

03-3-03

## The Small-Scale Bioreactor Culture for the Production of Tropane Alkaloids

Hee-Young Jung, Seung-Mi Kang, Won-Jung Kim, Young-Min Kang,  
Dong-Jin Park, Yong-Duck Kim, Ji-Yun Min, and Myung-Suk Choi\*

Division of Forest Science, Gyeongsang National University, Jinju, Korea

### Objectives

For the mass production of tropane alkaloids (TA), pharmaceutically important compounds, the bioreactor culture is required instead of the flask culture. At each stage of scale-up, optimization of culture condition is essential for the efficient operation of a bioreactor and enhanced biomass and productivity. Thus, this study was carried out for the investigation of the optimal culture condition of *Scopolia parviflora* hairy roots in small-scale bioreactor.

### Materials and Methods

Adventitious hairy roots were cultured in 500 ml bubble column reactors containing 300 ml B5 medium supplemented with 5% sucrose and 0.1 mg/L IBA. Different culture conditions were applied; inoculum density- 3, 5, 10, 15, and 20 g FW, culture period- 5, 10, 15, 20, and 25 day, and air flow- 0.1, 0.2, 0.3, 0.4, and 0.5 vvm. Root growth, conductivity, and DO concentration in culture medium were determined, and TA production were measured by HPLC after 3 weeks in cultures.

### Results and Discussion

Adventitious hairy roots of *S. parviflora* produced comparable or enhanced levels of TA in a small-scale bioreactor compared to a conical flask. In the experiment by different inoculum density, the greatest biomass production was achieved in 15 g FW/bioreactor treatment. However, the growth index(GI) value, which was calculated by the ratio of (harvested FW - inoculated FW) to inoculated FW, indicated 3 or 5 g FW was more effective than 15 g FW (Fig. 1). The

production in top and bottom region of root clumps was higher than core region, which might be caused by the different available capability of oxygen and nutrient elements in culture medium. At the end of 25-day culture period, biomass and total TA production reached up to 7.2 and 4.6 times higher than those of 5-day culture. As aeration increased from 0.1 vvm to 0.4 vvm, both root growth and TA production were correspondingly augmented while excessive aeration, 0.5 vvm, showed an inhibitory effect (Fig. 2). In conclusion, the optimized conditions in a small-scale bioreactor culture was determined as 5 g inoculum density, 15-day culture period, and 0.4 vvm air flow.

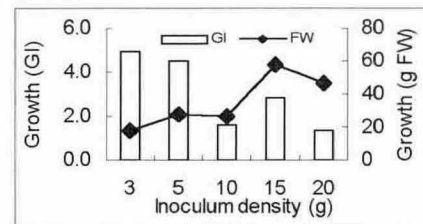


Fig. 1. The effects of different inoculum density on the growth of hairy roots.

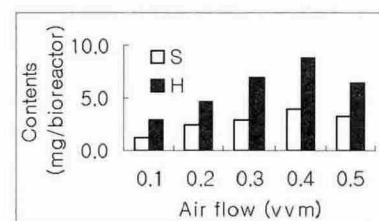


Fig. 2. The effects of aeration on TA total production. (S: scopolamine and H: hyoscyamine)