J Bioremediat Biodegrad 2017, 8:6 (Suppl)
DOI: 10.4172/2155-6199-C1-012

Comparison of polydioxanone and polyhydroxyalkanoate barbed and non-barbed surgical sutures: The effect of hydrolytic degradation on mechanical and morphological properties

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Introduction: Since approved by the US FDA in 2004, barbed surgical sutures have been applied to various fields, such as cosmetic, orthopedic, urological and other types of surgeries. Polydioxanone (PDO) is a well-studied absorbable suture material. An innovative biopolymer, poly-4-hydroxybutyrate (P4HB) manufactured by Tepha Inc. has been converted to various resorbable medical devices, including sutures. Both polymers are hydrolytically degraded in the body and the byproducts are metabolized and eliminated from the body without cytotoxic effects. Given the increased surface of barbed sutures, the purpose of the study was to compare the rate of change in mechanical and morphological properties of the hydrolytically degraded PDO and P4HB barbed and non-barbed sutures.

Methods: PDO and P4HB barbed sutures were fabricated with a laboratory mechanical cutting machine. Suture segments were immersed in PBS and stored in an incubator shaker maintained at 37°C. Suture samples were extracted every week for 10 weeks for measurement of weight, tensile properties and morphology.

Results: During the 10-week study, the weight loss of PDO suture was 6.5%, while there was no weight loss for the P4HB sutures. The cutting of barbs on suture's surface resulted in 42% and 62% strength loss for PDO and P4HB barbed sutures compared with non-barbed ones. Starting with same level of maximum tensile strength of 30 N, P4HB barbed sutures maintained 66% higher strength than PDO barbed sutures after 8 weeks and maintained at least 60% strength during 10-week hydrolysis (Figure 1.). SEM images indicated the integrity of barbs was maintained for both materials during the process of hydrolytic degradation.

Conclusions: P4HB barbed sutures have a longer degradation profile compared with PDO and significantly higher strength retention. In addition to the prolonged degradation profile, anchoring performance should be measured first *in vitro* and then *in vivo* to verify the unique characteristics of P4HB barbed sutures.

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