Proliferation of *Rindera graeca* hairy roots on polymeric scaffolds

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Plants are the greatest source of anticancer medicaments all over the world. The application of in vitro methods to plant tissue cultures allows for increasing biomass proliferation and maximizing the productivity of secondary metabolites. Various in vitro techniques are proposed to intensify plant biomass cultures for anticancer metabolite production. Literature data indicate that plant biomass immobilization is one of the most efficient techniques which significantly increases biomass proliferation and the yield of the secondary metabolites secretion. The application of polymeric-based scaffolds for pant biomass immobilization may be an easy and inexpensive way of supporting culture systems for hairy roots bioengineering.

The aim of the study was to quantitatively identify the influence of four various polymeric constructs on biomass proliferation and naphthoquinone derivatives secretion in cultures of *Rindera graeca* hairy roots. Biomass was independently immobilized on polymeric constructs made of pure and certified polylactic acid (PLA), acrylonitrile styrene acrylate (ASA), acrylonitrile butadiene styrene (ABS), or nylon (N). Different shapes and surfaces of scaffolds were applied. As a reference system, a culture of non-immobilized biomass without any polymeric constructs was performed. The increase of the fresh biomass and naphthoquinone derivatives concentration in culture systems were determined quantitatively.

Immobilization of hairy roots on PLA greatly increased fresh biomass, while immobilization on N had no significant impact on biomass proliferation. The application of ASA and ABS even decreased the level of fresh biomass in comparison to the reference culture system. The most effective in increasing proliferation was the polymeric scaffold made of PLA 90, which stands for overhang angle in 3D printing. Naphthoquinone derivatives have been noticed only in the culture immobilized on a ball-shaped PLA. In other cultures, naphthoquinone derivatives concentration did not reach the detection threshold.

Funding: This research was funded by the National Science Centre (NCN), Poland, grant no. 2021/41/N/ST8/00958.