

Theoretical development of a smart sustainable food packaging



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INTRODUCTION

Environmental concern

Presence of **plastic** in food packaging.
1950s humans have produced about **8,300 million metric tons** of plastic from which only **9%** of that plastic waste has been **recycled** and **12%** has been **incinerated**.

Plasticizers

Provide the necessary workability to biopolymers such as chitosan.

Nanoparticles

Can overcome some of the drawbacks associated to biopolymers such as robustness and flexibility.

ALTERNATIVE Bioplastics (Chitosan)

OBJECTIVE

This study is aimed to develop a theoretical smart sustainable food packaging to substitute the plastic used in food containers and thus overcoming the concern of society for the consequences involved in the excessive use of this material.

RESULTS

Matrix: CHITOSAN

Biodegradable

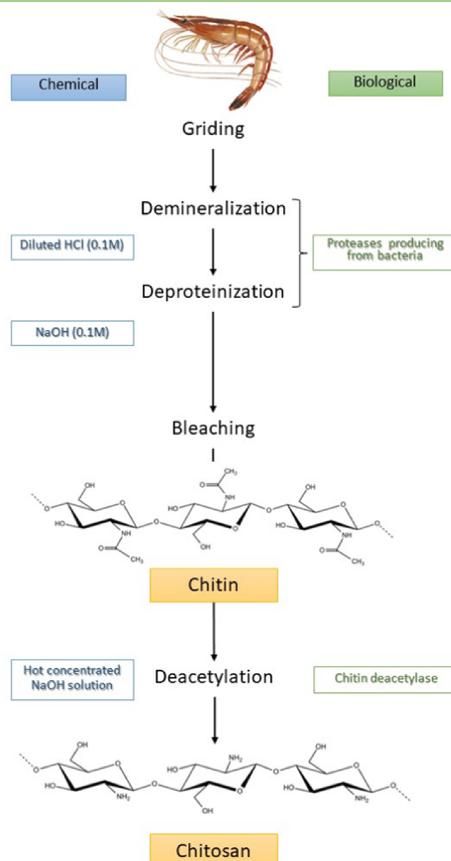
Second most abundant biomaterial that we can find on the earth.

Ecofriendly chitosan production

Biological

Microwave

Deep eutectics solvents (DES)



Plasticizer: GLYCEROL

Main by-product of biodiesel production:
Environmental problem
20% GLY: Flexible chitosan film with good mechanical properties.

Nanoparticles: Ecofriendly process

AgNps

Broad spectrum antimicrobial properties.

Commission Regulation (EU) No 10/2011

Chitosan suitable polymeric matrix for AgNP capping.

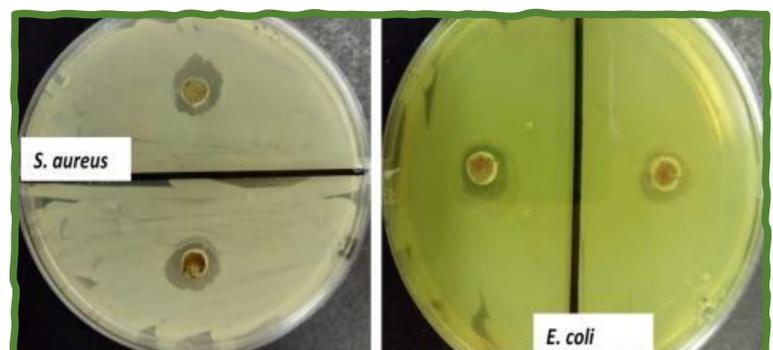
AgMgOnHaP@CSn

Nano-absorbent: Removes fluoride and pathogens from contaminated drinking water resources.

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Table 1. A selection of studies for biosynthesis of Ag nanoparticles

| Reference | AgNP source |
|---------------------------|--|
| (Ahmad and Sharma. 2012) | Ananas comosus (Pineapple) |
| (Konwarha et al. 2011) | Citrus sinensis (Orange) peel |
| (Basavegowda et al. 2013) | Citrus unshiu (Mandarin) peel |
| (Njagi et al. 2010) | Sorghum spp. (Bran powder) |
| (Dubey et al. 2010) | Tanacetum vulgare (Tansy fruit) |
| (Ankamwar et al. 2005) | Emblca officinalis (Indian Gooseberry) |
| (Kannan et al. 2013) | Codium capitatum (Seaweed) |
| Castro et al. 2013) | Syrogira insignis (Green alga) |
| (Raeshkumar et al. 2012) | Padina tetrastromatica (Brown seaweed) |



DISCUSSION

Solution for the current demand of food industries and society for a change in packaging.

This packaging could be useful in places where water is not in good conditions, **highly fluoridated** or with a certain number of **pathogens** in it. Removal of waterborne pathogens is one of the **main problems** related with the provision of drinking water in the world.