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Effect of sucrose and potassium nitrate on biomass and saponin content of *Talinum paniculatum* Gaertn. hairy root in balloon-type bubble bioreactor

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ABSTRACT

Objective: To increase biomass and saponin production in hairy root culture of *Talinum paniculatum* Gaertn. (*T. paniculatum*) in balloon-type bubble bioreactor (BTBB).
Methods: Hairy roots which were collected from leaf explants of *T. paniculatum* were infected by *Agrobacterium rhizogenes* strain LB510. The hairy roots were cultivated at 400 mL Murashige and Skoog liquid medium without growth regulator (MS0) in 1 000 mL BTBB. Each BTBB had 2 g hairy roots as initial inoculum and these cultures were treated with various concentrations of sucrose (3%, 4%, 5%, 6% w/v) and potassium nitrate (0.5, 1.0, 1.5 and 2.0 strength of MS medium). Cultures were maintained for 14 days. Fresh and dry weights of hairy roots at the end of culture were investigated.
Results: Various concentrations of sucrose influenced the biomass accumulation of hairy roots. Maximum biomass was reached by MS medium supplemented with 6% sucrose and it was approximately threefold higher than control. Culture supplemented with potassium nitrate at 2.0 strength of MS0 could increase biomass accumulation of hairy roots until 0.14 g dry weight and it was almost threefold higher than control. However, the maximum saponin content was obtained by MS medium supplemented with 5% sucrose and 2.0 strength potassium nitrate of MS.
Conclusions: Based on this research, those conditions can be used to produce biomass and saponin of hairy root of *T. paniculatum* in the large scale.

1. Introduction

Java ginseng [*Talinum paniculatum* Gaertn. (*T. paniculatum*)] has been used in pharmaceutical industries for source of saponins, flavonoids, tannins, triterpenes or sterols, and polyphenols. Saponins of *T. paniculatum* are accumulated in roots. Ability and effectiveness of saponins on many medicinal treatments have been scientifically proven. Saponins were reported to be able to enhance viability, motility and number of spermatozoa. Saponins also act as a anti-inflammatory agent, have androgenic potency, are able to induce cell differentiation through receptor cells [1], and could increase body resistance to disease [2]. *T. paniculatum* needs 3–4 years to produce the maximum saponins in the root. Root culture technology could be a solution to fill saponins demand in the market. This technology is important to be developed for plant preservation and increasing saponin content in roots.

Transformation by using *Agrobacterium rhizogenes* (*A. rhizogenes*) as a mediator to transfer transfer-DNA (T-DNA) into plant DNA is shortly alternative to produce roots. The T-DNA contains genes encoding enzymes for the synthesis of the phytohormones cytokinin and auxin, and of specific opine. The expression of oncogenes in Ri plasmid is indicated by adventive roots formation in infected area of explants. These adventive

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