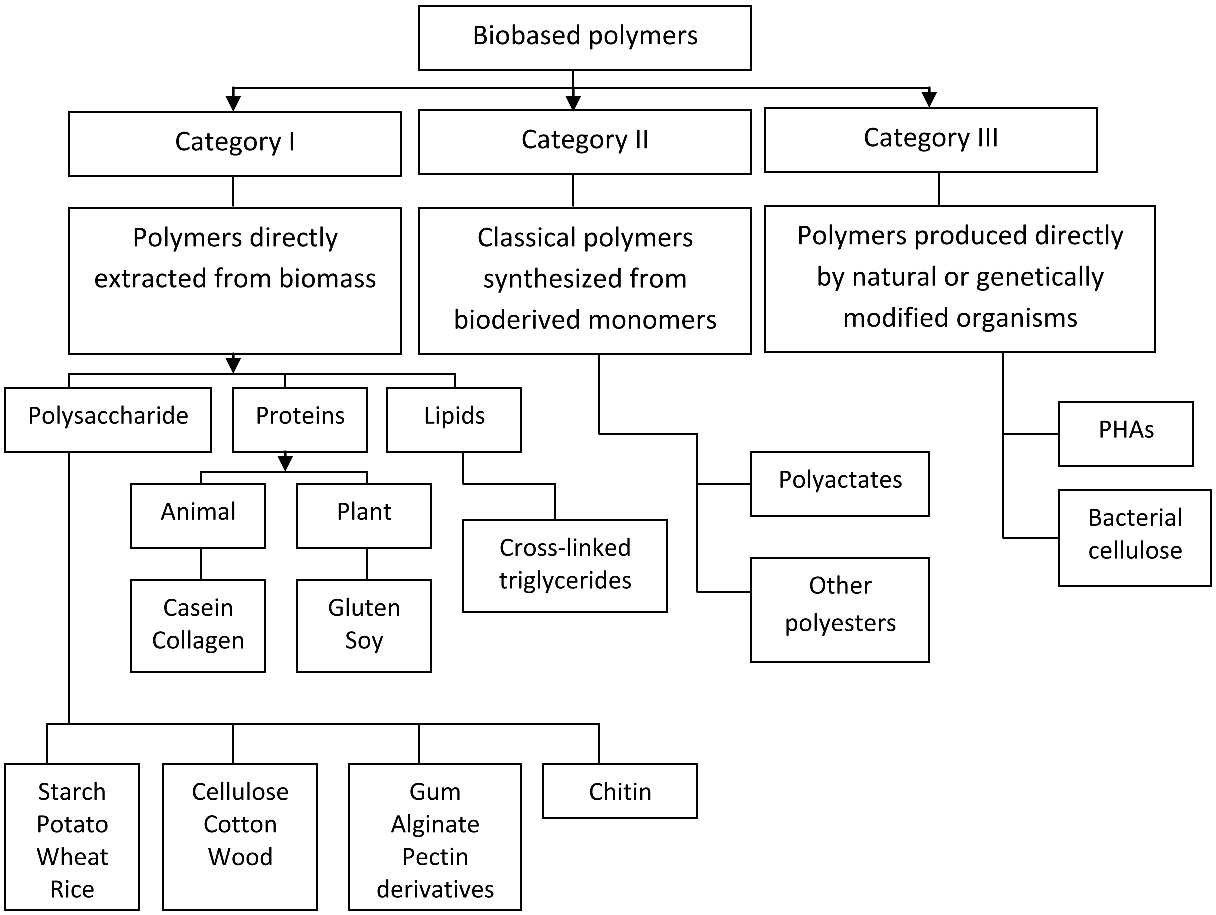
Third generation of Biobased packaging



Functions of edible films:

i. Retard migration and moisture

ii. Retard gas transport (O2, CO2)

iii. Retard oil and fat migration

iv. Improve handling characteristics

v. Retaining volatile flavor compounds

vi. Carrying additives e.g. antioxidants and antimicrobials

Advantaged of edible films over conventional polymeric films:

i. Can be consumed

ii. No disposal of packets

iii. Can enhance organoleptic properties – flavor, sweetness, color etc.

iv. Can supplement nutritional value

v. Small portion of food can be packed

vi. Can prevent inter-layer moisture migration

Sterilization methods

1. Irradiation:

Gamma radiation from Cobalt-60 or Caesim-137, Electron beams from machine sources that accelerate electrons to high energy levels (5 -10 MeV), X-ray Machines of energies less than 5 MeVare also used in some cases, More than 200 commercial gamma radiation processing plants exist in the world.
Used for Sterilization of healthcare products, Microbial decontamination of spices, herbs and vegetable seasonings, Food and food product preservation, Inhibition of sprouting in onions and potatoes.

2. Heat treatments:

Superheated steam: Superheated steam is mainly used for sterilization of tinplate and aluminum cans and lids. The cans are passed continuously at normal pressure under saturated steam at 220° to 226°C for times of 36 – 45 sec, depending on the construction material given that aluminum cans have a shorter heating time because of their higher thermal conductivity.

Hot air: Dry hear in the form o air has the advantage that high temperature can be reached at atmospheric pressure, thus simplifying the mechanical design problems for a container sterilization system. Hot air at a temperature of 315°C has been used to sterilize paperboard laminate cartons where surface temperature of 145°C for 180 sec is reached. However, such a system is apparently only suitable for acidic products with pH<4.5.

Hot air and steam: A mixture of hot air and steam has been used to sterilize the inner surface of cups and lids made from PP, which is thermally stable up to 160°C. In this process, hot air is blown into the cups through a nozzle in such a way that the base and walls of cup are uniformly heated.

Extrusion: During the extrusion of plastic granules prior to blow molding of plastic containers, temperatures of 180 - 230°C are reached for up to 3 min. However, because the temperature distribution inside the extruder is not uniform and the residence time of the plastic granules varies considerably, it is not possible to guarantee that all particles will achieve the minimum temperature and residence time necessary to result in sterility. Extrusion results in a three to four decimal reduction in microbial spores, and therefore extruded containers should only be aseptically filled with acidic products with a pH<4.5. For products with a pH>4.5, it is recommended that extruded containers be poststerilized with hydrogen peroxide or peracetic acid (PAA).

3. Chemical treatment

Hydrogen peroxide: It is used in combination with heat to sterilize the surface of paperboard laminated packaging materials. A minimum temperature of 70°C and a minimum concentration of 30% are necessary to achieve destruction of the most resistant spores on packaging materials within seconds. The peroxide itself is not able to sterilize the packaging material, hence number of systems have been developed as described below;

a) Dipping process: In one process, the packaging material is unwound from a reel and passed through a bath of 30 – 33% H_2O_2 solution containing a wetting agent to ensure uniform wetting of plastic surfaces that tend to be hydrophobic. The liquid H2O2 solution is reduced to a thin film, wither mechanically by means of squeeze roll or with jets of sterile air; the adhering liquid film is then dried with hot air.

b) Spraying process: In this process, H_2O_2 is sprayed though nozzles onto prefabricated packages. The peroxide is then dried using hot air. The death rate is dependent on the volume of sprayed H_2O_2 (larger volume requires larger drying times) and the temperature of the hot air. The trend now is to completely avoid spraying liquid droplets and use a mixture of hot air (130°C) and vaporized peroxide instead.

c) Rinsing process: When the prefabricated container is of an intricate shape such that the spraying process is unsuitable, it can be rinsed with peroxide or a mixture of peroxide and PAA.

After spraying, the container is drained and then dried with hot air. This process has been utilized to sterilize glass containers, metal cans and blow molded plastic bottles.

d) Combined with UV irradiation and heat: When UV radiation and H_2O_2 are used together they act synergistically, with the UV irradiation promoting the breakdown of the peroxide into hydroxyl radicals. The overall lethal effect is greater than the sum of the individual effects of peroxide 0.5 and 5%.

It is usual to use heat as well as UV irradiation and peroxide in the sterilization of packaging materials. The advantage of such a combination is that much lower concentration of peroxide can be used and the problems of atmospheric contamination by peroxide and residual peroxide in the product are reduced. However, because too high peroxide concentration reduces the effectiveness of sterilization, strict control of concentration is essential.

2. Peracetic acid: PAA is a liquid sterilant, which is particularly effective against spores. It is produced by the oxidation of acetic acid by H_2O_2 and a solution containing PAA and H_2O_2 is effective against resistant bacterial spores, even at 20°C. It is used for sterilizing filling machine surfaces as well as packaging materials such as polyethylene terephthalate (PET) bottles prior to filling, the PET bottles being rinsed with sterile water rather than hot air.