Development of low-cost biodegradable polymer from Crustacean shells

Ooi, Ying Ying

2013

Ooi, Y. Y. (2013, March). Development of low-cost biodegradable polymer from Crustacean shells. Presented at Discover URECA @ NTU poster exhibition and competition, Nanyang Technological University, Singapore.

https://hdl.handle.net/10356/84878

NANYANG TECHNOLOGICAL UNIVERSITY

URECA
Undergraduate Research Experience on CAmpus

Category: 2 **Student: Ooi Ying Ying** **Project ID: SCBE12051**
School of Chemical and Biomedical Engineering

Development of Low-Cost Biodegradable Polymer from Crustacean Shells

Objectives:

Develop low-cost biodegradable polymer from crustacean shells to be used as an eco-friendly alternative to plastics.

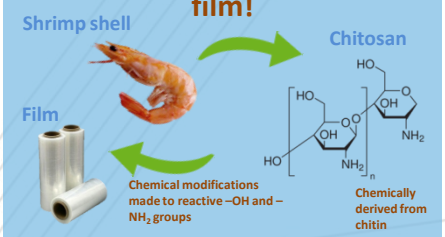
Brief background:

Chitosan is derived from the world's second most abundant natural polymer, chitin, which can be found in crustaceans such as shrimps. Due to its abundance, biodegradable and excellent film forming properties, there is a sustainable opportunity to develop chitosan into an eco-friendly alternative to the harmful plastics. Chitosan is currently being used in many applications such as in the biomedical field. However, its use has been limited due to its high moisture permeability. When chitosan film is in contact with water, the film absorbs water and its strength decreases.

Description:

The key challenges will be addressed through chemical modifications to chitosan to improve its water barrier property. Modifications made to the reactive primary and secondary hydroxyl groups and amino group will be shown in the following illustrations.

Turning crustacean shells into film!



Key challenges

A. Choice of a suitable solvent to dissolve chitosan powder and to improve the water barrier property of the film formed

B. Chemical modifications to chitosan to form film with high water barrier property

Overall procedures
Fabrication of chitosan film

Chitosan Powder [1]

1% Acetic acid solution [2]

Stir for 1 h

Stir mixture overnight at r.t.p

2.5 wt% Glutaraldehyde [3]

Stir for 1 h

Cast into petri dish and evaporate overnight at r.t.p

+

Aminopropyl-Isobutyl POSS [4]

Film

Quantities

①1g
②100g
③24g
④0.6g

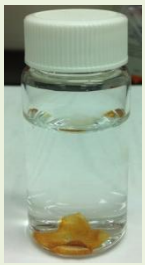
r.t.p: Room temperature and pressure

Experimental results

Water-resistance capability of each film was tested by immersing it in deionized water overnight

A. Choice of solvent: Acetic acid

Chitosan film prepared using acetic acid showed higher water barrier property (629% increase in mass) as compared to the film prepared using lactic acid (disintegrated in deionized water)



B. Chemical modifications: Glutaraldehyde and AminopropylIsobutyl POSS

Pros:
Film showed excellent water barrier property (no change in mass)
Cons:
Brittle

Conclusions:

The key challenges of obtaining the optimal solvent to dissolve chitosan powder and forming a film with high water barrier property had been addressed. The current on going task is to make further chemical modifications to reduce the brittleness and to increase the strength of the modified chitosan film.

Project Title: Development of Biodegradable Polymers 1
Supervisor: Asst Prof Loo Sun Sun Leslie **Co-supervisor: Dr Yang Yong Sheng**