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Elicitor signal transduction leading to enhanced norepinephrine and dopamine productivity in hairy root of *Portulaca oleracea L.* using a wave bioreactor

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Norepinephrine (noradrenaline) (NA) and dopamine (DA) are amines with a 3,4-dihydroxy-substituted phenyl ring that are synthesized in many plants in response to stress conditions. In mammals, these compounds are recognized as neurotransmitters with a glycogen mobilizing function. DA and NA are significant due to their potential involvement in the pathogenesis of cognitive and neuropsychiatric symptoms following traumatic brain injury (TBT). Recently, the production of DA and NA in the hairy root of *Portulaca oleracea L.* has been reported. Scaling up culture may represent a more effective strategy for the pharmaceutical production of these secondary metabolites than extraction from plants. In this study, a hairy root culture of induced by Agrobacterium rhizogenes was grown in a 2L wave bioreactor to assess the production of NA and DA metabolites. In addition, the effects of methyl jasmonate (MJ) as an elicitor in wave bioreactor culture were measured. The results showed that the biomass of hairy root grown in a wave bioreactor was higher than that in shake flasks. The DA content in the bioreactor was slightly higher than that in the shake flasks, while the NA content did not show a significant difference between the shake flask and bioreactor cultures. Our results also indicated that 48 h elicitation with MJ significantly increased DA and NA levels in hairy root grown in a wave bioreactor. DA content increased from 1.81 in non-elicited hairy root to 7.7 mg g−1 dry weight in hairy root treated with MJ. Additionally, the NA level was high (approximately 1.572 mg g−1 dry weight), more so than in non-elicited roots grown in the bioreactor (0.187 mg g−1 dry weight). Our results demonstrate that culturing hairy root in a wave bioreactor after elicitation with MJ could improve the production of the catecholamines NA and DA for large-scale application in the pharmaceutical industry.

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