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Abstract

Flow Chemistry for Developing Plant Biostimulants: Designed Grafting of Hydroxycinnamic Acids to Chitosan †

Ioana Silvia Hosu *, Luminita Dimitriu, Ioana Bala, Diana Constantinescu-Aruxandei, Ovidiu Dima and Florin Oancea *

Bioresources Department, National Institute for Research & Development in Chemistry and Petrochemistry—ICECHIM, 202 Spl. Independentei, Bioproducts, Sector 6, 060021 Bucharest, Romania; luminita_dimitriu@yahoo.com (L.D.); balaioana97@yahoo.com (I.B.); diana.constantinescu@icechim.ro (D.C.-A.); phd.ovidiu.dima@gmail.com (O.D.)

* Correspondence: ioana.shosu@yahoo.com (I.S.H.); florino@ping.ro (F.O.)

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A plant biostimulant (PBs) is any substance or microorganism applied to plants and intended to enhance nutrition efficiency, abiotic stress tolerance, and/or crop quality traits, regardless of its nutrient content. The first generation of organic plant biostimulants were complex mixtures obtained by extracting the existing organic fertilizer/soil improvers. The second generation of plant biostimulants are products based on the selected active ingredient. One of these active ingredients is chitosan. One of the problems is that chitosan is not water-soluble and cannot be applied easily to plants. Chemical covalent grafting of hydroxycinnamic acids could solve this problem and improve plant biostimulant activity. We investigated the grafting approach by flow chemistry and compared the results of the flow system with the batch reaction. We made batch and in-flow grafting reactions based on the radical grafting method. After the reaction, the conjugate was dialyzed for 3 days and lyophilized. Solubility was studied in water. The lyophilized grafted conjugates were characterized with FTIR, UV-Vis, TEM, and DLS and analyzed for their antioxidant activities. We compared the reaction performed in batch with the ones performed in flow chemistry. We determined the qualitative grafting of ferulic acid of dialyzed and lyophilized powder solubilized in water. The presence of absorbance at 287 and 310 nm corresponding to ferulic acid was observed on the hybrid [1]. The antioxidant activities were maintained for the flow chemistry reactions when compared to batch. FTIR showed an appearing peak corresponding to amide II groups, confirming the grafting. TEM images and DLS revealed the formation of particles with dimensions of around a few hundred nm.

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Reference

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