# Ecodesign for food packaging

## UNIT 3: CONCEPTS OF FOOD DEGRADATION AND CONSERVATION METHODS (FINAL VERSION)



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# Content unit 3, Ecodesign for food packaging





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# After learning this unit, the student will be able to:

- Objective 1. Understand the causes of food degradation
- Objective 2. To know the principles and methods of preserving food.



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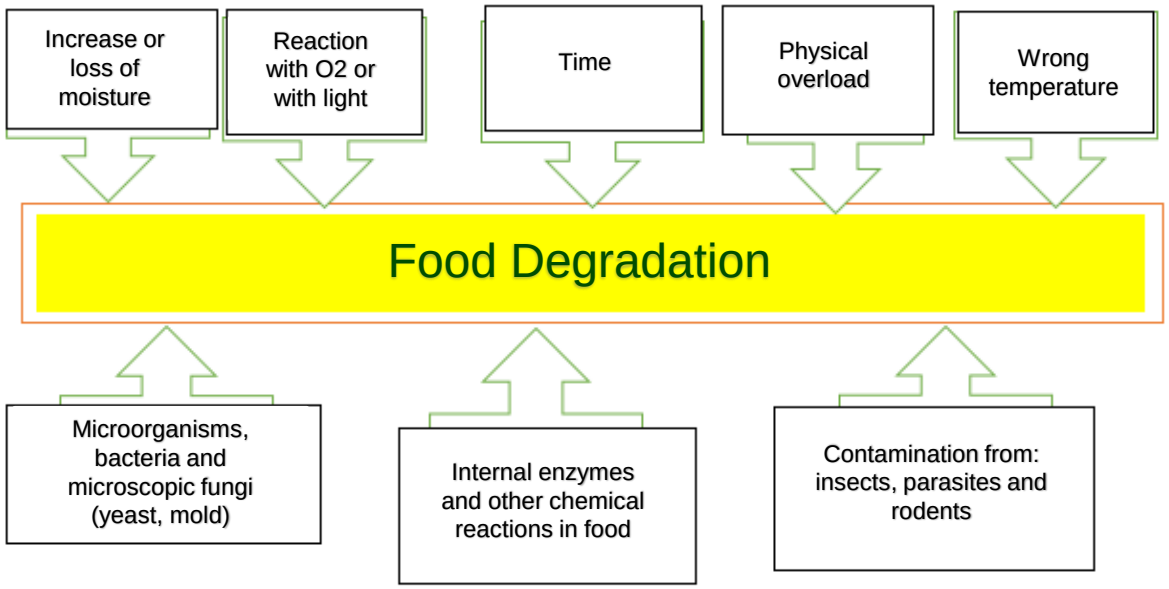
# Food degradation




Factors contributing to the deterioration of food, (processing by http://wiki.ubc.ca/Course:FNH200 lesson05)

With regard to food degradation, several situations can be distinguished:

- ❑ Impurification of food - The presence of foreign bodies (eg dust, hair, shavings, etc.);
- ❑ Food aging - Process that causes the loss of nutritional and sensory characteristics that foods have when they are fresh;
- ❑ Food alteration - Process that causes the appearance and smell of foods to change, making them inedible. It can be caused by physical factors such as heat, chemical (oxygen, water) or biological (enzymes and micro-organisms) or a combination of these.

- Enzymes, (from the Greek "enzime" = yeast) are complex globular proteins from living organisms that catalyze the acceleration of the rate of biochemical reactions.
- Microorganisms, all living beings that are not visible to the naked eye and see them need to use a microscope.



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# Food degradation II

## Enzymes

- The action of enzymes can be used with beneficial effects in the food industry, for example, in the manufacture of cheese.
- However, in order to preserve and extend the shelf life of foods, it is usually necessary to inactivate enzymes present in food and on the surfaces of the packaging using heat or chemical means.Fructele și legumele, reprezintă surse majore de enzime
- Most microorganisms that produce enzymes are molds. There are also bacterial species that produce amylase, stable enzymes to heat. Amylase degrades the starch, reducing the viscosity
- Citric, malic, phosphoric acid is used to inactivate the enzymes, or contact with oxygen in the air is avoided by immersion in brine or by packing.

## Microorganisms

- Bacteria, molds and yeasts are the microorganisms that are most commonly spoken about altering food. Microorganisms can cause changes in the character of foods, which can be "positive" or "negative".
  - Positive for cheese, yoghurt, wine
  - Negatives: As they grow, the microorganisms release their own enzymes in the surrounding fluid and absorb the products of external digestion. This is the main cause of microbial alteration of foods, which lowers their nutritional value.



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# Food degradation III

## Factors affecting the growth of microorganisms:

Internal Factors:

- Moisture Content, Water Activity - (Aw)
- pH, generally, microorganisms do not grow, or grow very slowly to pH <4.6.
- Available nutrients include water, a source of energy from carbohydrates, alcohols and amino acids, nitrogen, vitamins and minerals
- The physical structure of foods, food derived from plants and animals, especially in the raw state, have biological structures (shell, skin, skin, etc.) that prevents the entry and growth of pathogenic microorganisms. Processes such as slicing, cutting, milling, peeling will destroy physical barriers.
- The oxidation-reduction potential (redox) Eh, values between 0-800 mV, attests to good food consumption.
- The presence of antimicrobial agents. Some foods naturally contain naturally occurring antimicrobial compounds that give them a certain level of microbiological stability

## External factors:

- Temperature
- Relative humidity
- Carbon dioxide or oxygen in the air
- Types and number of microorganisms in food



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# Principles of technologies for limiting food damage

- **The main technologies for limiting food damage are presented in UNIT I, section 1.2.**
- **Principles underpinning technologies to limit food damage:**
  - ***Thermal processing:*** Most bacteria are destroyed at 82-93 ° C, but spores are not destroyed. To ensure sterility, humid heating is required at 121 ° C for 15 minutes.
  - ***Pasteurization:*** Destroys the pathogens and substantially reduces the number of microorganisms
  - ***Cold Conservation:*** Frozen foods (-10 ° C) usually have no free water (Aw is reduced)
  - ***Drying:*** Food dehydration also dehydrates microorganisms, which contain approx. 80% water. Drying by cold (lyophilization) is the most effective method of drying the food
  - ***Adding Sugar or Salt:*** Each of these can be added to a food to increase the affinity of food for water, decreases Aw in food, and removes water from microorganisms through osmosis.
  - ***Smoke:*** Contains formaldehyde and other preservatives. Heating during smoking helps to reduce microbial populations and dries food.



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# Principles of technologies for limiting food damage II

## Atmosphere

- Air is eliminated for control of aerobic microorganisms;
- Provides air for the control of anaerobic microorganisms;
- Carbon dioxide and nitrogen are added;
- Most fruits and vegetables emit ethylene; ethylene accelerates the baking process; for prolonging the shelf-life, ethylene should be removed.

## Controlled atmosphere

- Packaging with controlled atmosphere Modified atmosphere packaging (MAP) is generally used in combination with refrigeration to extend the shelf life of fresh, perishable foods (meat, fish and cut fruits, as well as various bakery products, snacks and other dried foods)
- Unprocessed fruits and vegetables continue to breathe after they have been packaged, consume oxygen and produce carbon dioxide. Using packages with specific permeability characteristics, the levels of these two gases can be controlled during the shelf life of the food.
- Alternatively, an active packaging may be used, incorporating chemical adsorbents (e.g., to remove the gas or vapor from the packaging) or vacuum packaging where all the gas in the package is removed after pasteurization.



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# Principles of technologies to limit food damage III

## Preservation by acidification

- The preserving fluids used are vinegar, brine, alcohol and some oils.
- **Mackerel preservation** is based on the creation of optimal fermentation conditions of lactic acid bacteria, resulting in lactic acid that has the property of inhibiting harmful bacteria and catalysing biochemical maturation processes. In fermentation acheration, the preservative is produced by the food itself during the fermentation process, and salt may be added to increase acidification. (pH of brine: 3.4-4.1). Specific foods: Dairy products (yoghurt, beaten milk, cow's cheese) and vegetables and fruits (cabbage, cucumber, dill, olives, etc.)
- **Preservation through marination (artificial acidification)** is an artificial preservation method that uses vinegar (acetic acid). The high concentration of vinegar in the environment destroys microorganisms. Molds and yeasts have a higher resistance to acids, and therefore NaCl and sugar are used and optionally supplemented with pasteurization / thermal sterilization.
- **Conservation of food with antiseptic substances** - substances that have the property of stopping the development and action of microorganisms (so they have bacteriostatic properties) or they can destroy them (bactericidal properties). Benzoic acid and its salts (black eggs, fruit juices, confectionery products, olives in brine, sulfur dioxide, sodium metabisulphite, (jams, natural syrups, broth, wines), sodium formate ), sorbic acid and its salts (tomato paste, frozen vegetables and fruits, sugar products).



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# Thank you!



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