Biotransformation of Hydroquinone to Arbutin by Cell-Suspension Cultures of Three Thai Solanaceous Plants

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ABSTRACT

Cell-suspension cultures of Capsicum annuum L., Solanum aculeatissimum Jacq. and, Datura fastuosa L. (Solanaceae) were established and investigated for the ability to biotransform exogenously-supplied hydroquinone to arbutin. All cultures exhibited good 24-day growth in Murashige and Skoog medium, supplemented with 2,4-dichlorophenoxyacetic acid and benzylaminopurine as plant growth regulators, and with sucrose as a carbon source. The feeding of 15.57 mM hydroquinone into the system resulted in the production of arbutin after 24 hours and reached a maximum value after 2 to 5 days. The cell-suspension culture of C. annuum exhibited the fastest growth and the strongest glycosylation ability. The maximum yield of arbutin, as determined by a HPLC method, was 368.71±57.46 mg/L in the suspension culture of C. annuum. Cell cultures of S. aculeatissimum and D. fastuosa also showed the production of arbutin. For all systems, the amount of arbutin released into the culture medium was higher than that accumulated in the cells.

Key words: arbutin, HPLC, cell suspension culture, biotransformation, Capsicum, Solanum, Datura

INTRODUCTION

Plant cell cultures can serve as a source of enzymes that carry out the biotransformation of chemicals exogenously supplied into the system. This strategy has been used to produce high-value and/or biologically-active phytochemicals from the lower-value substrates (Yokoyama, 1996). The production of a natural tyrosinase inhibitor arbutin (hydroquinone-β-D-glucopyranoside; Figure 1A) from its precursor hydroquinone (Figure 1B) is an example of utilizing plants or plant cells as "chemical factories". The success on arbutin biotransformation by plant cells was first reported by Tabata and co-workers on cell cultures of *Datura inoxia*, which glucosylated hydroquinone into arbutin within 10 hr after administration (Tabata et al., 1976). The efficiency of *D. inoxia* cells to convert hydroquinone into arbutin was later investigated and maximum yields of 4.2 and 7.1 g/L were achieved at the usual cell density and at a high cell density, respectively (Suzuki et al., 1987). In 1991, a