renewable resource utilization. The grand challenge in biorefining is the full utilization of biomass into high value-added products. In our 3D-Biomat project we will provide valorization pathways to overcome this gap. Our main goals are new material concepts and production value chains by combining novel biomaterials with the fast-developing 3D-additive manufacturing technologies.

In this project we have developed solvent free resins, which can be used in the paste extrusion technology (one of the main 3D-printing technologies) to prepare large/coarse objects (Figure 1A). These resins can also be used in SLA 3D-printing technology to prepare more accurate/small resolution objects (Figure 1B). These developed resins consist of 5-50 % of bio-based material. Moreover, the existing oil-based material in the resin, namely acrylic acid, is a good candidate to be the next bio-based material prepared in industrial scale[1]. In parallel with the resin developments, we have been able to modify the paste extrusion technology so that printing of overhangs has become possible.

We also have developed different methods to prepare 100% bio-based 3D-objects. In these methods the 3D-objetcs are prepared via; 1) growing bacterial cellulose inside a mold (Figure 1C), or 2) paste extruding of concentrated biomaterial/water solutions.
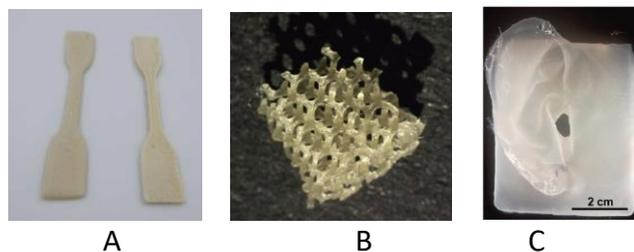

| A | B | C |

Figure 1   3D-printed objects; A) tensile test bars, length >100mm, bio content 32 wt-%, B) gyroid, 8*8*8 mm, bio content 15 wt-% C) ear, height ¨70 mm, bio content 100%

In the future, we are aiming to scale up of this paste extrusion technology, together with these new acrylic acid based resin, enabling the preparation of larger objects (weights of >500 g). Also, we are studying the possibility to use these 100% bio-based materials in medical applications, like for cultivation of cells, bacteria and tissue.

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