Available online at
www.agrospheresmagazine.com

ISSN: 2582 – 7022

Agrospheres:e-Newsletter, (2021) *2*(4), 88-90

Article ID: 227

Hurdle Technology in Food Processing

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Article History
Received: 4.04.2021
Revised: 12.04.2021
Accepted: 17.04.2021

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INTRODUCTION

Hurdle Technology is a type food processing technique in which all the pathogens in food products can be controlled or completely eliminated so that the final food products will be safer with extended shelf-life. In this technique, more than one approach (hurdles) are combined which forfend microbial safety and stability as well as organoleptic and nutritional quality and economic viability of food products (Alasalvar., 2010). Examples of the hurdles are High acidity, low water activity or redox potential, high temperature while processing, low temperature while storage or the presence of preservatives. The aim is to abolish, halt, or impede the microorganisms that are undesired in the food products.

Principle of Hurdle Technology

Homeostasis of microorganism is disrupted by Preservative factors or hurdles. Microorganisms should not be able to "jump over" all the hurdles present in the food. Preservative factors impede microorganisms' proliferation and make them to remain inactive or even die. The concept of hurdle emphasizes that complex interactions of temperature, water activity, pH etc. are significant to the microbial stability (Leistner., 1992).

Physical Hurdles applicable in Food Processing

Electromagnetic energy (microwave, radio frequency, pulsed magnetic fields, high electric fields), high temperatures (sterilization, blanching, pasteurization, baking, extrusion, frying evaporation), aseptic packaging, ionizing radiation, low temperature (freezing chilling), modified atmospheres, packaging films (including active packaging, edible coatings), photodynamic inactivation, ultrasonication, ultra-high pressures, ultraviolet radiation (Ohlsson and Bengtsson et al., 2002).

Physicochemical Hurdles applicable in Food Processing

Ethanol, Carbon dioxide, lacto peroxidase, low pH, low redox potential, lactic acid, low water activity, Maillard reaction products, organic acids, phenols, oxygen, ozone, phosphates, salt, sodium nitrite/nitrate, smoking, sodium or potassium sulphite, herbs and spices, surface treatment agents (Ohlsson and Bengtsson et al., 2002).

Biological Hurdles applicable in Food Processing

Microbial, bacteriocins, antibiotics, competitive flora, protective cultures (Ohlsson and Bengtsson et al., 2002).

Mechanism of Hurdle Technology

Some recent researches in hurdle technology is done on homeostasis, metabolic exhaustion, and stress reactions of the microorganisms and the novel concept of multi-target preservation is introduced which is gentle but most effective preservation of hurdle technology in foods.

Homeostasis: It is defined as steadiness and firmness of the internal States of organisms. The pH maintenance is necessary. And the fact is, the microorganisms will not multiply if their homeostasis is disturbed, they will remain in lag phase or even perished before the homeostasis is restored (Leistner et al., 2000). This can be done by applying preservative factors (hurdles). This can be done for a short period or permanently to preserve food.

Metabolic Exhaustion: By this auto sterilization of foods is achieved (Leistner et al., 2000). The spore count in stable hurdle technology starts decreasing due to storage at ambient temperature of food products. Vegetative microorganisms will die and if the stability is close to threshold for growth, elevated storage temperatures, presence of antimicrobial and sub lethally injured microorganisms, they die more rapidly. Apparently, microorganisms became metabolically exhausted because of hostile environment created by stable hurdle technology which strain every possible repair mechanism for their homeostasis and leads to an auto sterilization. This auto sterilized food is microbiologically stable, safer during storage, especially at ambient temperature.

Stress Reactions: stress shock proteins generated by Bacteria which is induced by pH, aw, heat, oxidative compounds, ethanol, etc. and they became more resistant or toxic and lethal under stress by starvation by this they create an obstruction in food preservation and can became a serious problem for the process of hurdle technology. So by Multiple target preservation synthesis of stress shock proteins can be forbidden or it will harm the microbial safety and stability of hurdle technology foods. (Leistner et al., 2000).

Multitarget preservation: Concept of Multitarget preservation is introduced by Leistner (1995) to provide most effective preservation of foods. Combining different hurdles is more effective and competent and it will hinder microbial stability as well a synergistic effect could be achieved. They will act synergistically if the hurdles in a food hit, different targets (Eg. Cell membrane, DNA, enzyme system, pH), at same time and by disturbing the homeostasis of the microorganisms multitarget preservation is achieved. This makes activation of stress shock proteins as well as the repair of homeostasis more difficult therefore, employing different hurdles simultaneously in the preservation of a particular food will lead to optimal microbial stability so we should apply different hurdle of small intensity instead of large hurdle of big intensity (Leistner et al., 2000).

CONCLUSION

This article highlights one of the best possible food preservation techniques i.e. hurdle technology. The application of this techniques is based on the Physiological responses of microorganisms during preservation (i.e their homeostasis, stress reactions and metabolic exhaustion). Homeostasis disturbance play's a major role. Stress reaction may complicate the preservation so multi-target preservation is

used to achieve the novel and determined goal by applying synergistic effect. Metabolic exhaustion could boost food preservation of stable hurdle technology foods so a set of hurdle should be applied for the better results in preserving food.

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