

INJECTION MOLDING OF ORTHOPAEDIC POLYMERS

Bioresorbable polymers

Under normal physiological conditions, polylactides/polyglycolides are hydrolytically degraded into non-toxic (lactic and/or glycolic acid) easily metabolized and eliminated by the body under CO₂ and H₂O.

Mechanical properties

Molded parts made from polymers show mechanical properties that are similar to those of other plastics. Tensile strength, bending strength and modulus of elasticity can be influenced to a great extent by the following factors:

- Composition: the strength of highly crystalline types is higher than that of low-crystalline or amorphous products.
- Molecular weight: the strength increases with higher molecular weight.



FIGURE 1 : Interference screw

Under environmental as well as physiological conditions, polymers are hydrolytically degraded into glycolic acid or lactic acid, naturally present in the human body and easily metabolised.

The degradation rate depends on the molecular weight, the surface quality, the composition of the polymers crista-

linity, manufacturing parameters and, shape, size and site of the implant:

The degradation rate depend on the different polymer properties:

- type L-Lactide: degradation time in: Months/years,
- type D,L-Lactide and glycolide: degradation time in: Months,
- mix: degradation time in: Weeks/Months.

The hydrolytic degradation of the polymers leads first to a decrease in molecular weight. Only at the end of the degradation time can a loss in mass be observed, which leads to the complete decomposition of the polymer in water and carbonic gas.

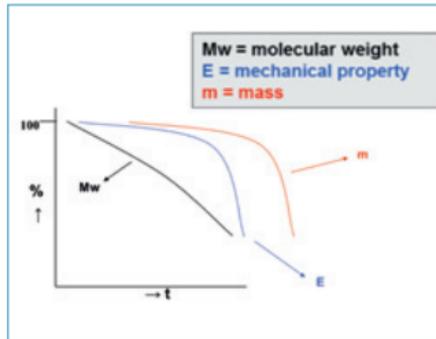
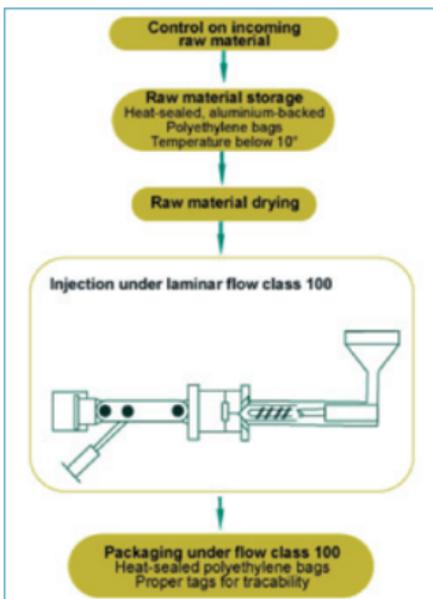


FIGURE 2 : Purac - Strength to time ratio

Injection molding



Manufacturing is made by injection molding or implants in synthetic implantable bioresorbable material PLA, PGA, mix with TCP, HA, Bioglass and others such as: PMMA, acrylic bone cement, PEEK, PEEK carbon, PEEK ceramics...

FIGURE 3 : Processing steps



FIGURE 4 :
Injection
molding under
laminar flow
class 100



FIGURE 5 : Mold

Applications in orthopaedics



FIGURE 6 : Ligament screw ACL

- Arthroscopy: ligament screws, anchors, buttons, fixations for soft tissues.
- Reconstruction: spacers, plugs, centralizers.
- Trauma: plates, pins, void filling, screws.
- Tensile samples.



FIGURE 7 : Carbon peek



FIGURE 8 : PLA cement plug

Guarantees of quality

Standard tests

- Inherent viscosity.
- Composition.
- Residual monomer content.
- Residual Solvent content.
- Water content.
- Heavy metal content.
- Sulphated ash.
- Residual catalyst content.
- Gel permeation chromatography (GPC) molecular weight distribution M_w , M_n , polydispersity.
- DSC Melting behavior, glass transition point, recrystallization.

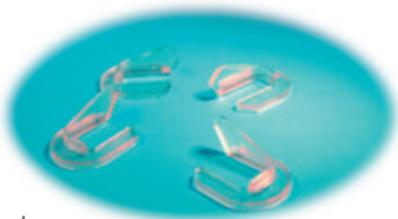


FIGURE 9 : Centraliser



FIGURE 10 : iVisc System from Lauda

Partner

VBM company was formed in 1998 by Forecreu, specialized in cannulated round bars in stainless steels and titanium alloys for surgical instruments and implants, as arthroscopy was moving away from metals towards bioresorbable plastics.

VBM is ISO 9001 & 13485 as well as CE marked by the notified body " LNE / G- MED ".

www.vbm.fr

