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Food Biotechnology- An Important and Promising Research Field

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Food biotechnology is an important and promising research field that applies biotechnology to the production, processing and manufacture of foodstuffs [1-3]. It includes the oldest biotechnology processes like food fermentation and brewing, as well as the use of modern biotechnology to improve the genes related to the processing quality of food raw materials, produce high-quality agricultural products, manufacture food additives and cultivate plant and animal cells to access food functional ingredients, and other biotechnologies related to food processing and manufacturing, such as enzyme engineering, protein engineering and evolutionary engineering of enzyme molecules, etc. [1,4-6].

Generally, the contents of food biotechnology are as follows:

1) Improving the quality and yield of agricultural products through genetic engineering and cell engineering.
2) Producing "green" antioxidants and preservatives, etc., for the preservation of agricultural products through genetic engineering and fermentation.
3) Improving the added value of food and the utilization of agricultural products and the health function of food, and making the food processing effective through genetic engineering, fermentation, enzyme engineering, protein engineering and molecular evolution engineering.
4) Reducing food losses, improving the efficiency of food quality management and ensuring food quality and safety through genetic engineering, enzyme engineering and fermentation.
5) Improving the resource utilization rate, and reducing the environmental pollution by treating food processing wastes through fermentation and enzymatic engineering.

Applications of Food Biotechnology

Firstly, the application of biotechnology in the food industry is in the field of genetic engineering [7]. Food raw materials or food microorganisms can be improved by the genetic transfer of animals, plants and microorganisms or the DNA recombination by means of DNA recombination technology or cloning technology, such as the use of genetic engineering to improve the raw materials of food processing and the performance of food microorganisms, and to produce enzyme preparations and active ingredients of health-care food [8].

Secondly, cell engineering is also an important application field of biotechnology in food industry [9]. The health-care food ingredients, new food and food additives can be produced by cell engineering including cell fusion technology and animal and plant cell culture [10].

Thirdly, enzymes can be applied to the transformation of substances in food production process [11,12]. Amylase and cellulase have been successfully developed and used in food industry [13]. For example, cellulase has a wide application in the production of fruit juice, fruit and vegetable, instant tea, and in soy sauce brewing and wine making [14,15]. Finally, the industrially pre-designed food or food functional ingredients can be easily accessed by means of the modern fermentation equipment to make the preferred cells or the modified strains to undergo the scaled-up culture and controlled fermentation [16,17].

As a new technology with great potential and development space, the biotechnology in the food industry will show a trend of developing new varieties of food additives greatly [18,19]. At present, the international requirement for food additive quality is to make food more natural and fresh, pursue low-fat, low-cholesterol and low-calorie food, and enhance the quality stability of food storage process [20].

Therefore, two aspects should be paid attention:

1) Using biologically- produced food additives to replace chemically-synthesized ones;

2) Developing the functional food additives with immune regulation, anti-aging, anti-fatigue, anti-hypoxia, anti-radiation, blood lipid regulation and gastrointestinal functional components adjustment, etc.

The development of microbial health-care food has a long history, and soy sauce, vinegar, beverage wine and mushrooms belong to this area. Like bifidobacteria drinks, yeast tablets and dairy products, they have a huge development potential [21,22].

Microbial production of food has some unique characteristics:

1) Fast breeding process of microorganisms: the large-scale production of food can be achieved in a certain equipment conditions.

2) Simple requirements of nutrients.

3) Higher input and output ratio of edible fungi than other economic crops.

4) Easy to achieve industrialization, etc.

Transgenic biotechnology has brought new impetus to the agricultural, medical and food industry, which has directly accelerated the cultivation of new varieties of agriculture, the prevention and treatment of various diseases, the improvement of food nutrition and the management of ecological environment [23]. The development of genetically modified technologies can accelerate the development of agriculture, forestry and fisheries, and increase crop yields.

Looking forward to the development of genetic food, the future biotechnology will not only help achieve the diversification of food, but also help produce specific nutritional health-care food [24,25]. In terms of environmentally coordinated food production, biotechnology will reduce the use of agrochemicals and make crops better adapted to specific environment [23]. However, the development of genetically modified organisms is also controversial, such as their impact on human health, environment and socio-economy [26,27]. The main reasons are that the public is not enough confidence in the current genetic food management system, and that scientists and the public lack the necessary communication [2,28]. Therefore, the government should take active measures to readily disseminate the research results of genetic food to win the trust of the public. Meanwhile, an international community which works on biotechnology policy research should be established to coordinate and manage the orderly development of genetic food.

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