Using Different Concentrations Of Some Agricultural Wastes as a Carbon Source For The Production of Xylanase Enzyme

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Abstract. xylan extracted by dilute acid treatment from papyrus was used as a carbon source to produce xylanase enzyme in five concentrations of 0.1, 0.3, 0.5, 0.7 and 0.9%. the highest production of xylanase was at a concentration of 0.5%, with an enzyme activity of 2800 U/ml, then a concentration of 0.7% with an enzymatic activity of 2520 U/ml, then concentrations of 0.9, 0.3 and 0.1% with an enzymatic activity 0f 2360, 2280 and 1280 U/ml, respectively. Under production conditions, the rotor was incubated in front of the vibrating incubator at 150 rpm and at a temperature of 37 C for 48 hours.

Keywords: Agricultural Wastes, Carbon, Xylanase Enzyme

Introduction: xylan, after cellulose, is the most available polysaccharide in wood. many agricultural and industrial wastes consist of a number of major chain heterogeneous sugars that contain different or branched alternatives (Shallom and Shoham, 2005). the alternatives include arabinofuranosyl, glucuronyl and acetyl group, which show a clear effect on the chemical properties. structural and also on the enzymatic hydrolysis of xylan in lignocellulose (Collins et al., 2005).

Xylanase is produced by many fungi and bacteria. Industrially, filamentous fungi that produce these enzymes are important due to the secretion of xylenes and their ease of use (Dekker, 2003)

These commercial enzymes are used in the pulp and paper industry, food and beverage, textile and animal feed industries (Polizeli et al., 2005)

Also, xylanase enzymes show a great potential to increase the production of many useful products such as xylitol and ethanol in an economic way (Beg et al., 2001)

Most commercial xylanase enzymes are produced by Penicillium, Aspergillus, Bacillus, Trichoderma, Taloromyces and Aureobasidium (Li et al., 2000).

Keyword: Agricultural waste, xylanase enzyme, submerged fermentation

Materials and Methods

Extraction of xylan from papyrus: xylan was extracted from papyrus by using the dilute acid treatment method for the purpose of recovering the largest amount of xylan present in the biomass

Dilute acid treatment: the dilute acid treatment method was used to extract xylan mentioned in Yang et al,. (2005)

Quantification of extracted xylan: the xylan extract was estimated according to the method reported by Dubois et al. (1956) based on the phenol-sulfuric acid method for the determination of total sugars

Microorganism: Bacillus subtilis bacteria, which produce xylanase enzyme.

Production medium: the nutritional medium mentioned in Gowdhaman et al., (2014) was adopted consisting of : Xylan 0.5, Peptone 0.5, Nacl 0.1, K_2HPO_4 0.2, $Cacl_2$ 0.01, $MgSo_4.7H_2O$ 0.01, Yeast extract 0.1 (g/l).

Production of xylanase: the 250 ml flasks and the container on the production medium were inoculated with 100 ml / flask with 1 ml of bacterial suspension and 1 x 10^7 cells / ml of pure Bacillus subtilis bacteria and incubated in the vibrating incubator at a temperature of 37 C at a number of 150 rpm for 48 hours (Gowdhaman et al,. 2014).

Enzyme extraction: xylanase was extracted by centrifuging the production medium at a speed of 12000xg for 10 minutes at a temperature of 4 C. The precipitate was discarded and the filtrate was counted as the crude extract in the enzyme (Roy and Rawshanul, 2002).

Estimation of enzyme activity: it was followed as described by Miller, (1959) in estimating the activity of the enzyme according to the method of estimating reducing sugars.

Result and Discussion

The optimum concentration of the carbon source: the carbon source is one of the necessary and variable components in the fermentation medium of microorganisms, as important and vital for the growth and metabolism of cells (Gowdhaman et al., 2014). xylan extracted by acidic method was used for the agricultural residues was added to the production medium instead of the carbon source in the same quantity. The obtained results showed in Figure (1) that xylan extracted from the papyrus plant gave the highest activity to the enzyme xylanase produced by Bacillus subtilis with an efficiency of 2800 U/ml. the reason for the difference in effectiveness, may be due to the difference in the concentration of extracted xylan, which may contain nutrients that support bacterial growth and enzyme production. Thus, the presence of physiological differences may enable the bacteria to give a high productivity of the enzyme.

In order to determine the optimal concentration of the carbon source in the production of xylanase enzyme from Bacillus subtilis strain bacteria, the effect of different concentrations of xylan produced from sedge was studied, including concentrations (0.1%, 0.3%, 0.5%, 0.7%, and 0.9%) with a difference of 0.2% between the concentration Finally, the results shown in Figure 1) showed that the enzymatic activity reached a maximum of 2800 U/ml at a concentration of 0.5% compared with the rest of the concentrations.

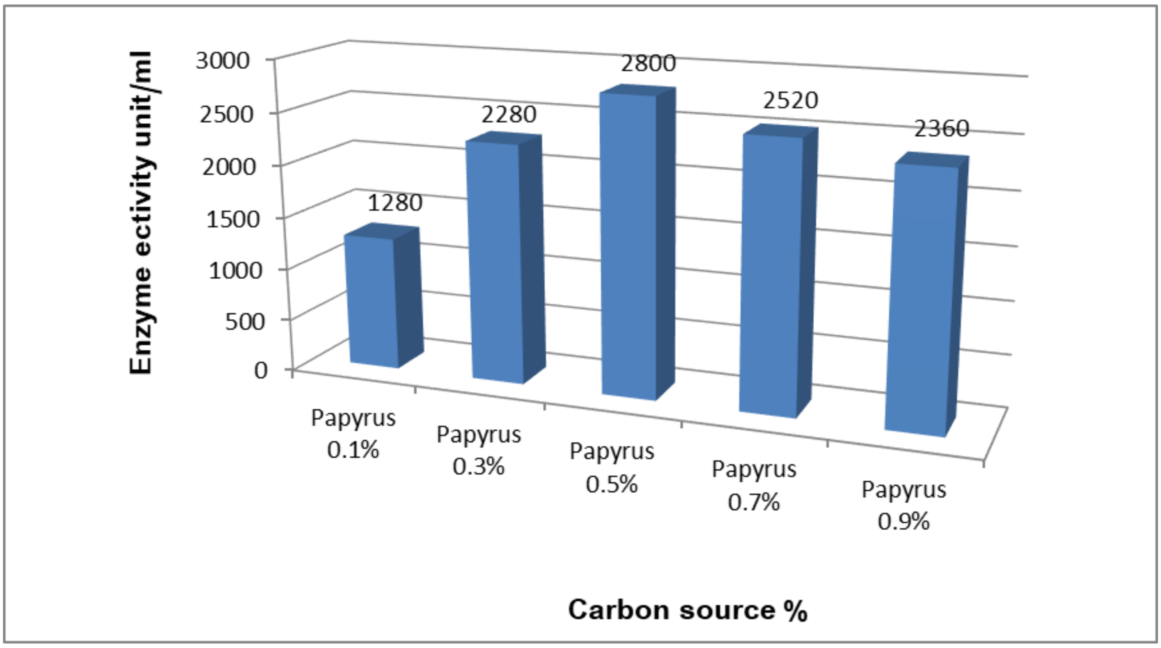

Fig (1) : effect of xylan concentration produced from papyrus on the productivity of xylanase enzyme from Bacillus subtilis bacteria.

The type and concentration of carbon sources required to be provided in the production medium varies for the development of different types of microorganisms intended for the production of industrial enzymes.

several researchers have studied the effect of carbon source concentration on the production of xylanase from different microorganisms, as Yasinok et al., (2008) mentioned that the best production of xylanase enzyme from Bacillus pumilus is by using corn grain powder at a concentration of 3%, as found Annamalai et al., (2009). that the optimum concentration of oat xylene for producing xylanase from Bacillus subtilis bacteria was 5 g/l, and Roy and Rowshanul, (2009) found that the production of xylanase enzyme from Bacillus cereus was using oat xylan at a concentration of 0.5%, while Krishnaveni indicated, (2011) indicated that the use of xylan and glucose together gives the best production of xylanase enzyme from Bacillus cereus at a concentration of (0.5-3%) for each, while (Sharma et al., 2013) indicated that the highest production of xylanase enzyme from Paenibacillus macquariensis was by using Birch wood xylan at a concentration of 2%, and Gowdhaman et al., (2014). showed that the best concentration of birch wood xylan for producing xylanase enzyme from Bacillus aerophilus KGJ2 is 0.5%, and Amit and Nikul, (2014) found that a concentration of 0.3 g/100 ml of xylan pine wood give The highest yield of xylanase was obtained by using bacterial isolate from garden soil.

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