



Effect of Growth Factors & Nutrients On Growth & Elaboration of Cellulase Enzymes from *Aspergillus niger*

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Abstract – Fungi are responsible for biodegradation of different materials, mainly celluloses, under aerobic, anaerobic, mesophilic and thermophilic conditions by accumulating enzymes in their culture media. These enzymes aid in the biodegradation of cellulosic substances, either directly or indirectly. Fungi, such as, *Aspergillus niger*, are potential Cellulase Enzyme sources. The present work deals with the study of various growth factors and Vitamins that are responsible for growth of microorganisms and the Cellulase Enzyme produced by them.

Index Terms – Cellulase, Biodegradation.

I. INTRODUCTION

Microorganisms need a variety of materials from environment to function and accomplish two primary goals—supply enough energy to manage their processes and extract building blocks to repair themselves or procreate. All microorganisms need food. The food sources can vary but the organisms primarily extract carbon and nitrogen from substances, such as, proteins, fats and carbohydrates. Some microorganisms seek out and absorb such particles. Others may perform chemical reactions with surrounding elements, such as, carbon dioxide to gain what they need. Nitrogen, which is used to synthesize proteins, can be taken from the surrounding atmosphere to form the organic matter. There are many organisms that require an oxygen-rich environment to survive, but others actually flourish in low-oxygen surroundings.

Aspergillus niger is a highly cellulolytic fungus, known as a producer of Cellulase Enzymes. Singh et al (1988) isolated a cellulolytic strain of *Aspergillus niger* which possesses a complete Cellulase system and efficiently utilizes different lignocellulosic substrates in submerged as well as in solid state cultures. It is a filamentous fungus used in the commercial production of citric acid and homologous

enzymes. It is also a promising host for heterologous protein production on both laboratory and commercial scales. Collings et al (1988) investigated the production of endoglucanase, exoglucanase, glucosidase and related enzymes by the mesophilic fungus *Aspergillus niger*. According to them the production of extracellular enzyme by *Aspergillus niger* was greatest when it was grown on carboxymethyl cellulose. Muhammad Sohail et al (2009), observed that the production of endoglucanase reaches its maximum during exponential phase of growth, while β -glucosidase during the stationary phase.

II. EXPERIMENTAL

A. Materials & Method:

To determine the effect of various growth factors and nutrients, *Aspergillus niger* was grown on Czapek's medium containing different nitrogenous compounds, vitamins and growth promoting substances. The flasks were incubated at $28 \pm 1^\circ\text{C}$ for 7 days under stationary conditions. Control flasks, lacking any nutrient, were also incubated.

After 7 days of incubation, the growth of the fungal cultures was observed and calculated in terms of dry mycelial weight. The activities of the elaborated enzymes were determined as the amount of reducing sugars formed at the end of the reaction. The results are recorded in the Table.

Effect of growth factors and nutrients on growth and elaboration of enzymes

Growth Factors/ Nutrients	<u>A. niger</u>	
	Cell mass (mg/100 ml)	Enzyme activity (μ g/ml)
Control	340	700
Biotin	365	750
Calcium pantothenate	362	720
Riboflavin	361	690
Thiamine-HCl	360	690
Asparagine	170	120
Peptone	358	590
Ammonium chloride	358	670
Ammonium sulphate	353	490
Ammonium phosphate	360	570
Sodium nitrate	177	270
Urea	356	570

Number of determinations were three in each case.



B. Result and Discussion:

The results recorded in the Table indicate that the fungus shows maximum growth and maximum enzyme activity when the medium contains Vitamins, like biotin and calcium pantothenate. Riboflavin and thiamine-HCl are also found to be effective in enhancing the growth to some extent. The medium containing asparagine and sodium nitrate as Nitrogen sources show very poor growth and a very low enzyme activity. Peptone is ineffective for growth but lowers the enzyme activity to some extent. Other nitrogen sources, like ammonium chloride, ammonium sulphate, ammonium phosphate and urea in the medium show normal growth and normal enzyme activity.

Trivedi and Rao (1979) reported maximum production of all Cellulase components of *Aspergillus fumigatus* on the 12th day of growth in basal medium containing cellulose as sole carbon source and a combination of ammonium sulphate and ammonium di hydrogen phosphate as nitrogen source. The favorable effect of yeast extract on cell growth of *Clostridium thermocellum* in glucose medium may be due to either organic nitrogen sources or growth factors contained in yeast extract (Park and Ryu, 1983). They found that biotin, which is related to the fatty acid metabolism and membrane permeability, had the most favorable effect on glucose utilization and cell growth, followed by thiamine-HCl, pyridoxal-HCl and pantothenic acid.

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