Role of microorganisms in food contamination, processing and safety.

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Introduction

Recent studies indicated that the advanced technologies that support modern civilization did not affect completely a large proportion of food supply for humans mainly due to spoilage or otherwise wasted. The development of agricultural and food preservation technologies is of great importance to provide large human populations with safe food [1,2]. Many sources of microbiological contamination are found in or on soil, water, plants and animals [3]. Several types of bacteria are mainly responsible for contamination of food such as coliforms, micrococci, pseudomonads, etc. [4,5]. Many of these bacteria colonize animals in their skin or in the gastrointestinal tract [6]. Soil is an another source of contamination as many microorganisms including bacteria, yeast and molds thrive in most soils and can propagate to very large numbers. Direct contamination occurs during the production and harvesting of crops, however the indirect contamination with soil microorganisms occurs through the deposition of wind-born dust particles. The presence of microorganisms in water serves as a serious source and a vector of contamination [7]. Many pseudomonad bacterial strains grow well in surface water, however enteric bacteria are present in waters polluted with sewage. The contamination mainly occur during irrigation by the contaminated water [8,9].

Generally most microorganisms are not harmful to humans and some are even beneficial, however many others exist and can cause disease. The last category includes food borne microorganisms which display a wide range spectrum of resistance responses to some antimicrobial agents [10]. This resistance is mainly due to bacterial structural features such as a mechanism of antibiotic-inactivation or an impermeable outer membrane [10,11]. These microorganisms acquire their resistance through mutation or genetic transfer processes such as conjugation, transduction and transformation. Resistance can also be conferred by biofilm formation on food processing surfaces. Resistant microorganisms can also develop as a result of physical processes treatments used during preservation, acid treatment and irradiation processes. Many strategies were adopted to counteract resistance through developing new potent antibiotics, changing of antibiotic usage, applying new preservation approaches, prevention of bacterial adhesion to avoid biofilm formation [12]. Undesirable microbial growth in a food processing environment causes dangerous problems as a result of food spoilage organisms [13]. On the other hand, microorganisms play a beneficial role in food industry as they are used in production of various food products. The recent chemical engineering achievements enable producers under specific fermentation conditions [14] to manufacture hundreds types of dairy products (such as cheeses and fermented milk products) [15,16], vegetable products (such as pickles and olives), meat products (such as fermented sausages), in addition to breads, alcoholic beverages (such as beer, wine and cider), vinegar and other food acids as well as oils. Recently, increased interest has been directed to the production of bulk chemicals (such as solvents and ethanol) [17], specialty chemicals (such as pharmaceuticals, industrial enzymes), biofuels and food additives. In agriculture fermentation processes using microorganisms are also used to prepare single cell protein (SCP), silages and microbial pesticides. Investigators reported many advantages of fermentation processes which can be summarized in the following benefits: a) Low energy consumption, b) Development of preferable food textures and flavors, c) Mild conditions of pH and temperature, d) Relatively simple technologies, e) Low capital and operating costs. More recently, the potential applications in the areas of food nanotechnology and functional food by engineering biological molecules opening up a new area of research and development in food technology [18].

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