ENZYMATIC PRODUCTION OF ACYLATED NARINGIN TO IMPROVE ITS SOLUBILITY

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Introduction. Naringin is a flavonoid that has been shown to be a good antioxidant nutraceutical ingredient (1), although its applications in final formulations represent a challenge due to its low solubility, both in water and in organic solvents. This study addresses this problem by functionalizing naringin through enzymatic acylation catalyzed by the immobilized lipase *Candida antarctica* lipase B and using acyl donors of different chain lengths.

Methods. Acylation was performed using three different molar ratios (1:3, 1:5, 1:10) using acetonitrile as the reaction solvent, three activated acyl donors, acetate (C2), propionate (C3), and laurate (C12) vinyl esters, were used the reaction products and solubility were evaluated by HPLC and the acylation was confirmed by mass spectrometry and FTIR analysis.

Results. For naringin acetate and propionate, we found that the acylation reaction reached a maximum of 99.3% conversion at the three molar ratios in 24 h, while at 48 h, it reached 100% conversion, and for laurate, only 90% conversion was reached at 48 h (see in figure 1), only a main monoacylated product was observed in HPLC analysis, which was also corroborated by FTIR and MS/MS.

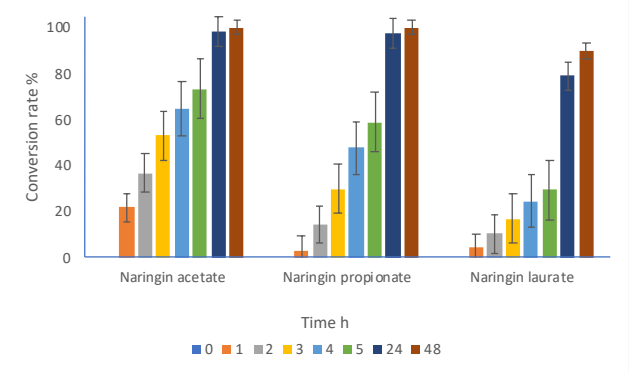

Fig. 1. Conversion rate vs time of naringin acetate, propionate, and laurate.

Compared to naringin solubility, all acylated compounds increased their solubility either in water or in solvents, up to 14, 67, and 100-fold for naringin acetate, naringin propionate, and naringin laurate, respectively, as it's shown in table 1.

Table 1. Solubility enhancement factor of naringin derivatives.

Solvent	Naringin acetate	Naringin propionate	Naringin laurate
Water	4	1	1
Ethanol	2	10	11
Methanol	14	58	100
Acetonitrile	11	67	22
Acetone	8	48	82

Conclusions. We reach a faster and efficient process to obtain naringin monoacylates, compared to others reported in previous studies with similar conditions like Yadav(2) and Sun (3). In addition, less enzyme was used, and no need for further purification.
Furthermore, the solubility was improved in different polar solvents by the modification of the naringin structure with an acyl group. These improvements could enhance the use of naringin in the food and cosmetic industries, which is often limited by its low solubility in its nonacylated form.

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