



Absorbable Polyurethanes from Functionalized Tyrosine

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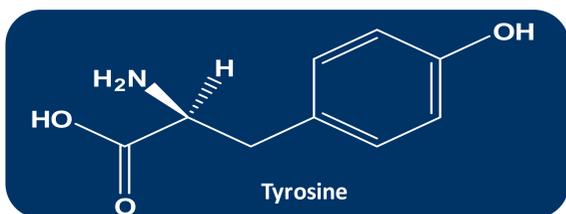
Hillsborough, NJ, USA



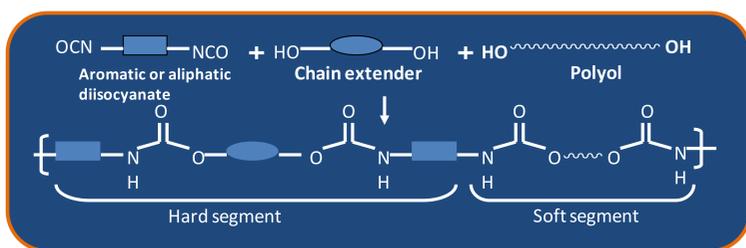
INTRODUCTION

- ❖ Tyrosine is a non essential natural amino acid used by cells to make proteins. It is a parent amino acid for skin, hair and eye pigments.
- ❖ Tyrosine is an important precursor of the neurotransmitters epinephrine, nor epinephrine and dopamine and hence plays an important role in transmission of nerve impulses and serve as an antidepressant.
- ❖ Tyrosine is also the precursor amino acid for thyroid gland hormone thyroxin thereby promoting the healthy functioning of thyroid, adrenal and pituitary glands.
- ❖ Tyrosine is also effective in alleviating stress, increasing mental alertness and improving memory. Furthermore, it is also beneficial in treatment of narcolepsy, fatigue, anxiety, allergies and headache.

Hence, it is highly beneficial to have absorbable polyurethanes that incorporate Tyrosine in the polymer main chain for various biomedical applications



Polyurethanes: Importance and Biomedical Applications



Commercial Biomedical grade polyurethanes and their various applications

Trade Name	Manufacturer	Isocyanate	Chain extender	Polyol
Duraflex	VASCOR, Inc.	HMDI	1,4-butanediol	Non-polyether
Tecoflex	Noveon	HMDI	1,4-butanediol	Polyether
Tecothane	Noveon	MDI	1,4-butanediol	PTMEG
Biomer	Ethicon	MDI	Ethylene diamine	PTMEG
Elasthane	Polymer Tech Group	MDI	1,4-Butanediol	PTMEG
Bionate	Polymer Tech Group	MDI	1,4-Butane diol	Polycarbonate
Pellethane	Dow Chemical	MDI	1,4-butanediol	PTMEG

Applications

- Cardiac pacemakers
- Infusion pumps
- Dialysis catheters
- Blood contact materials
- Bandages
- Cardiovascular catheters



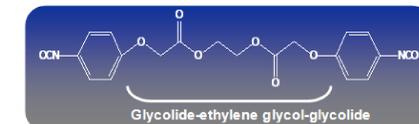
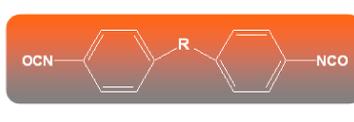
Non-Hydrolysable

Prior Art



- Non-degradable aromatic diisocyanates
- Derived polyurethanes biostable

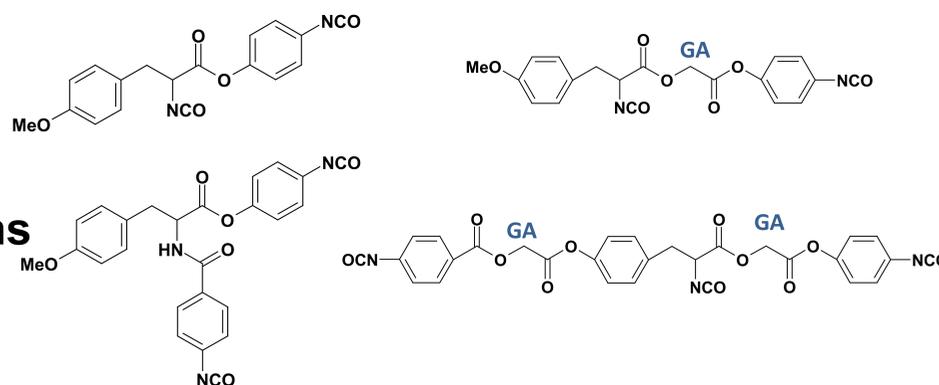
Our State of the Art



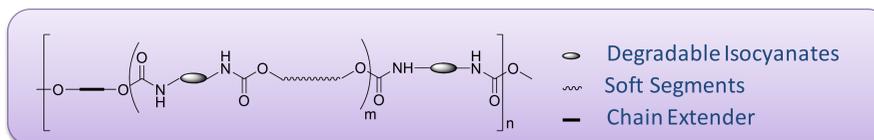
- Degradable Aromatic Diisocyanate similar to MDI
- Derived from safe and biocompatible monomers
- Degradation products: safe and biocompatible
- Controlled degradation profile

Renders derived polyurethane hydrolysable/absorbable

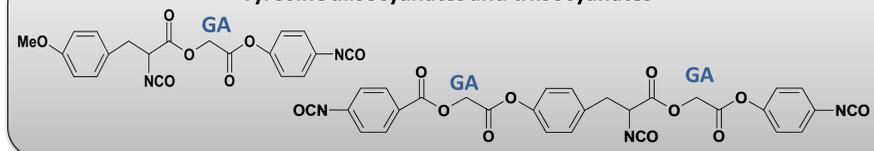
Selected examples of Absorbable Tyrosine diisocyanates and triisocyanates



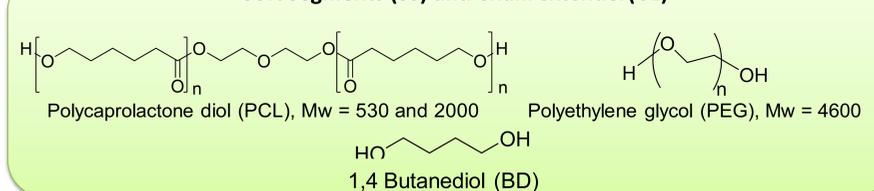
Absorbable Polyurethanes: Representative Examples



Tyrosine diisocyanates and triisocyanates



Soft Segments (SS) and Chain extender (CE)



Potential applications



Advantages

- Controlled degradation profiles
- Tunable physical and mechanical properties
- Derived from safe and biocompatible molecules
- Degradation products safe and biocompatible

SUMMARY

- For the first time, our company has developed Tyrosine based isocyanates with controlled hydrolytic degradation profiles.
- These isocyanates are similar to MDI and are derived from safe and biocompatible monomers such as glycolide, lactide, and caprolactone.
- Polyurethanes derived from these tyrosine isocyanates with chain extender diols and amines will not only be absorbable but will have hydrolytically unstable urethane and urea hard segment.
- These polyurethanes are expected to have toughness and mechanical properties of that of commercially available medical grade polyurethanes and absorbability of that of commercial bioerodible polymers.
- These polyurethanes are expected to degrade into safe and biocompatible degradation products and have controlled degradation profiles.



Bezwada Biomedical, LLC
A Drug Device Research Company