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Materials characterization of an explanted polypropylene-PTFE hernia mesh

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Long-term polymeric implants continuously activate the inflammatory response, bathing the implants with powerful oxidants such as hydrogen peroxide and hypochlorous acid in an attempt to breakdown the material. Biomaterials such as polypropylene and polytetrafluoroethylene (PTFE) are susceptible to oxidation and/or hydrolysis which can lead to overall degradation of the material, both physically and chemically. Material degradation is evidenced by changes in surface morphology, a build-up of hydroxyl and/or carbonyl groups on the surface of the material, changes in thermal properties, and weight loss. This undergraduate research project performed materials characterization on an explanted polypropylene-PTFE composite mesh. The mesh was obtained with an approved IRB protocol from the MU Hospitals. Fourier transform infrared spectroscopy with ATR was utilized to evaluate changes in the chemical structure/functional groups on the surface of the material. Thermal gravimetric analysis (TGA) was utilized to examine %weight loss of the explant as compared to pristine samples. Differential scanning calorimetry (DSC) was utilized to examine material's melt temperature and heat of enthalpy as compared to the pristine samples. The results demonstrated that the polypropylene-PTFE composite material did undergo degradation. The FT-IR scans indicated the presence of carbonyl groups which is indicative of oxidation while the TGA graphs indicated that the explant materials lost mass while in vivo. The DSC scans demonstrated a change in thermal properties of the explanted materials as compared with the pristine. In conclusion, the hernia mesh materials will be degraded and damaged while in vivo.