

Synthesis and characterization of Bioabsorbable Polyurethanes from novel Isocyanates

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INTRODUCTION

Segmented polyurethane elastomers have enjoyed wide use as biomaterials due to their excellent mechanical properties and great chemical versatility. The vast majority of research devoted to the development of biomedical polyurethanes has focused on long-term applications such as vascular grafts and pacemaker lead insulators. Despite the progress thus far in the development of polyurethanes, relatively little research has been directed at developing intentionally degradable polyurethanes for temporary implantation. Several papers were published in the early 1980's describing polyurethane/poly lactide blends as degradable materials for skin substitutes, vascular prostheses and nerve regeneration guides. However, in these cases the polyurethane portion of the blend was non-degradable and served only to provide favorable mechanical properties. Subsequent work by Bruin et al.,⁽¹⁾ "Design and Synthesis of Biodegradable Poly(Ester-Urethane) Elastomer Networks Composed of Non-Toxic Building Blocks," involved the synthesis of cross linked polyurethane networks incorporating lactide or glycolide and epsilon-caprolactone joined by a lysine-based diisocyanate. These polymers displayed good elastomeric properties and were found to degrade within 26 weeks in vitro and 12 weeks in vivo (subcutaneous implantation in guinea pigs).

In order for surgical adhesives to be successful, they should be accepted by surgeons, they must possess a number of properties. First, they must exhibit high initial tack and an ability to bond rapidly to living tissue. Secondly, the strength of the bond should be sufficiently high to cause tissue failure before bond failure. Thirdly, not cause local histotoxic or carcinogenic effects.

A number of adhesive systems such as alkyl cyanoacrylates, polyacrylates, maleic anhydride/methyl vinyl ethers, epoxy systems, polyvinyl alcohols, formaldehyde and gluteraldehyde resins and isocyanates have been investigated as possible surgical adhesives. None has gained acceptance because each fails to meet one or more of the criteria noted above. The principal criticism of these adhesive systems has been the slow rate of reaction and potential toxicity problems they pose.

This paper describes our research efforts to develop novel safe, biocompatible and absorbable diisocyanates and diamines and novel biodegradable and biocompatible polyurethanes from them. The polyurethanes prepared from the new isocyanates will be discussed as potential candidates for drug delivery, tissue engineering, adhesion prevention and other implantable medical device. Synthesis of these monomers and polymers will be presented and the *In Vitro* hydrolysis profiles will be discussed.

REFERENCES

1. (a) Makromol. Chem., Rapid Commun. 9, 584-594, (1988) (b) U.S. Patent Nos. 6,894,140; 5,173,301; 4,994,542; and 4,740,534.