Hurdle Technology: The Combination of Food Preservative Methods

A.P. Khapre
Assistant Professor, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani – 431 402, Maharashtra
Corresponding Email: khapreft@gmail.com

Introduction

"Hurdle technology" was developed as a new concept of food preservation employing a combination of preservation procedures or hurdles to inhibit the growth of spoilage causing microorganisms for the realization of safe, nutritious, tasty and economical foods. The microbial stability and safety of the food is based on a combination of several preservative factors (called *hurdles*). The hurdle effect is of fundamental importance for the preservation of foods, since the hurdles in stable product control spoilage. The application of hurdle technology is increasing rapidly worldwide.

Hurdles

Hurdle technology employing a combination of preservation procedures or 'hurdles' to inhibit growth of microorganisms in the product. These include manipulation of factors such as temperature, water activity and acidity, as well as processes such as gas packaging and high pressure processing. The aim is to interfere with several different mechanisms within microorganisms simultaneously. Potential hurdles for use in the preservation of foods can be divided into physical, physicochemical, microbially derived and miscellaneous hurdles.

Table 1: Most important Hurdles for food preservation (Leistner, 2000)

Symbol	Parameter	Application
F	High temperature	Heating
T	Low temperature	Chilling and freezing
a_w	Reduced water activity	Drying, curing and conserving
pH	Increased acidity	Acid addition or formation
Eh	Reduced redox potential	Removal of oxygen or addition of ascorbate
Pres.	Preservatives	Sorbate, sulphite and nitrite
c.f.	Competitive flora	Microbial fermentations

Fundamentals of Hurdle Technology

Food preservation implies exposing microorganisms to a hostile environment to inhibit their growth, shorten their survival, or cause their death. The feasible responses of the microorganisms to such a hostile environment determine whether they grow or die. More basic research is needed in this area, because a better understanding of the physiological basis for growth, survival, and death of microorganisms in food products could open new dimensions for food preservation. Furthermore, such an understanding would be the scientific basis for an efficient application of hurdle technology in the preservation of foods. Advances have been made by considering the homeostasis, metabolic exhaustion, and stress reactions of microorganisms, as well as by introducing the concept of multi target preservation for gentle yet effective preservation of foods (Leistner and Gorris, 1995).

Table 2: Examples of Hurdles used to preserve foods (Ohlsson and Bengtsson, 2002)

Type of hurdle	Examples
Physical hurdles	Aseptic packaging, electromagnetic energy (microwave, radio frequency, pulsed magnetic fields, high electric fields), high temperatures (blanching, pasteurization, sterilization, evaporation, extrusion, baking, frying), ionic radiation, low temperature (chilling freezing), modified atmospheres, packaging films (including active packaging, edible coatings), photodynamic inactivation, ultra-high pressures, ultrasonication, ultraviolet radiation
Physico-chemical hurdles	Carbon dioxide, ethanol, lactic acid, lacto peroxidase, low pH, low redox potential, low water activity, Maillard reaction products, organic acids, oxygen, ozone, phenols, phosphates, salt, smoking, sodium nitrite/nitrate, sodium or potassium sulphite, spices and herbs, surface treatment agents
Microbially derived hurdles	Antibiotics, bacteriocins, competitive flora, protective cultures

Conclusion

In the fastest growing world food industry, the application of hurdle technology as a food preservation method is extended. The concept behind hurdle technology is to block the growth of microorganisms by creating a variety of barriers. In industrialized countries, hurdle technology is currently of particular interest for minimal processed and

convenience foods, whereas in developing countries foods storable without refrigeration, due to stabilization by hurdle technology.

References

Leistner, L. and Gorris, L.G.M. (1995). Food preservation by hurdle technology. *Trends Food Sci. Technol.* 6(1):41.

Leistner, L. (2000). Basic aspects of food preservation by hurdle technology, *Int. J. Food Microbiol.*, 55, 181.

Ohlsson, T. and Bengtsson, N. (2002). The hurdle concept (Chapter 7). Minimal Processing Technologies in the Food Industry. CRC Press, New York. pp. 175-195.

* * * * * * * * *