Testing of the Efficiency of Some Enzymatic Mixtures, Concerning the Conversion of Glucide Polymers from Sweetpotato to Reducing Sugars, as a Notable Source to Produce Bioethanol

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Abstract

Introduction. The increased dependence on fossil fuel in meeting the energy demands of the modern society results in elevated CO2 levels in the atmosphere, linked to global warming. As fossil energy supplies will no longer be adequate and affordable in the near future, the attention is driven to industrial biotechnology, able to develop biofuels from renewable energy sources [5]. The important quantities of glucide polymers and the high randament of their transformation in fermentable glucides, recommend sweetpotato as a notable source to produce bioethanol. The glucides represent 80-90% of the total dry substance. Of the total polyglucides, 2-5% is represented by cellulose, 3-4% by hemicellulose, 70% by starch and 2.5-3% by pectins. The mono and oligo glucides are present in concentrations of 10 times lower compared to the starch ones, the reducing glucides are present as traces, while the dextrines are missing [3]. Conclusively, sweetpotato starch, cellulose and hemicellulose hydrolysis can be performed by using enzyme mixtures having specificity for the respective substrates [2, 4]. The goal of this research is the testing of the efficiency of some enzymes and enzymatic mixtures, used for the hydrolysis of polyglucides from the sweetpotato storage roots, to reducing glucides.

Materials and Methods. We used conditioned sweetpotato storage roots (pre-dried and crumbled). The first step which has been performed was the laboratory analysis concerning the % moisture content of the substrate at 60 and 105°C (The Practical Reference Method, SR ISO 712/1999). After that, the polyglucide substrate was hydrolysed using some commercial enzyme preparations: Amylex 3 T (α-amylase), Laminex 440 (glucanase, pentosanase), Dyazime X4 (amyloglucosidase), MethaPlus (β-glucanase, xylanase, cellulase), Veron M4 (β-amylase) and BG α-malt (α-amylase). Enzymatic hydrolysis was performed at 60°C, during 20 h period, on a rotary shaker at 200 rpm. The efficiency of hydrolysis was estimated by quantifying the amount of reducing sugars. The reducing sugars were recorded as glucose, by reading the absorption at 640 nm, using 3,5-dinitrosalicilic acid (Peterson and Porath modified method) [1].

Results and Discussions. The most active proved to be the mixture of Dyazime X4 and Laminex 440 (78.71% glucose on dry matter basis), Dyazime (75.81% glucose), followed by the mixture of Amylex 3T+Laminex 440 (64.92% glucose on dry matter basis) and MethaPlus (64.92% glucose on dry matter basis). Increase in reducing sugars, comparative to control, was between 5.41-82%, reported to the enzymatic mixtures used. After enzymatic hydrolysis, the glucide juice was fermented with some Saccharomyces species and distilled. Purification and anhydridation was efficiently performed on molecular sieve.

References