*International Journal of Minor Fruits, Medicinal and Aromatic Plants. Vol. 8 (2) : 86- 90, December 2022*

***Short communication***

# Development of Eco-friendly Smart Bio-food Wrapper using Undersized *Heliconia bihai* leaves

**I.C. Dodampe, L. M. Rifnas*, W. G. C. Madushani and S. S. Weerasinghe**

*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and Rural Sciences, Weligatta New Town, Hambantota, Sri Lanka*

**Email: rifnaslm@yahoo.com*

*Received : 15.07.2022 ; Revised: 05.09.2022 ; Accepted: 07.09.2022*

**DOI :** 10.53552/ijmfmap.8.2.2022.86-90



**ABSTRACT**

*Two consecutive experiments were conducted with the objectives of developing eco-friendly food wrappers with Heliconia leaves. First experiment was conducted to attach narrow leaves of Heliconia bihai together along with the outer packing paper introduce as a user friendly smart bio food wrapper since those are narrow and not in adequate size for wrapping food. Sago solution, gelatin, wheat flour and rice starch solutions were tested as sticking agents to attach leaves. There were twenty replicates in each treatment and performances of the product was evaluated using a taste panel comprised of twenty un trained numbers. "Kruskal Wallis H Test" was used to analyze the data as non-parametric test ($p>0.05$). There were significant differences between the treatments on smell, adherence and overall acceptability up to ten days after the production. Texture and colour showed significant changes after four and six days respectively. It was observed that up to four days of time all the sticking agents gave good results in all the tested parameters. Sago and gelatin solution showed good in all qualities up to six days. Based on the results of first experiment, second experiment was conducted to determine the quality of food wrapped inside the wrappers. Food wrappers prepared with sago and gelatin were compared with Banana leaves as a food wrapper. There were no significant differences ($p<0.05$) between the tested food wrappers on taste, smell, appearance and overall acceptability. User friendly food wrappers can be produced as two in one (wrapping and packing) wrapper by sticking narrow Heliconia bihai leaves in fairly good size.*

***Keywords*:** Bio food wrapper, friendly user, *Heliconia bihai*, sticking agent.

## INTRODUCTION

Plastics are extensively favored and used due to their resistance to corrosion, light in weight, moisture proof, and adaptability. Use of plastic food packing is hard to environment and damage the human and animal health. Disposable plastic packages take several decades to degrade and they remain in the environment and leading to environmental pollution (Verma *et al.,* 2016). These are preferred only due to their low cost and short term convenience. At present, many industries are moving towards developing biodegradable packaging materials, leading to zero waste in the environment. Biodegradable means the materials can be easily decomposed within a shorter duration under the action of microorganisms (Babu *et al.,* 2013). It is considered that biodegradable packaging materials can substitute for synthetics at a low cost, thereby making positive effect on both environment and ecosystems.

Several plant-based packaging materials can be used as an alternative to plastics and safe for environment (Khazir and Shetty, 2014). As reported by Guillard *et al.* (2018) 50% packaging waste production can be reduced by 2050, if one in two food packs are made. As a trend in creating sustainable and eco-friendly packaging materials, attention is turned towards the plant products such as leaves and agro-based waste materials. Several materials are joined to produce food packaging; this method generally uses each of the materials' functional or aesthetic characteristics (Marsh and Bugusu, 2007). These two characteristics are linked, helps to determine things like shelf life, product protection, and the packages insulation properties. Finding the ideal material or combination of materials aids to retain product quality and originality during storage, supply, and consumption (Fellows and Axtell, 2002).

The home gardens in Sri Lanka are abundant in different species of medicinal plants. Since almost every component of the plant has therapeutic potential, it is employed in conventional Ayurvedic procedures. In contrast to other plant organs, however, leaves, roots, flowers, bark, fruits, and rhizomes have greater therapeutic potential (Mirihagalla and Fernando, 2021). Banana leaves are the commonly and popularly using leaf material for wrapping foods. Weerasinghe *et al*. (2007) has introduced banana leaves as food wrappers in cured form, which last long under refrigerated conditions without affecting the quality. However, there are certain limitations eg. especially under dry zone conditions, most of the banana leaves are subjected for tearing due to blowing winds that limits the availability of pieces of leaves in desired size. Therefore, the identification of an alternative suitable leaves regardless of the size is of prime importance. *Heliconia*, ornamental herbaceous shrubs, has a high potentiality of utilizing *its* leaves for alternative purposes in various household applications due to their close relationship to bananas, cannas and ginger. Among Heliconia species, *Heliconia bihai*, well known as Parrot's beak has drawn a considerable attention for its medicinal value. Leaf extracts of *H. bihaii* is used as a diuretic and as a astringent while the root extract is used to ease the expulsion of the fetus at the birth (Awodele *et al*., 2015). Moreover, their large paddle-like leaves, shows similarity to banana leaves and hence shows potential to be used as food wrappers. This has scientifically been proved by Weerasinghe and Madhushani in 2019 by producing cured food wrappers with *heliconia bihai* leaves in adequate size for wrapping food. Heliconia is grown in wet zone in Sri Lanka and they produce large leaves under shade conditions. Under dry zone condition they grow well but produce somewhat narrower leaves compared to the wet zone. Hence, the present study was conducted to develop food wrappers with small Heliconia leaves but in adequate size by attaching narrow leaves together along with the outer packing paper as a user-friendly smart bio food wrapper.

Two experiments were conducted at the Institute for Agro-Technology and Rural Sciences, Weligatta New Town, Hambantota, Sri Lanka where the climatic condition was warm and belongs to the Agro Ecological Zone of DL5. The suckers of *Heliconia bihai* collected from the wet zone, Gannoruwa, were planted in a well-prepared land in the experimental location with 30cm x 30cm spacing. Plants were maintained under well managed conditions. Harvesting of leaves was done four months after establishment in the field, just before the flowering. Leaves with well grown, fresh, fully expanded, and good look were cut and separated using a sharp knife. Just after harvesting of leaves, they were washed, cleaned and ashes adhered to then lower surface of the lea were removed carefully using a piece of cotton cloth. They were dipped in boiling water for few seconds. Thereafter, they were air dried under room temperature for 4 – 5 hours for curing. Midrib was removed using a sharp blade. Heliconia leaves were joined together by adhering them with a natural sticking agent to achieve the adequate size. They were placed on pieces of demy papers in desired size for wrapping a pack of food.

The different types of sticking agents were used as the treatments. There were 5 treatments and 20 replicates in each. The treatments were;

T1 - Sago solution (50 g of sago granules added with 100ml of boiling water)

T2 – Gelatin solution (50 g of gelatin powder added with 100ml of boiling water)

T3 – Wheat flour solution (50 g of wheat flour added with 100ml of boiling water)

T4 – Rice starch solution (50 g of rice added with 100ml of boiling water)

T5 -No sticking agent used (Control)

Prepared food wrappers were kept inside the refrigerator and taken out at two days interval for the sensory evaluation. The observations were made using a panel comprised of twenty members For Colour, Texture, Odor, Adherence and Overall acceptability of the food wrapper. A Likert scale ranging from 0-5 (Very bad to very good) was used for the sensory analysis.

Based on the observations from 1st experiment, experiment 2 was conducted with following treatments;

T1 – Food wrapper with Banana leaf

T2 – Smart food wrapper prepared with sago solution as sticking agent

T3 – Smart food wrapper prepared with gelatin solution as sticking agent

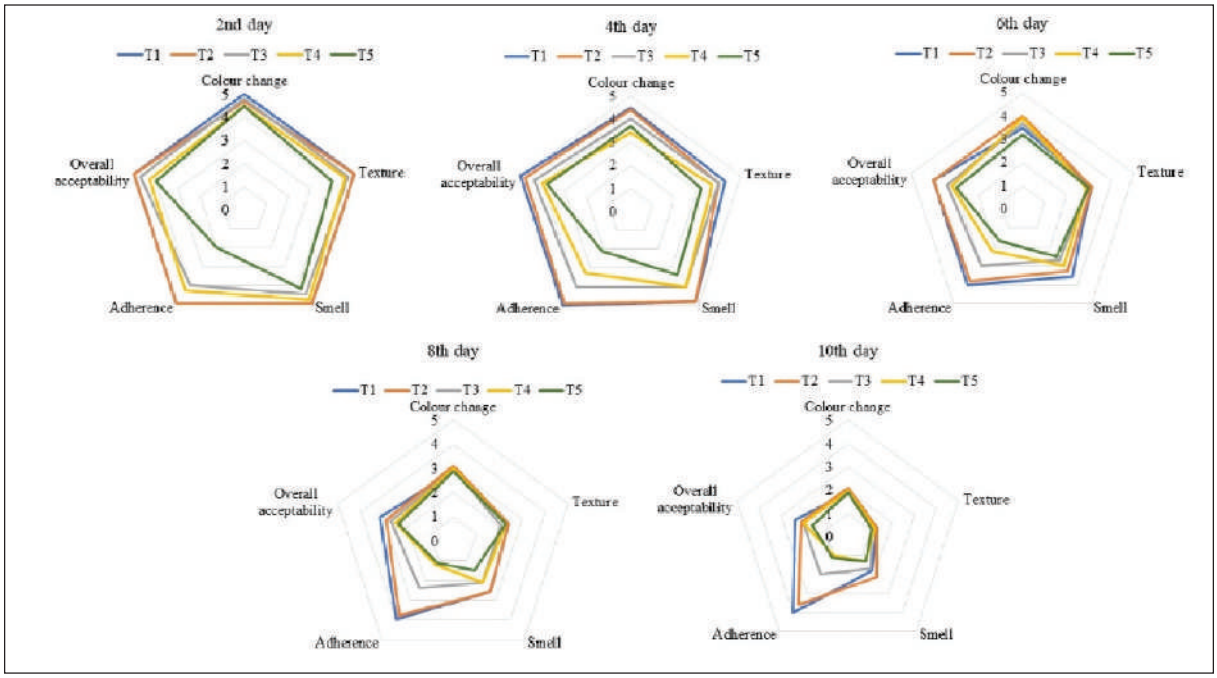


**Fig. 1: Performances of food wrappers up to 10 days of production**


**Fig. 2: Prepared food wrappers**

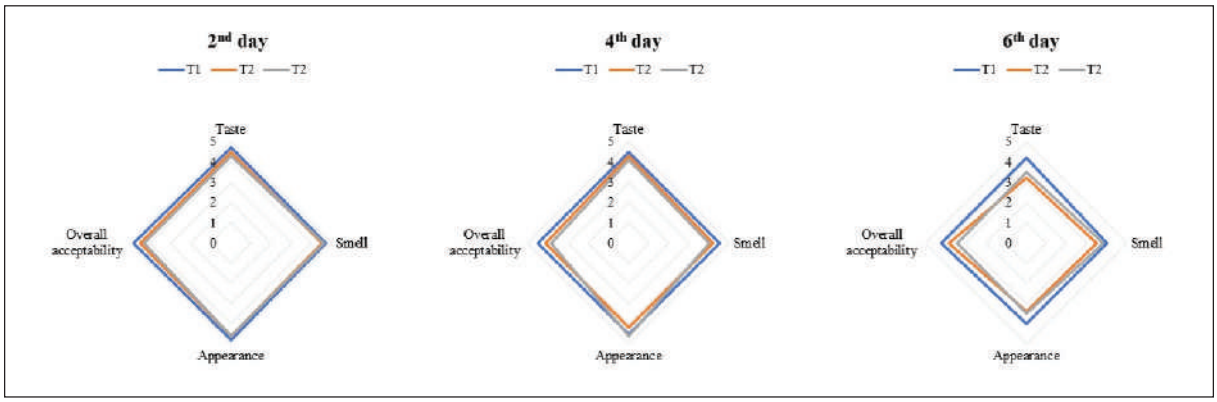


**Fig. 3: Performances of food wrapped up to 6 days of production**

One serve of food was packed inside the prepared food wrapper and taste, smell, appearance and overall acceptability were evaluated up to 6$^{th}$ day at 2 days interval after preparation of food wrapper using a panel comprised of twenty untrained members. A Likert scale ranging from 0-5 (Very bad to very good) was used for the sensory analysis. Collected data were analyzed using Minitab statistical software. Each response were given numerical value as a rating system and "Kruskal Wallis H Test" used to test the significance as non-parametric test ($P>0.05$).

Food wrappers were stored under refrigerated conditions to observe the maximum period that can be stored without affecting the quality. The results at different time periods were shown in figure 1. There were statistically significant ($p<0.05$) differences among treatments in odor, adherence, and overall acceptability up to 10 days. Further, Colour showed significant ($p<0.05$) change up to 6 days, as texture showed significant change up to 4 days. The food wrappers produced in all techniques can be stored up to four days without affecting the quality. There were significantly low performances in all parameters of wrappers developed using wheat flour starch and rice broth than that of in wrappers produced with sago solution and Gelatin solutions. Therefore, this revealed that there is no use of applying wheat flour starch and rice broth if we expect the shelf life more than four days.

Results confirm that only sago and gelatin can maintain the quality of wrapper up to six days. However, the wrappers prepared with sago and gelatin solution reduced in all qualities except adherence. Hence, it showed better adherence up to 10 days. Adherence is an important factor while considering the production of smart food wrapper. Mohamed *et al.* (2008) mentioned that Starch in the Sago is generally used as an efficient component such as thickener, stabilizer, and gelling agent in the food industry. Gelatin is used in many foods production processes as a binding agent and as a source for texture (Abdelfadeel, 2012). As revealed by Nishimoto *et al.* (2005); Karim and Bhat (2009) the distinct hydrocolloidal feature of gelatin has facilitated it to find various applications in the food industry including providing chewiness, texture, water binding, mouthfeel, etc. Food wrappers were stored under refrigerated conditions up to 6 days, wrapped with the food and results taken at 2 days interval were shown in figure 3.

It was found that, there were no statistically significant ($p>0.05$) differences among treatments in all the tested parameters taste, smell, appearance and overall acceptability up to 6 days. Quality of food packed in wrappers having the shelf life up to 6 days were evaluated with a sensory panel revealed the quality of packed foods were in good quality and good in appearance, taste and flavor. Newly developed food wrappers with Heliconia leaves showed not significant differences with the generally used Banana food wrappers. As indicated by Ng (2015) one of the better visual differences between the flora of the tropics and the flora of other climates is the huge difference in the size of leaves. In the tropics, the leaves of bananas, heliconias, gingers, palms, bamboos, macarangas, cordylines, water lotus, dipterocarpus and many others are much bigger and many are put to outstanding use wherever sheets of waterproofed materials are required.

It was concluded that *Heliconia* leaves in fairly good size can be produced by sticking under sized leaves together. For that Sago and Gelatin solutions could be considered as appropriate sticking agents. Hence, using *Heliconia bihai* leaves it is easy to produce bio food wrappers coupled with outer packing papers in more user friendly manner for busy consumers as smart food wrappers to replace synthetic wrapping materials.

**REFERENCES :**

Abdelfadeel, H.F.A., 2012. Extraction and characterization of gelatin from melon bug (*Aspongubus viduatus*) and sorghum bug (*Agonoscelis pubescens*) for application in to ice cream making. *Msc. Thesis*, *Sudan Univ. Sci. Techn.* Khartoum, Sudan.

Awodele, O., Ikumawoyi, V.O., Iwuanyanwa, U.I., Akntonwa, A.and Mabadige, A.B. 2015. a Nicological Evaluation of the Aqueous Leaf Extract of *Heliconia pendal*, *University of Lagos Journal of Basic Medical Science*, **3**: 1-8.

Babu, R.P., O'connor, K. and Seeram, R., 2013. Current progress on bio-based polymers and

their future trends. *Progress in biomaterials*, **2**(1): 1-16.

Fellows, P. and Axtell, B. 2002. Packaging materials. *Appropriate food*

*packaging: materials and methods for small businesses. Essex, UK: ITDG*

*Publishing. P*, 25-77.

Guillard, V., Gaucel, S., Fornaciari, C., Angellier-Coussy, H., Buche, P. and Gontard, N. 2018. The next generation of sustainable food packaging to preserve our environment in a circular economy context. *Frontiers in nutrition*, *5*, pp.121.

Karim, A.A. and Bhat, R. 2009. Review fish gelatin: properties, challenges, and prospects as an alternative to mammalian gelatins. *Food Hydrocoll.,* **23**: 563-576.

Khazir, S. and Shetty, S. 2014. Bio-based polymers in the world. *International journal of life sciences biotechnology and Pharma research*, **3**(2), pp.35.

Marsh, K. and Bugusu, B. 2007. Food packaging—roles, materials, and environmental issues. *Journal of food science*, **72**(3), pp.R39-R55.

Mirihagalla, M.K.P.N. and Fernando, K.M.C. 2021. Medicinal plants use for home remedies in Sri Lanka: A Review. *International Journal of Minor Fruits, Medicinal and Aromatic Plants.* **7** (2):29-39.

Mohamed, B. Jamilah, K.A. Abbas, R. Abdul Rahman and Roselina, K. 2008. A Review on Physicochemical and Thermorheological Properties of Sago Starch. *American Journal of Agricultural and Biological Science,* 3(4):639-646. DOI: 10.3844/ajabssp.2008.639.646

Ng, C. 2015. Plant leaves in food preparation and packaging. *UTAR Agriculture Science Journal (UASJ)*, **1**(4).

Nishimoto, M., Sakamoto, R., Mizuta, S. and Yoshinaka, R. 2005. Identification and characterization of molecular species of collagen in ordinary muscle and skin of the Japanese flo under (*Paralichthys olivaceus*). *J. Food Chem.,* **90**: 151-156.

Turner, W.A. 1988. Prepared foods. Dan Best Chicago, USA.

Verma, R., Vinoda, K.S., Papireddy, M. and Gowda, A.N.S. 2016. Toxic pollutants from plastic waste-a review. *Procedia Environmental Sciences*, **35,** pp.701-708.

Weerasinghe, S. S. and Madushani, W.G.C. 2019. Cured *Heliconia bihai* -Parrot's beak an environmentally friendly bio food wrapper. *Proceedings of the 5th International Symposium on Minor Fruits, Medicinal and Aromatic Plants.* 4th -6th September 2019. Pp.33.

Weerasinghe, S.S , Ruwanpathirana, K.H., Jayasinghe, N.N., Karunathilake, A., Gamachche, C. and Chamara, G.A.S. (2007) . Banana ( *Musa spp*) leaves as bio wrappers . *Annals of the Sri Lanka Department of Agriculture,* **9**:295-296.