TELECHELIC MACROMER-BASED POLYMER-MATRIX REINFORCED WITH E-GLASS FIBERS

OBJECTIVE: Water sorption and flexural properties of fiber reinforced composites (FRC) prepared from extended urethane dimethacrylate (PEG-400-EUEDMA), hydroxypropyl methacrylate (HPMA) and E-glass fibers were investigated.

METHOD: The resins contained 72, 50, or 28 wt% PEG-400-E-UEDMA (Esstech Inc., USA) and 28, 50, or 72 wt% HPMA (Esstech Inc., USA), respectively, and camphorquinone (1 wt%)/N,N-cyanoethyl methylaniline (1 wt%) (Accu-Chem Industries Inc., USA). Resin preimpregnated E-glass fibers were placed unidirectionally in a rectangular mold (2×2×20mm3) incorporating ~42 vol% of fibers. The specimens were light-cured (λ=400−500 nm) for 20s with a light curing unit (Elipar™ 2500, 3M ESPE, Germany). In the water sorption tests (based on ISO 3696:1987E), the specimens (N=6) were stored in deionized Milli-Q water (15ml) at +37°C for 4, 12 or 24w. In the 3pt bending tests, the specimens (N=6/group) were measured using a universal testing machine (ElectroPuls™E3000, Instron Industrial Products, USA), where the l=20mm (span) and v=1.0 mm/min (crosshead speed utilizing a load cell of 500 N).

RESULT: During the first days, all the groups increased with a rapid water sorption (weight uptakes 4.8-6.2 wt%). During the first week, the water uptake decreased (4.5-5.2 wt%). In dry conditions, the highest flexural strength was ca. 275 MPa for the composite containing 28wt%/72wt% of PEG-400-E-UEDMA/HPMA. In wet conditions, the highest flexural strength (~50MPa) was for the specimens containing most PEG-400-E-UEDMA. In terms of increased HPMA concentration, water molecules seem to penetrate easier into hydrophilic networks causing an obvious plasticizing and deterioration of biomechanics.

CONCLUSION: The flexural properties of telechelic macromer based hydrophilic PEG polymer matrices decreased considerably after being stored in water.