Glucosidation modification of alcoholic and phenolic compounds using transglycosylation reaction of a solvent tolerant α-1,4-glucosidase from a strain of deep-sea Geobacillus

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Glucosidation of alcoholic and phenolic compounds is a useful modification that not only can protect the hydroxyl group(s) from oxidation and enhances water solubility of the aglycols but may also provide the precursory compounds with new biological properties. Chemical glucosidation of a hydroxyl group often employs a two-step strategy (1-3): i) glucosidation using acetobromoglucose and ii) deacylation. Besides the inherent low specificity of the chemical reaction, both steps are carried out in a strong alkaline condition that leads to the degradation and polymerization of alcoholic and phenolic compounds. These reasons contribute to the low yield of the method. The use of UDP-glucosyltransferases has some advantages over the chemical method, e.g. high specificity and yield, mild condition; however, the enzymes utilize an expensive substrate, UDP-glucose, and attempts to design an in vivo system produce both the enzyme and GDP-glucose were not successful making the method not imminent for applications (4-5).

We have isolated and exogenously hyperproduced an alkaline, thermostable, and solvent tolerant α-1,4-glucosidase (GSJ) from a strain of deep-sea Geobacillus (HTA-462), one of deepest sea bacteria isolated from the sediment of Mariana Trench, and the enzyme possesses an overwhelming transglycosylation activity (6). We present here a useful and cost effective method for glucosylation of alcoholic and phenolic compounds. A typical reaction using 0.3U/l of GSJ, 0.5M maltose as sugar-donor, pH 5-9, acetone (or acetonitrile) 0-25%, a suitable amount of sugar-acceptors, ambient temperature, and 2-3h reaction-time could give an overall yield of glucosyl products between 20-60%, depending on the nature of the sugar-acceptors. A number of novel attractive compounds synthesized by GSJ will be presented including glucosyl derivatives of chloramphenicol, cortisone, and farnesol. Insights into the mechanism of the transglycosylation reaction catalyzed by GSJ and perspectives of the method will be discussed.

References