Chapter 32
Industrially Important Enzymes Production From Food Waste:
An Alternative Approach to Land Filling

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ABSTRACT

To link food demand and reduction in food waste, proactive approaches should be taken. Perishable food is mainly fruits and vegetables, waste from different processing industries like pulses, meat products, oil products, dairy products, and fishery byproducts. Conventional food waste management solution is land filling which is not sustainable as it generates global warming gases like methane and carbon dioxide. To reduce food waste, the process known as "food valorization" has become another solution to landfilling, the concept which is given by European Commission in 2012, meaning food processing waste conversion to value-added products. In this chapter the study focuses on production of industrially important enzymes from food waste which could be one of the reactive solutions. Different enzymes like pectinase, peroxidase, lipase, glucoamylase, and protease can be produced from food waste.

INTRODUCTION

Food Demand is rising globally in the proportion to rapid population growth. This leads to increase in Food production and ultimately in food waste or loss in food supply chain from initiation to final consumption. For sustainable food waste management, the waste hierarchy concept (1975) given by European Waste Policy can be useful to categorize the food waste and treat them accordingly. Some of the indicators used in food waste classification are edibility (edible/nonedible), State (Eatable/uneatable), Origin (Animal/plant) and complexity (single product/complex product). Water activity is the main factor assisting to predict the presence of microorganisms spoiling the food. Among them bacteria need water activity 0.85 and molds (0.7-0.8) for growth. It is important to treat solid food waste and liquid food waste eco-friendly.

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Liquid waste generally contains proteins, sugars, starches, and fats. The researchers focused on the study of different problems faced by developing and developed countries regarding food waste generation and management.

Out of total industrially important enzymes production food industry useful enzymes are 45%, detergent industry 35%, textile 10%, and leather 3%. For the production, fungi and bacteria are mainly used and others involve higher plants, higher animals, yeasts and *Streptomyces*. Chapter covers the information from food waste generation, classification, different strategies used to manage food waste, microbial sources used in different enzyme production, different food waste types with examples, future aspects and conclusion.

FOOD WASTE GENERATION

According to many researchers hospitality industries and households which are the end of the food supply chain are contributing food waste generation. Developed and developing countries are defined by the Gross National Income (GNI) index. This study reveals that though the developing countries have less food demand as compared to developed countries, the food waste generation contributed by both of them is equal in quantity. Many researchers have shown that most food is wasted at the end of the food supply chain. Before considering Food Waste (FW) it is important to distinguish between food loss and food waste. (As classified in Table 1)

Food loss is the one which occurs before completing food supply chain and transformed into a final product. Before that point only food spills, lost or reduce in nutritional value and volume also. Food waste is the one which occurs after completing food supply chain. It may occur before consumption or before spoiling it is left to spoil. Table 1 explains the food loss and food waste.

Table 1. Food loss and waste along the value chain

Production	Handling and storage	Processing and packaging	Distribution and Market	Consumption
During or immediately after harvesting on the farm	After produce leaves the farm for handling, storage and transport	During industrial or domestic processing and/ or packaging	During distribution to markets, including losses and wholesale and retail markets	Losses in the home or business of the consumer, including restaurants/ caterers
Fruits bruised during picking or threshing	Edible food eaten by pests	Milk spoiled during pasteurization and processing	Edible produce sorted out due to quality	Edible produce sorted out due to quality
Crops sorted out post- harvest for not meeting quality standards	Edible produce degraded by fungus or disease	Edible fruits or grains sorted out as not suitable for processing	Edible products expired before being purchased	Food purchased but not eaten
Crops left behind in fields due to poor mechanical harvesting or sharp drop in prices	Livestock death during transport to slaughter or not accepted for slaughter	Livestock trimming during slaughtering and industrial processing	Edible products spoiled or damaged in market	Food cooked but not eaten

Source: Bagherzadeh et.al, 2014 OECD, France