Chapter I

Introduction

The last few decades expressed on active scientific and technologicol development of research on ultilization of waste materials as a renewable base. There has been a growing interest in lignocelluloses bioconversion as a renewable energy source. Xylan is the major constituent of hemicelluloses and has a high potential for degradation to useful products. These compounds were present in the cell wall and in the middle lamella of plant cells. Xylan was a complex structure of the hemicelluloses in wood. The main enzyme using for de-structure of the xylan backbone was xylanase. Xylanase hydrolyze randomly on the backbone of xylan to make shorter chain monosaccharide as xylose (Khucharoenphaisan and Sinma, 2010).

Chemical hydrolysis of xylan applied extensively by the industries, although the proces was faster, it is accompanied with the formation of toxic compounds and is hazardous to the human health and environment (Ninawe *et al*., 2008).

Microorganisms in particular have been regarded as a treasure of useful xylanase enzymes, because they multiply at extremely high rate and synthesize biologically active products, which can be controlled by humans. In recent years, there has been a phenomenal increase in the use of

enzymes as industrial catalysts. These enzymes offer advantages over the use of conventional chemical catalysts for numerous reasons: they exhibit high catalytic activity, a high degree of substrate specificity, can be produced in large amounts, are highly biodegradable, pose no threat to the environment and are economically viable. Filamentous fungi have been widely used to produce hydrolytic enzymes for industrial applications, like xylanase whose levels in fungi are generally much higher than those in yeast and bacteria (Sarao *et al.,* 2010).

Recently, extensive research on fungi has been conducted to isolate new organisms with tremendous secretion of ligninolytic enzymes as well as enzymes with potential industrial applications. One of the major enzymes associated with lignin-degrading ability is xylanases (Altaf *et al.,* 2010).

Xylanase acts on β-1,4 xylan and cleaves β-1,4 glycosidic linkage randomly. Xylanase enzyme has attracted considerable research interest because of its potential applications in various industries in biotechnology. For instance, increasing the body mass of the animal (Silversides and Bedford, 1999) and food industry (Figueroa-Espinoza *et al.*, 2004). It is of industrial importance in paper manufacturing to degrade xylan and increasing the brightness of pulp and for clarification of fruit juices. The use of xylanase avoids the use of chemical processes that are very expensive and cause pollution. The chemical extraction of lignin from pulp improved by treatment with xylanases. The screening for naturally occurring microbial strains that are capable of secreting xylanases was found by Garg *et al.* (2009).

The understanding physiological mechanism regulating enzyme synthesis and purification could be useful for improving the technological process of enzymes production (Songulashvili *et al.*, 2007).

The importance of understanding of the effects of electromagnetic radiation on biological systems has spurred a great research effort, not only because of its basic biological interest, but also for its technological applications (Trombert *et al*., 2007).

Geweely *et al.* (2006) stimulated alkalo- thermophilic *Aspergillus terreus* xylanase by low intensity radiation. Characterization of the purified enzymes revealed that the enzyme recovered from the irradiated fungus was more thermostable and had a wider range of optimum pH values (60-70 ºC) and pHs (4.0-12) respectively, compared to that recovered from non-irradiated fungus. The xylanase enzyme recovered from irradiated alkalo-thermophilic *A. terreus* is preferable enzyme than that recovered from non-irradiated fungus, which applied in chemical bleaching and other industrial processes. Santiago *et al.* (2006) stated that the mutant strains from *Aspergillus niger* were produced by UV radiation to increase their enzyme activity production.

The main aim of the present work is to search for new sources of fungal xylanase isolated from different soil samples located in Jeddah district, Saudi Arabia. The fungal isolates, exerting high potentiality in xylanase activities were evaluated under different conditions. Selection of the most efficient fungal species producing xylanase will be taken in to consideration. More consideration will be given to the cultural and physical factors influencing the induction of

extracellular xylanase enzyme. Radiation mutagenesis by ultraviolet will be carried out for stimulating the production of extracellular xylanase. Extraction and purification of the most efficient radio-stimulated fungal species producing extracellular xylanase in order to characterize and specify it for possible use in application in biotechnology.