



SEAD

INNOVATIVE PACKAGING FOR HEIRLOOM SEEDS

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We are at a tipping point in our systems of production and consumption. I am called to find practical applications for unconventional materials derived from waste.

SEAD applies the high **material potential of seafood processing waste** to facilitate the **cultivation and distribution of heirloom seeds** for subsistence growers and gardeners in small farms, community gardens, and at-home growing. SEAD demonstrates the potential for the utilization of a waste stream to have far reaching implications in **package life cycle, biodiversity, and cultural advocacy.**

Entry Point

In the US

- ~40 mil tons of food discarded per year
- Makes up 22% of waste in landfills
 - Largest single category
- 30% of food waste occurs at industrial, commercial, and institutional levels
- Byproducts like peels, trimmings, stems, shells, and seeds can account for more than 50% of the food item
- Plentiful and consistent byproducts could hold high potential in material applications



Material Opportunity

- 6-8 million tons of crustacean shell waste produced annually
- Shells make up to 60% of shellfish weight (40% is edible meat)
- The shell extract, **Chitin** and its various derivatives like **chitosan** have characters with a wide array of potential applications
- Chitin makes up to 40% of seafood shell content
- Currently, only 10,000 tons of industrially produced chitin is used annually

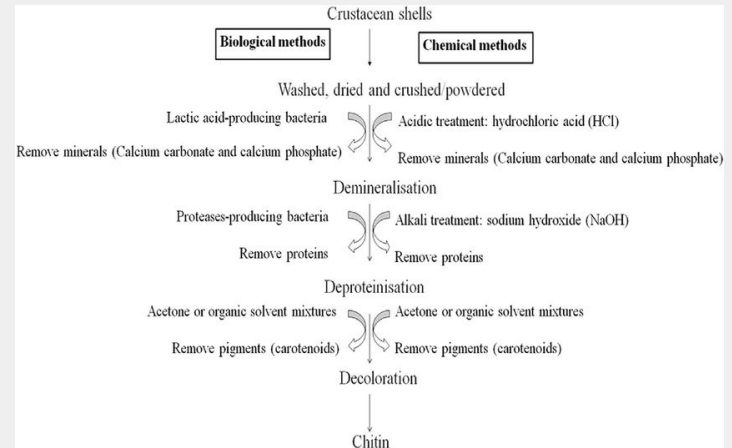
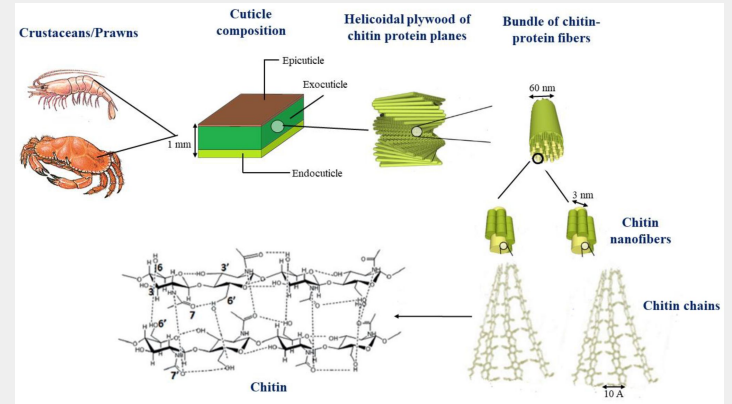


Research



Chitin

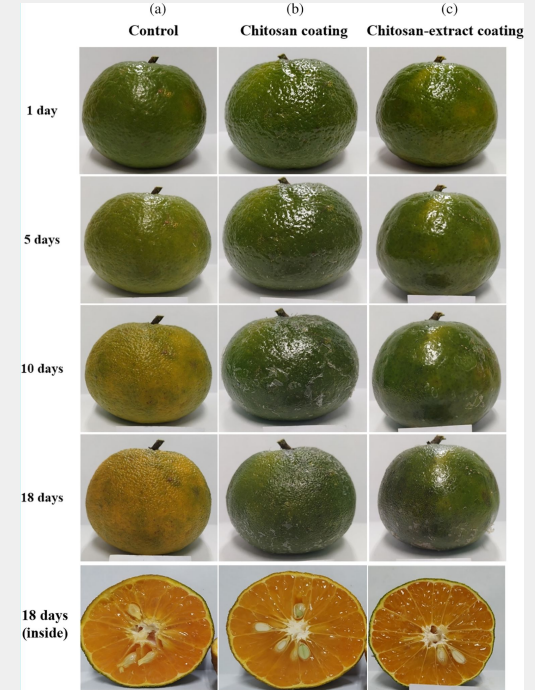
- the second most abundant organic polymer in the world after cellulose
 - Can form gels, membranes, and fibers
- Very low solubility
- Protein and minerals are separated from shells leaving pure chitin
 - Currently harsh chemicals are widely used to achieve this
 - New organic processes are beginning to be developed and applied
 - They utilized a lacto fermentation process that is lower cost and more sustainable



Research

Chitosan

- A further shell extract sourced by treating chitin with an alkaline substance, changing its molecular structure
- Water soluble
 - Thus very easy to modify
- Biocompatible
 - safe integration with animal and plant tissue
- Bioactive
 - beneficial effects on living matter



Evaluation

Mechanical Performance

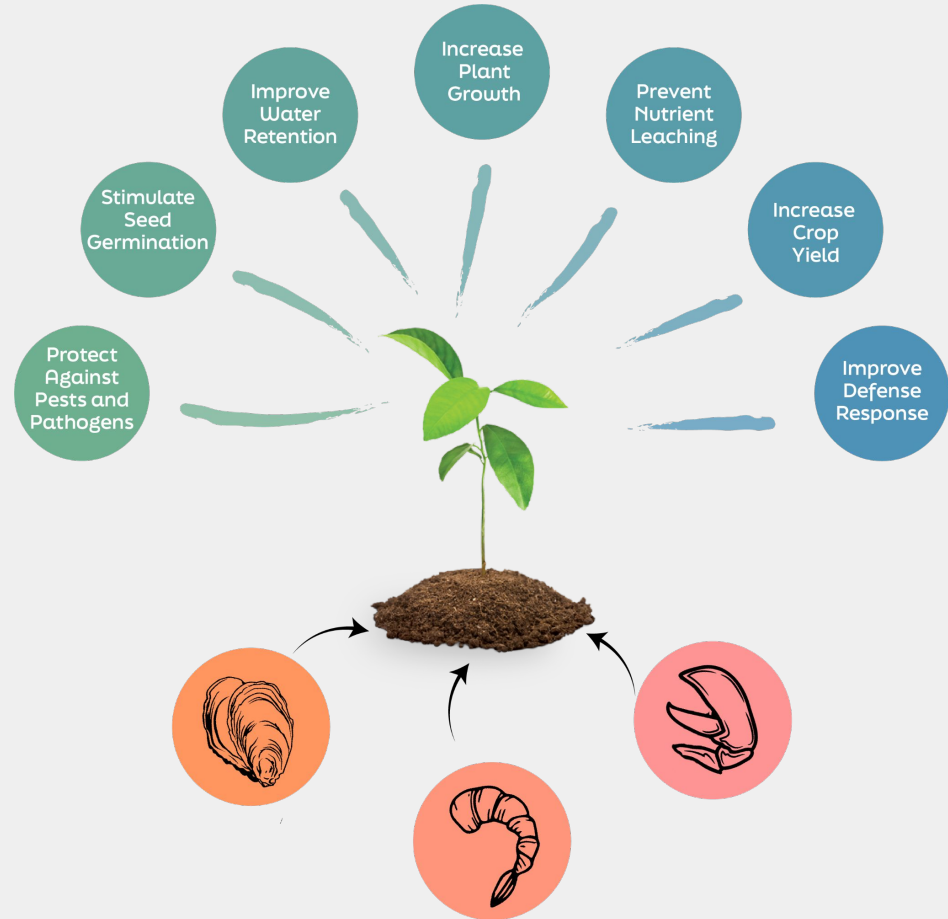


Experimentation



Evaluation

Agricultural Performance



Application

Plantable packaging



Made from compressed chitin, the SEAD bar is made up of protective pods each containing seed. The Chitin offers agricultural benefits when planted in the ground and protection along with extended shelf life when stored.

Use



Break-off

break the desired pod or pods from the bar along perforated lines



Crush

Give the broken off pod a squeeze to allow for better seed exposure and germination



Plant

Sow the crushed pod along with the seed giving it added nourishment and protection

Manufacturing

Chitin is formed into SEAD packaging through compression and heat in a three step pressing process. It self-binds without needing additional agents.



A milled custom press mold was made for use in a heated hydraulic press.



Loose chitin is loaded into molds, then pressed and heated at 600 psi and 400 °F to make a flat sided bottom half and the pod containing top half.



Seeds are placed in the inverted top then a thin layer of chitosan 'glue' is applied to surface contact points. The bottom half is placed on top and the package is pressed for a final time sealing it together.



Labeling is laser engraved on the front and back. This is not an additive step, avoiding the need for any inks or dyes. Repeated seed labels are applied so the variety can always be identified as parts of the package or broken off and used.

Why Heirloom?



Biodiversity

Localized strains have been preserved for their strong traits, heirloom propagation plays an important role in sustaining resilient and varied crop access as the environment experiences shifts and changes.



Adaptability

These plants have evolved natural defenses to certain diseases, pests, and weather patterns. Because they are open pollinated, heirloom seeds with the best performing traits can be continually saved and adapted.



Culinary Use

Factors more associated with large scale agriculture like shipping and shelf life are typically less important so flavor characteristics have been able to take a front seat in the heirloom seed saving and breeding process.



History

Keeping these seeds alive maintains a connection to cultural roots, ancestral ways, and the earth. We can promote Indigenous cultural diversity for future generations by collecting, growing, and sharing heirloom seeds and plants

Life Cycle





Thank you!