1. **Poly(methyl methacrylate):**

In 1943, a protocol for the chemical production of bone cement was established in the companies of Degussa and Kulzer. A lot of research and development work has been done since then. In 1958, Sir John Charnley first succeeded in femoral prosthesis in the femur with self-polymerizing PMMA. Since then, the PMMA bone cement (now known simply as bone cement) emerged as one of the premier synthetic biomaterials in contemporary orthopedics. It is currently the only material used for cemented arthroplasties to the contiguous bones.

A typical PMMA bone cement consists of two parts, a solid part in a packet and a liquid part in a vial (See Table 11. 2 ) . When the two parts are mixed before use, the viscosity of mixture will gradually increase and become the dough in a few minutes. The dough will harden in another few minutes. This process actually involves a MMA polymerization process. Polymer PMMA is used to minimize the shrinkage and the heat release caused by the polymerization of monomer MMA, because the pure MMA will exhibit a shrinkage of about 21% due to the change of density and the heat release which can cause the temperature to increase to over 100°C .



Heat stable antibiotics, such as gentamycin, tobramycin, erythromycin, vancomycin, cephalosporin, can be added in a powder form to the powder part. Antibiotics can be slowly release to eliminate possible infections of the surgery.

1. **Polyester:**

Polyester is a family of polymers which have ester linkage connecting the polymers .



Among the polyester family, poly(ethylene terephthalate) (PET) is the world leading synthetic fibers and films. The typical synthetic reaction of PET uses dimethyl terephathalate and ethylene glycol .



The synthesis of PET is a two-step process. First, dimethyl terephthalate is heated with ethylene glycol to obtain low molecular weight oligomers of PET. Then the mixture is heated to a higher temperature of 250°C under vacuum to further promote the condensation reaction. The byproduct methanol is removed using vacuum and heat.

PET is considered to be biocompatible. It has very good mechanical properties. Therefore, PET fibers and the structures made from fibers, such as woven, knitted, felted and braided structures, are used as sutures, internal patches, pledgets, ligamentous prosthesis, artificial blood vessels, heart valve sewing cuffs, etc.

1. **Polycarbonate:**

Polycarbonate family polymers have carbonate linkages in their polymer chains .



Polycarbonate can be synthesized by the reaction of phosgene with bisphenol A [2,2-bis(4-hydroxyphenyl) propane]. The obtained PC is a tough and transparent plastic commercially available .

Polycarbonate is used to make components for oxygenator for open heart surgery, venous reservoir, and arterial filter due to its sterilizability, ease of processing, biocompatibility, and clarity.

