IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT OF BIODEGRADABLE SMART PACKAGING FOR SEAFOOD USING CHITOSAN- A MARINE WASTE

[1]Dhanush S Kumar Shetty
[1]Student
[1]Department of Biotechnology Engineering
[1]NMAM Institute of Technology, Udupi, India

Abstract : In the present world there is a high demand to develop biodegradable, functional, antimicrobial material for food packaging. Chitin and chitosan is a chief, most abundant natural polymer owing incomparable properties such as nontoxicity, antioxidant, film forming ability has received increasing attention for its application in food biotechnology. The present study involves not only developing the same but also develop beyond that to detect adulterant in Sea-foods. Many hazardous chemicals are being used to preserve food which are harmful to human life causing several diseases. Hydrogen peroxide and formaldehyde are used as preservatives in some food like chicken, fish, tofu, sweets etc which will cause health problems. Films were prepared using chitosan which is used to remove hydrogen peroxide and to detect formaldehyde. Chitin from shrimp shells was de-acetylated to produce chitosan and chitosan films were produced using chitosan solution. Chitosan films were immobilized with catalase extracted from banana peel and chemical agent to degrade hydrogen peroxide and detect formaldehyde respectively.

I. INTRODUCTION

Chitosan is a linear polysaccharide, chitosan is produced commercially by deacetylation of chitin which is the exoskeleton of crustaceans (such as crabs and shrimp). Both chitin and chitosan are polysaccharides which can be formally considered as derivations of cellulose. The solubility of chitosan in organic acids allows for gel and membrane fabrication. Chitosan has number of commercial uses. It can be a fine agent, helping to prevent spoilage.

Enzymes are often immobilized into solid support to increase the thermostability, operational stability and recover. Catalase was chosen because of its relatively high activity and industrial using. Catalase is a common enzyme found in nearly all living organisms exposed to oxygen. It catalyzes the decomposition of hydrogen peroxide to water and oxygen it is a very important enzyme in protecting the cell from oxidative damage by reactive oxygen species.

Food contaminated formalin has been an issue in many countries. Some traditional food sellers uses formalin as food preservative which is illegal according to FAO regulation. The present of formalin in food is not easily detected because food sample must analyze in chemical laboratories for sequence chemical analysis.

There have been several methods in formalin determination some of which are NASH method, Chromotrophy acid and Huhner-Fulton test. Those methods require several steps of laboratory procedure using toxic and corrosive chemicals, thereby they are not simple and practical ways for community. Chitosan based rapid indicator was formulated by coating chemical reagent which is simple detection technique.

II. MATERIALS AND METHODS.

2.1 DEACETYLATION OF CHITIN:

100 gram of chitin (shrimp shells) was treated with 60% NaOH (60 gram of NaOH in 100 ml distilled water) for 90 minutes and filtered. The residue was washed with distilled water until neutral pH. Dry the residue to obtain the chitosan powder in hot air oven overnight under 60 degree temperature for 90 minutes.

2.2 SOLUBILITY OF CHITOSAN AND FILM PRODUCTION:

The chitosan powder dissolves completely in organic solvents. The organic solvent used is acetic acid. 1g of chitosan powder was dissolved in 1% acetic acid. Later the chitosan solution was poured into the petriplate by solution casting method to produce film. The dried film in the petriplate was subjected to 0.2M NaOH to remove the film from the petriplate. Another method used to produce film was spray pyrolysis where equipment was used.

2.3 APPLICATIONS:

2.3.1 REMOVAL OF HYDROGEN PEROXIDE FROM SEA FOODS

2.3.1.1 IMMOBILIZATION OF CHITOSAN FILM

The chitosan film were conditioned in water and then treated with glutaraldehyde for 60 minutes at room temperature and washed until free glutaraldehyde disappeared. The films were mixed with catalase solution (prepared from banana peels) at room temperature and were left for a night, and finally washed until free catalase disappeared.

2.3.1.2 DETERMINATION OF IMMOBILIZED PROTEIN

The amount of immobilized enzyme protein was estimated by subtracting the amount of protein determined in supernatant after immobilization from the amount of protein used for immobilization. The protein content in the solution was determined by the Bradford method.

2.3.1.3 ENZYME ACTIVITY ASSAY

The activity of free and immobilized catalase were determined spectrophotometrically by the direct measurement of the decrease of light absorption at 240 nm caused by the decomposition of hydrogen peroxide by the enzyme.

2.3.2 FORMALIN DETECTION BY CHITOSAN BASED RAPID INDICATOR STRIPS

2.3.2.1 PREPARATION OF CHITOSAN BASED RAPID INDICATOR STRIPS

The chitosan film was coated with combination of chemicals and dried at room temperature for 45 minutes. The strips were designed from chemically coated chitosan film to detect formalin adulterated sea food.

III. RESULTS AND DISCUSSION

3.1 IMMOBILIZATION OF CATALASE ONTO CHITOSAN FILM

Prepared chitosan films were treated with glutaraldehyde to facilitate the reaction with enzyme. It is seen that when the amount of glutaraldehyde was increased, immobilized protein did not change and activity of enzyme increased. When glutaraldehyde concentrations were increased the films became fragile. And thus glutaraldehyde concentration was chosen 0.02%.

Table 1: Immombilized sample results.

Sample	Before immobilization	After immobilization
blank	0.00	0.00
standard	0.05	0.05
sample	0.20	0.57

By Bradford's method amount of immobilized protein on the chitosan film was found to be 10.2 mg (14 cm- diameter film)

Table2: UV analysis for adulterated fish washings

Washings	OD at 240nm
Positive control(adulterated fish)	1.2
negative control(adulterated fish wrapped in chitosan film)	1.2
Sample(adulterated fish wrapped in catalase immobilized chitosan film)	0.9

Table 3: UV analysis for different concentration of chitosan

1% chitosan film	3% chitosan film	5% chitosan film
1.617	2.260	2.361

3.2 CHITOSAN BASED RAPID INDICATOR STRIPS FOR THE DETECTION OF FORMALIN IN SEA FOODS

Chitosan based indicator was able to detect formalin by showing the colour change (pink) and it was able to detect formalin even at 1ppm concentration

IV. CONCLUSION

Chitosan has better film forming property and anti-microbial property hence it can be used in food packaging. Catalase can be of great values in food industries for removing hydrogen peroxide. Catalase immobilized chitosan film acts as packaging material as well as adulterant remover even at minimum concentration of adulterant.

The chitosan based rapid indicator strip can detect formalin concentration even at 1ppm and gives instant results within 30 seconds. This detection technique is easy and effective which can be performed even by the common man and it is also economically feasible and does not involve any usage of chemical reagent while performing the test**.**

V. ACKNOWLEDGEMENT

First and foremost, we would sincerely like to thank Dr C Vaman Rao, head of the department and our project guide Dr Anil Kumar H S for his everlasting guidance, support and advice throughout this project work.He inspired us greatly to work in this project.

We would also like to thank our non teaching staff namely Mrs. Poornima, Mrs Radhika, Mrs Veena, Mr Sandeep and Mr Prakash for their constant support and help throughout the project. Finally we would like to thank our classmates for their support..

REFERENCES

[1] Çetinus, Şenay Akkuş, and H. Nursevin Öztop. "Immobilization of catalase on chitosan film"(2000) *Enzyme and microbial technology* 26.7: 497-501.
[2] Blog- Italy is bleaching old seafood to make look fresh by Daisy Meager (2016).
[3] M. Adlim, Hasan, Zarlaida Fitri, Yulida Amri, Martina Sari and Saiful Mahaya (2011) "Preparation of chemical sensors for simple formalin detection in contaminated food"
[4] Esam A.El-Hefian, Mohamed Mahmoud Nasef and Abdul Hamid Yahaya. (2011)"Preparation and characterization of chitosan/ploy(vinyl alcohol) blended films: Mechanical, Thermal and Surface Investigations".
[5] Anggraini Citra Dewi, Susaina, Sari Putri Yurida, Anggriawan Randi Dwi, and Firadaus Muhamad (2013) "Permorma (paper test kit formalin) as the alternative selection to improve the quality of food ingredients"
[6] S Bhuvaneshwari, D Shruthi, Sivasubhramanian Velmurugan, Niranjana Kalyani. (2011) " Development and characterization of chitosan film".
[7] Maher Z Elsabee, Entsar S. Abdou (2011) "Chitosan Based Edible Fims and Coatings:A review".
[8] LO Farhan, Seena A Mustafa, Areej Sh. Hameed (2016) "Partial purification and charecterization of catalase from banana peels".