

## **Materials for food packaging. Classification including biodegradable materials.**



Systematic increase of consumption in European countries causes the increase of amount of packaging used, which is dangerous for environment. The area of landfills enlarges and waste filling them does not undergo spontaneous disintegration. Significant amount of municipal waste are food packaging refuse. Thus, for proper choice, it is necessary to know the different packaging types actually used for food packaging.

Food and beverage packaging with regard to raw materials used for their production can be classified as follow: metal, glass, plastic, paper and cardboard as well as packaging from mixed substances. All of mentioned materials have advantages and disadvantages.

- Glass – possibility of various forming and manifold recycling without changes of mechanical properties (but glass processing needs high temperature i.e. supplying high amount of energy), very good barrier properties (it means the lack of permeability of gasses and water vapor), the disadvantageous ratio of mass to volume (glass packaging are heavy), brittle, non-degradable (but it is not harmful for environment); it is mainly used for production of bottles and jars, which can be pasteurized at high temperatures.
- Metals (steel and aluminum) – very good barrier properties, relatively expensive, can be recycled (reprocessing needs high amount of energy); mainly used for can production, (food in cans be pasteurized); produced metallic trays and forms for ready-to-cook food are resistant for high and low temperatures, thus can be applied for frozen and heated meal; thin aluminum foils are used for packaging of sweets, cheese, coffee, tea, etc; metallic are also bottles caps and jar lids.
- Paper and cardboard – cheap cellulose-based materials (from wood), paper waste can be burned (with energy recovery), recycled or biodegraded during composting in environment; light, easy printable, permeable for air, water vapor and oxygen dioxide; they have low tear strength; produced bags and boxes for different applications, which are mainly used for dry food such as sugar, salt, flour, bread, cakes; from paper are also made labels for packages from glass, metal and plastics.
- Synthetic plastic (mainly on the base of synthetic polymers such as polyethylene, polypropylene, polyethylene terephthalate, polystyrene, polyvinyl chloride) – they are characterized by a low production cost, good mechanical and barrier properties (owing these properties, nowadays they substitute glass, metal and paper), easy processability and modification for getting required properties, light, esthetic, unbreakable, elastic, transparent or colored, non-degradable in nature; can be recycled or burned.
- Biodegradable plastics – biopolymers on the base of hydroxybutyrate or hydroxyvalerate acids, which are produced in nature during biosynthesis; biodegradable (undergo decomposition under enzymatic action of microorganisms: bacteria, fungi), non-recyclable; another type of biodegradable plastic are blends of synthetic polymers with starch (from potatoes, rise, corn) or cellulose, in which only natural component undergoes decomposition to oxygen dioxide and water (in air conditions) or to water and methane (in oxygen-free circumstance), whereas the synthetic component only breaks up to small pieces and dissipates; relatively expensive.
- Mixed materials (laminates) – packaging composed from few thin layers, e.g.: metallic, plastic and paper films, have very good barrier properties, laminate packaging are hermetic owing welding possibility; difficult for utilization because of problems with layers separation.
- Active and intelligent packaging, which contain substances prolonging shelf-life thanking interactions with food article or informing about changes in atmosphere inside of packaging; these substances are mainly oxygen and ethylene absorbers, compounds

emitting or binding oxygen dioxide, regulating water, also antioxidants and antibacterial substances.

- Nanocomposites – new generation packaging with specific properties, containing small amount of mineral fillers (such as glass or carbon fibers, calcium carbonate or silicates) with very small size particles, which improve mechanical and barrier properties; can be applied for production of bottles or films with very low permeability of oxygen and water vapor, relatively expensive yet, can be recycled.

Because of management possibilities of used packaging, they can be divided for:

- Multi-use packaging e.g. glass bottles which can be refilled; costs are connected with collection and washing.
- Packaging destined for material or chemical recycling - packaging from glass, metal, paper and plastics (for instance, beverage bottles from polyethylene terephthalate i.e. PET); installations are expensive (cost bearing once), plastic recycling can be economic dependently on collection and segregation costs.
- Packaging destined for burning i.e. energetic recycling with energy recovery (paper, cardboard, plastics), especially profitable for mixed materials (difficult for separation), chimney gases have to be cleaned, slag and ashes are deposited on landfills.
- Single-use, degradable packaging from paper and biodegradable plastics, which are used as packaging as well as fast-food utensils, they are decompose in natural environment.
- Edible packaging (from starch, gelatin, pectins, wheat bran), biodegradable, it is also valuable feed for animals.
- Packaging materials deposited on landfills without any treatment (the cheapest but non-ecological solution).

Although the increase of biodegradable packaging materials is expected in the forthcoming years, their ecological importance is still controversial because products of their decomposition are not always neutral for environment. Actually, the influence of biomass formed during biodegradation on the plant growth processes is intensively studied. From environmental point of view, the most of packaging used should be destined to recovery and recycling but as low as possible should be deposited on landfills.

The choice – ecological or economical packaging? – it should be decided not only by producers but also by all of us, consumers, who are interested in environment purity. Moreover, reasonable management of waste - their segregation and selective collection can contribute to the reduction of area of landfills. Lets leave unpolluted nature for next generations!

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*Photo: Anna Kaczmarek*