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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.

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.

Overall procedures
Fabrication of chitosan film

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