The Differential Impact of Chitin and Chitosan on Heavy Metal Pollution in Water Samples

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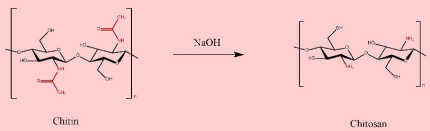
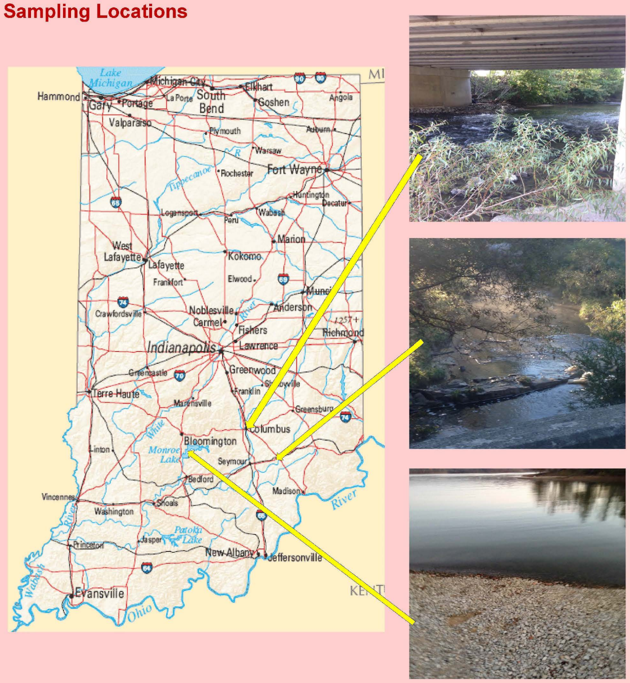
Introduction

- Chitin is a naturally occurring polysaccharide that can be found in the shells of many different organisms[1]
- Chitin is commercially extracted from shrimp shells and used for purposes that range from wound dressing to thickening agents
- Chitosan, an important derivative of chitin, can be obtained via the deacetylation of chitin[2]



- Farm raised shrimp, primarily from Southeast Asia, are the main source of chitin used commercially
- Our past studies have shown chitin from different source materials have nearly identical thermal and mechanical properties

Sampling Locations



Above: A map of Indiana with the locations of the bodies of water that samples were collected from marked using yellow arrows. Top: Haw Creek. Middle: Fish Creek. Bottom: Monroe Reservoir.

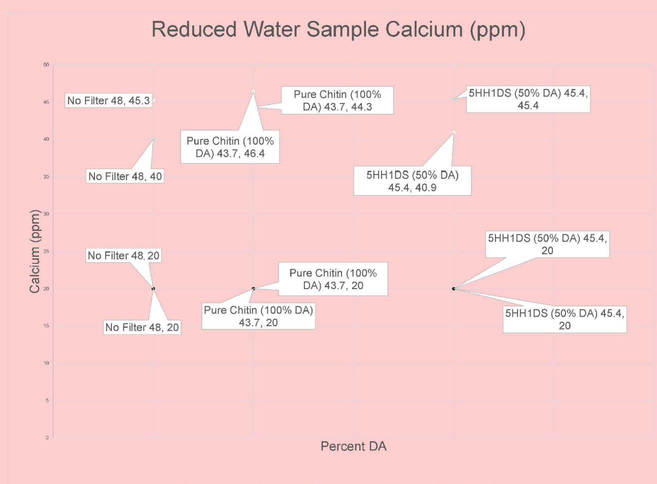
Current Methods

- The source material utilized is cicada sloughs
- Samples were collected in 3,000 ml amounts and reduced to 100 ml
- Source materials were cleaned and converted to chitin through a series of chemical reactions
- Samples were selected and converted at varying amounts to chitosan
- Chitin and chitosan powder were packed into glass filters and allowed to react with environmental water samples
- Handheld testers and titrations were utilized to determine the levels of pollutants remaining in the water samples

Right: An image of calcium levels being tested utilizing the Hanna H1758 Marine Calcium Tester

Metal Content

- Levels of various heavy metals-such as lead, chromium, and nickel-were too low to detect
- Calcium levels were tracked using a Hanna H1758 Marine Calcium Tester

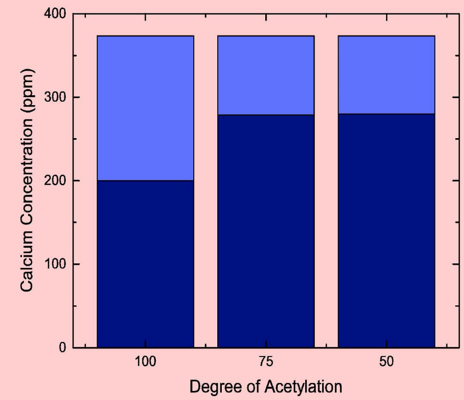


Above: A graph of the levels of calcium present in reduced water samples after reactions with various chitin/chitosan deacetylation rates.

Conclusions

- Inconclusive for most heavy metals due to low pollutant amounts present
- Differences in calcium levels at varying percentages of chitin and chitosan filtering can be seen

Right: A chart comparing calcium levels present in a 0.015 M calcium standard. The light blue represents calcium levels before reaction. The dark blue represents calcium levels after reaction.



Future Work

- Research will be done on whether the best chitin to chitosan ratio can be cast into a film that can be utilized as the filter
- Further testing will be done utilizing new equipment that can detect other heavy metals like lead
- New water samples from various locations will be tested

Above: An image of a chitin film cast utilizing acetic acid

Selected References

1. *Zeng, J., He, Y., Li, S., Wang, Y. (2011). Chitin whiskers: An overview. Biomacromolecules, 13, 1-11.*
2. *Mendez, J.D., Johnson, H., McQueen, J., & Clack, J.W. (2015). Optimizing the extraction of chitin from underutilized sources. Journal of Chitin and Chitosan Science, 3, 1-4.*

Acknowledgements

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