

REVIEW ARTICLE

Chemical Aspects of Fermentation Technology in Food Processing Industries

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ABSTRACT

Fermentation is brought about by the conversion of sugars into ethanol chemically (Ganguly, 2012a). The fermentation technology applicable to food processing sector is also popularly known as zymology or zymurgy. Fermentation is an important and popular technique in food processing technology. It is resulted from the chemical reaction resulting from the breakdown of higher carbohydrates to alcohols and organic acids or alcoholic derivatives.

Key words: Fermentation, Food processing

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INTRODUCTION

Fermentation is a microbial technique and the reaction to be controlled in favorable and desirable conditions for food safety and quality after fermentation, especially in the production of alcoholic premium quality beverages like beer, wine and cider [1-3]. The same technology is employed in the bread manufacturing industries for leavening activity brought about by the production of carbon dioxide by the microbial or yeast activity. The preservation effect during fermentation is attributed to the production of lactic acid in sour foods such as yoghurt, dry sausages, pickles, sauerkraut and vinegar (extremely diluted acetic acid) [2,4].

The fermentation technology under controlled conditions is an age old practice both in households and industries for food processing and preservation, be it alcoholic beverage products of edible products derived from vegetable, fish and meat sources [2]. Louis Pasteur, the renowned French chemist is the world famous and first known zymologist in history, who in 1856 established the pivotal role of yeasts in fermentation. Pasteur originally defined fermentation as "respiration without air" after regular performances of lengthy experimental protocols [5]. After observation of the breakdown of sugars to alcohols by the action of yeast, the pioneer concluded that the entire reaction is driven by the chemical catalytic action of certain forces called ferments inside the yeast cells. It was further observed that the yeast extracts can bring about fermentation of sugars even also in the absence of viable yeast cells. In 1897, Eduard Buchner of Humboldt University of Berlin, Germany discovered that sugars are fermented in the absence of viable cells also in the fermentation mixture. The yeast cells secrete a chemical component called zymase. For his memorable contributions in research and discovery of cell-free fermentation, in 1907 Buchner was awarded with the prestigious Nobel Prize in Chemistry. In 1906, NAD⁺ was discovered out of studies carried out from ethanol fermentation.

PRIMARY BENEFITS

Fermentation technology is primarily employed for the preservation of different food by production of acids and alcohols, biological fortification and enrichment of food items with potential biogenic products like essential amino acids, easily digestible proteins, essential fatty acids and useful vitamins, neutralization of anti-nutritional factors, to diversify and enrich the diet with various aromas, flavours and textures in food substrates and decrease in requirements of further processing techniques like cooking etc [2].

FERMENTED FISH PRODUCTS AVAILABLE WORLDWIDE

Specifically, in the fish processing technological research aspect, Bagoong, Faiseekh, Fish sauce, Garum, Hákarl, Jeotgal, Hentak [6], Rakfisk, Shrimp paste, Surströmming, Shidal [7-9] and Ngari [10] are the popular fermented fish products worth mentioning.

PUBLIC HEALTH RISKS INVOLVED FROM CONSUMPTION

There are certain risks and health hazards associated with excess and regular consumption of fermented food products. In Alaska, since 1985, there has been increase in incidences of botulism exceeding the case reported in the Americas. This is mainly caused for the practice of allowing whole fish, fish heads and meat of animals like sea lions, walrus, whale flippers, birds, seal tallow, beaver tails etc. to ferment for prolonged periods before consumption by the resident Eskimos there. During this extended fermentation, if plastic wrappers or containers are used, then *Clostridium botulinum* gets a conducive condition to thrive in the micro-aerophilic condition inside the plastic containers [11].

Alaska has witnessed a steady increase of cases of botulism since 1985. It has more cases of botulism than any other state in the United States of America. This is caused by the traditional Eskimo practice of allowing animal products such as whole fish, fish heads, walrus, sea lion, and whale flippers, beaver tails, seal oil, birds, etc., to ferment for an extended period of time before being consumed. The risk is exacerbated when a plastic container is used for this purpose instead of the old-fashioned, traditional method, a grass-lined hole, as the botulinum bacteria thrive in the anaerobic conditions created by the air-tight enclosure in plastic containers [12].

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