Towards the synthesis of mannose derivatives of natural phenolic compounds


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Objectives

The aim of this project is to graft a sugar moiety onto polyfunctional natural phenolic compounds (see examples in figure 1). This should enhance their water solubility and the choice of an adequate sugar such as mannose could provide cellular recognition. The synthesis route was first tested on cinnamyl alcohol which is structurally close to the base pattern of the molecules in figure 1.

Synthesis of cinnamyl mannoside

**Reactional Scheme**

- **α-D-Mannopyranose M**
- **Cinnamyl alcohol CA**
- **Cinnamyl mannoside CM**

**Comparison of the chemical and enzymatic synthesis routes**

- **CM: enzymatic route**
- **CM: enzymatic MWA route**
- **CM: chemical route**
- **CM: chemical MWA route**

**Optimisation of mannose and water levels for the enzymatic route**

- **Water 15%**
- **Mannose 0.2M**
- **Mannose 0.4M**
- **Mannose 0.8M**

Initial concentration conditions (Akita, 2006) => best CM production

**Design of experiment**

Optimum obtained with 0.2M mannose and 10% water

**Comparison of two methods for the enzymatic synthesis**

- **β-D-glucosidase from almond (12U/ml) + D-mannose (0.2M) + water (15%)**
- **CA (0.8M) + t-BuOH (Akita’s method) [co-solvent (pyridine or DMSO)]**
- **CA (as solvent and reactant) [Vic’s method]**

Reaction for 7 days at 50°C

**CM enzymatic production**

- Best CM production obtained when using the CA as solvent
- However, tert-butanol is necessary to solubilize solid alcohol reagents
- No activity was observed in the presence of Pyridine or DMSO.

Conclusions

- Results show that β-glucosidase is able to synthetize CM from M and CA.
- Enzyme-catalyzed route lead to only one product and is so more specific than the chemical route where several products are observed.

Perspectives

- This reaction will be tested with more complex molecules (for example coniferyl alcohol).
- Obtention of only one product will be important for next fundamental studies (Interaction of the product with model membranes by Isothermal Titration Calorimetry and with the Langmuir Film Trough technique).

References

- Akita, H. et al. Journal of Molecular Catalysis B: Enzymatic 2006, 40, 8–15

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