POLYOLEFINS IN PACKING

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Polyolefin-based polymers, polymer blends and composites are popular nowadays because of their versatility of use and balanced properties. Various materials like wood, paper, glass or metals are being replaced by plastics because these are much cheaper and often easy to process, while maintaining desired physical properties. Most of the packaging materials are either purely polyolefinic or polyolefin based and polyolefins are presently the most used polymer materials in common. Their importance in our lives increases as we are getting used to foods, beverages and other goods in plastics packaging, which takes less space, is usually tough enough to withstand even harsh handling and presents good protection and shelf life, so best before date look more pleasant and does not bind us to consume or use the product early. As can be seen, packaging industry and barrier sheets and films production extends continuously and every day there can be something new invented, so a complete objective observation cannot be done. A purpose of this thesis is to summarize some interesting facts about this wide field of plastics use The purpose of this work is to present contemporary view of packaging industry, most common processing methods, properties of these materials and finally barrier properties of packaging and ability to keep packed product fresh and safe for a maximum time possible.

Ever-evolving packaging film technologies strive to deliver product protection, food safety, quality retention and ultimately, consumer satisfaction, to the meat, poultry, and prepared food industries. Nearly all used packaging films and sheets are based on polyolefins because of their reduced price and moderate physical properties. A disadvantage of polyolefin films is its permeability which means that polyolefins layer by itself have low barrier properties for gasses for instance. Solution of this problem is an addition of high-barrier layer like Ethylene-vinylalcohol

(EVOH) copolymer or polyamide (PA) which provides necessary gas or moisture barrier. Packaging films then appear as multilayer structures with polyolefin base and additional barrier layers. Polyolefin film usually makes outer layers because of protection of high-barrier layers in the middle and provides an adhesion possibility for attaching these films to containers which might not be possible when using bare barrier layers (PA).

In nearly all applications of plastics in packaging, the first step is to convert the solid plastics, usually in pellet or cut scrap form, into a melt, which is going to be shaped using heat and pressure into some useful form, mostly films and sheets of flat or round (bubble). The equipment used to do this is an extruder. It is used directly for film and sheet, and it is part of a blow moulder for bottles, and of an injection moulding machine for injection-moulded or injection blow-moulded packaging. The extruders used in all of these applications work in a similar manner - the purpose of an extruder is to use heat, pressure, and shear to transform the solid plastics into a uniform melt, for delivery to the next stage of processing. This frequently involves mixing in additives such as colour concentrates, blending resins together, and incorporating regrind materials. The final melt is uniform in temperature and in composition and is extruded through a die of particular shape and directions. Specific types of extrusion are described further. Because single screw extruders are often not very good mixers, another mixing systems may be needed.

A single-screw or double-screw extruders are used according to heat and mechanical properties of extruded polymer or blend and to properties of die or other additional attached machinery. Screws and barrels have different shapes, lengths and layouts.

Olefin, which means oil-forming, is an old synonym for alkene, and was, originally, the name given to ethylene. Alkenes are hydrocarbons containing carbon-carbon double bonds, such as ethylene and propylene. In the plastics industry, olefin is a common term that refers to the family of plastics based on ethylene and propylene. The term polyolefin strictly applies to polymers made of alkenes, whether homopolymers or copolymers. It includes the family of polyethylene, and the family of polypropylene.

More specific type of olefin is a poly-alpha-olefin (or poly-α-olefin, PAO), a polymer made by po-lymerising an alpha-olefin. It is an alkene where the carbon-carbon double bond starts at the α-carbon atom, i.e. the double bond is between the #1 and #2 carbons in the molecule. Common al-pha-olefins used as co-monomers to give a polymer alkyl branching groups.

Polyethylene (PE) is a family of polymers based on ethylene. Polyethylene can be linear or branched, homopolymer or copolymer. In the case of a copolymer, the other comonomer can be an alkene such as propene, butene, hexene or octene or a compound having a polar functional group such as vinyl acetate (VA), vinyl alcohol (VOH), or ethyl acrylate (EA).

The family of branched polyethylenes includes homopolymers and copolymers of ethylene that are non-linear, thermoplastic, and partially crystalline. They are fabricated under high pressure and temperature conditions by a free radical polymerisation process. Backbone length, side chain length and branching vary. Branched PE has lower crystallinity and consequently lower density than the linear type, so is known as low density PE (LDPE). LDPE typically has a crystallinity of 40 to 60 %, with a density of 0.910 to 0.940 g/cm3; in contrast, HDPE has a density of about 0.940-0.970 g/cm3. Comonomers such as propylene and hexene are commonly used in the reaction to help con-trol molecular weight.

Polypropylene is a thermoplastic material produced by polymerisation of propylene. Polypropylene is commercially available as both PP homopolymer, and PP random copolymer, which is produced by the addition of a small amount of ethylene during the polymerisation process. Thermoplastic PP polymers are characterized by low density (0.89-0.92 g/cm3) and good resistance to chemicals and to mechanical fatigue, including environmental stress cracking. There are a wide variety of applications for PP, from automobile parts to packaging film and containers. Manufactur-ers of PP continuously are offering PP grades with improved or modified properties.

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