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Original Research Paper

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PROPERTIES AND APPLICATIONS OF INTELLIGENT PACKAGING INDICATORS FOR FOOD SPOILAGE

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ABSTRACT Pigments are available in all living matter and give appealing tones and assume fundamental parts in the development of organic entities. Anthocyanins are soluble in polar solvents, such as water, ethanol, and methanol. Thus, the extraction process of anthocyanins is generally done using the three types of solvents, which are watered to stabilize the anthocyanin in the form of flavylium cation. In this work we prepared Anthocyanin based indicator film based on biodegradable polymers such as starch, PVA, Chitosan, characterization , functional properties ,film antioxidant activity, deterioration study of indicator film was done.

KEYWORDS : anthocynanin, biodegrable polymers, indicator film

INTRODUCTION

Packaging ensures that freshly produced or processed products reach consumers safely from production facilities. Intelligent packaging is designed to include internal or external indicators that provide information about the package's history and the quality of the food inside. Active packaging involves incorporating specific components into the packaging material or headspace to enhance the system's performance.

Anthocyanins are responsible for the red, purple, and blue hues in various fruits, vegetables, and grains. There are six common anthocyanidins, pelargonidin cyanidin, peonidin, delphinidin.

For instance, the consumption of certain artificial dyes has been linked to increased hyperactivity in children. Additionally, studies frequently report allergic reactions in susceptible individuals who consume artificially colored foods. The preference for natural dyes in food products also offers technological and bioactive benefits, leading to products with higher added value (PoyatosRacionero and Ros-Lis,2018). Given this, the food industry should explore the processing of underutilized natural raw materials for the development of new dye products, which could attract more consumers by meeting their evolving preferences (Sharma and Ghoshal,2018) .

MATERIALS AND METHODS

Red cabbage and Eggplant were collected from the local market and *Clitoria ternatae* and *Bougainvillae spectacles* were collected from plant in surrounding area. The samples (Apples, Orange, Pomagranate, sapodilla) were collected and rinsed thoroughly with distilled water and used for isolation and identification of bacteria.

Biochemical test was done. Anthocyanin was collected by heating for 10 minutes and The extract was added with 2M Hcl,2M NaoH and heated at 100°C for 5minutes. The color was red indicates the presence of anthocyanin. The total anthocyanin measurement was based on the spectrophotometric pH differential method. The PVA and starch hydrogel were prepared by dissolving 2g of starch and polyvinyl alcohol in 100ml of distilled water under a magnetic stirrer at 100° c for 30 minutes respectively. The mixed solution was stirred until they dissolved and homogenized, at 25°C for 5 minutes. Then, 18 ml of the mixed solutions were spread on a plastic petri dish and dried in an incubator at 25 degrees Celsius with 50% RH for 18 h.

Functional properties of extract and indicator film by pH and ammonia sensitivity, antibacterial pigment activity was done. Antioxidant activity Reducing assay. Character of indicator film: Water Solubility, Swelling Properties, Water content analysis and Deterioration study of the indicator was done .

RESULT AND DISCUSSION

Fruit pathogens were isolated from spoiled apple, orange, pomagranate and sapodilla by streaking on selective plate media. EMB plate showed metallic sheen green colonies, Cetrimide agar plate showed white colonies and at last Bacillus media showed cream coloured, dry colonies.

Anthocyanin was extracted from *Clitoriaternatae*petals, *Bougainvillae spectacles* petals,Red cabbage leaves and Egg plant peel by means of soaking and boiling method. After the filtration the extract was stored for further processing. In this study the water solubility of the *Clitoriaternatae*(Starch and PVA) is 15.42% and*Bougainvillae spectacles* (Starch and PVA) is 12.13% and Red cabbage (Starch and PVA) is 14.86%and Eggplant (Starch and PVA) is 16.52% whereas for *Clitoriaternatae*(Starch and chitosan)is 21.08% and Bougainvillae spectacles (Starch and chitosan) is32.16% and Red cabbage(Starch and chitosan) is 19.68% and Egg plant (Starch and chitosan) is 27.08%. Anthocyanin might have indirectly increased the hydroxyl group, thereby improved the affinity towards the water.

The initial and final observation of coated grapes under room temperature and cold temperature for 7 days . The grapes were wrapped with four different films such as *Clitoriaternatae* (S+P, S+C) and*Bougainvillae spectacles*(S+P,S+C) under room and refrigeration temperature 6 and 7 days. Grapes were used as the samples. The grape are acidic and the pH range is 3.4. Therewas no obvious difference between film and samples coated after a day of storage but the condition of all grapes were bad after one week in room temperature. The condition of all grapes were good after one week in refrigeration temperature. The colour coated grapes were faded under room temperature. This was because of the colour changes of fruit from the synthesis of carotenoid and anthocyanin and degradation of chlorophyll. The scent of coated grapes was sweet until day 6 and 7. As coating could slowdown fruit deterioration, storing grapesunder room temperature. Grapes without coating could causes quality deterioration because of structural collapse.(Table 7)

However the film coated grapes became faded under room temperature after 4 days. The pH of grapes decreased during storage, the film wrapped with grapes turned light pale purple at 3 day of room temperature.It showed that the grapes were acidic , it can be seen that films changed to light purple

(*Clitoriaternatae* S+P, S+C) and light brown *Bougainvillae spectacles* (S+P,S+C) . This might be due to protein denatured.

CONCLUSION

The fruit spoiled pathogen was isolated from spoiled fruits like orange, apple, pomegranate, sapodilla. The identified pathogens were *E.Coli, Bacillus.sp, Pseudomonas.sp*.

Anthocyanin pigment extracted from Cliteria ternatea flower,Red Cabbage Egg plant and bougainvillea spectecles by soaking and boiling method.Then extracted pigment was confirmed by preliminary identification by using NaoH, Hcl and NH3.Then total anthocyanin yield was measured by Ph differential method.Indicatar film was prepared by using degradable polymers such as starch,PVA,and chitin with addition of pigment extract respectively.The fuctional characters such as ph sensitivity of pigment and film, antibacterial activity, ammonia sensitivity,and antioxidant activity.The pH sensitivity of pigment and a film showed differnt valient colours to diffent pH value 2-12. Antibacterial activity Showed that signet hoad antibactual activity. The antioxidant activity revealed that were in, increased absorbed large with increased concentration.

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