**Synthetic Non-Biodegradable Polymers:**

Synthetic polymers have been widely used in making various medical devices, such as disposable supplies, implants, drug delivery systems and tissue engineering scaffolds. The advantages of using polymers, as biomaterials, are their manufacturability. Polymers are easy to fabricate into various sizes and shapes compared to metals and ceramics. They are also light in weight and with a wide range of mechanical properties for different applications.

1. **Polyethylene:**

There are three type of polyethylene: linear high density polyethylene

(HDPE), branched low density polyethylene (LDPE) and ultrahigh molecular weight polyethylene (UHMWPE). HDPE and UHMWPE are frequently used as biomaterials.

* 1. **High Density Polyethylene:**

High density polyethylene (HDPE) is a very inert material with very low tissue reactivity. It has been used as bone and cartilage substitutes since 1940s. More than 30 years of follow-up results showed favorable response to these HDPE implants. Therefore, HDPE has become a standard reference material for biocompatibility testing. Histological examination of HD implants reveals a lack of minimal inflammatory and foreign body reactions.

When HDPE was fabricated into porous scaffolds, it has the added advantages of allowing fibrous tissue ingrowth into the implant. The ingrowth of the fibrous tissue will provide adequate stabilization in a non-load-bearing environment. MedPor is a porous HDPE product fabricated by sintering HDPE microbeads in a mold to create implants with interconnected porous structure. The average pore size in this material is greater than 100 µm and the pore volume is in the 50% range. These materials are readily available in a variety of preformed shapes and can be customized with a scalpel easily.

The pore size and porosity is very important for tissue ingrowth. Studies have shown that pore size larger than 100 µm encourages tissue ingrowth. The tissue ingrowth results in firm attachment and integration of the implant to the surrounding tissue leading to decreased migration of the implant, thus obviating the need for screw or suture fixation in some cases.

Porous HDPE has been successfully used for craniofacial applications, such as chin, malar area, nasal reconstruction, ear reconstruction, orbital reconstruction, and the correction of craniofacial contour deformities.

* 1. **Ultrahigh Molecular Weight Polyethylene:**

UHMWPE is produced as powder and must be consolidated under elevated temperatures and pressures because of its high melt viscosity—the result of ultra-high molecular weight. As already discussed previously, as the molecular weight increase, the molecular chain of PE start to entangle each other, so UHMWPE does not flow like lower molecular weight polyethylene when raised above its melting temperature. For this reason, many thermoplastic processing techniques, such as injection molding, screw extrusion, or blow molding, cannot be used for UHMWPE fabrication. Therefore, compression molding is a common method to produce finished or semi-finished UHMWPE.

UHMWPE possesses many attractive properties, notably high abrasion resistance, low friction, high impact strength, excellent toughness, low density, ease of fabrication, biocompatibility, and biostability. These properties make it very attractive for use in fabricating bearing surfaces in arthroplasties. In fact, UHMWPE is the sole material currently used for the manufacture of the liner of the aceabular cup in total hip arthroplasties (THAs) and the tibial insert and patellar component in total knee arthroplasties. In these cases, the clinical performance of the components is considered to be very good except for the concern about their wear.

Hip replacement is one of the world's most common operations, with approximately half a million diseased or damaged joints replaced annually worldwide. The number of procedures is growing with a commensurate increase in revisions. After a number of failed attempts with fluorocarbons, success was achieved in the early 1960s in the production of total joint replacements (TJRs) with UHMWPE. This remains the preferred material because of its exceptional mechanical properties, chemical inertness, impact resistance, and low coefficient of friction.

The problem asociated with the use of UHMWPE is the wear debris that will evoke a series of undesirable effects. It has been hypothesized that these particles are phagocytosed, resulting in many "reactions": formation of grannulamatous lesions, osteolysis, and bone resorption.