Development of Nutraceutical Edible Tape from Organic Food Waste Utilization

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ABSTRACT

Over the past few decades, the variety and demand for nutraceutical products has grown significantly in the fields of innovation and technology sciences. Studies are being conducted to prove the effects of nutraceutical bioactive substances on human health statuses. For this scenario, introducing our revolutionary tape snack, a game-changer for all your taping and wrapping needs. This innovative product not only serves as a reliable adhesive but also offers a pleasant taste, a tape that not only securely holds ingredients together however also mends a burst of flavor to your day. The tape snack is skillfully prepared from biodegradable materials to ensure a lesser amount of environmental impact. Additionally, it is made to be entirely edible. It creates a novel solution by fusing usability, sustainability, and delectable flavors. As a consumer one have faced the difficulty in eating tortilla wraps, sandwiches that does not hold its ingredients properly and fall out yet these items were developed to allow people to eat food with their fingers without getting messy. Some scholars have attempted to solve this problem by wrapping their sandwiches and tortilla products in paper to enclose the product and hold it together but it can easily torn away. The aim of innovation is to make gelatin based edible tape which can be used to tape or hold the ingredients together in wrap as they are being consumed as well as the purpose of this innovation is environmental pollution is a significant issue that the world has been dealing with. In this context, non-biodegradable tape or packaging forms are a leading concern due to pressure to tackle the increasing amount of packaging trash globally, the water vapor permeability of the test sample was also competitively close. The analysis of pomegranate peel powder reveals its nutritional composition. With moisture content 4 ± 0.22%, while ash content measures at 5 ± 0.14%, indicating the presence of essential minerals. A notable 9.4 ± 0.1% fat content. The pH of 3.75 ± 0.2 signifies a mildly acidic nature. Further analysis includes 21 ± 0.6% crude fiber. Total sugar content at 31.38 ± 0.3%, broken down into 30.40 ± 0.11% reducing and 0.98 ± 0.12% non-reducing sugars. Additionally, protein content stands at 1.395 ± 0.30%, supported by nitrogen analysis at 8.719 ± 0.10%, showcasing the powder's nutritional richness. The developed tape contain 11.7% ash content, 1.5% moisture content. This allows the edible scotch tape to be enjoyed as a flavorsome snack, Upon analysis the presence of photochemical in the edible tape was examined. The analysis revealed the presence of protein, amino acids, carbohydrates, flavonoid, phenol highlighting the product's richness in essential building blocks for health and nutrition. Now, you can indulge in a snack that not only serves its practical purpose but also satisfies your taste buds.

Keywords: Nutraceutical, bioactive, tape, snack, innovation, waste utilization, biodegradable.

INTRODUCTION

Innovation is the driving force behind progress and sustainability in the modern world. As global populations continue to burgeon, the need for innovative solutions to address environmental challenges becomes increasingly urgent. One such challenge is the mounting problem of food waste and its ecological repercussions. A staggering one-third of the world's food production is lost or wasted each year, and this waste has severe environmental, economic, and social consequences. Amidst these concerns, a novel approach to

both reducing food waste and developing sustainable packaging materials has emerged the creation of organic edible tape from waste utilization.

In the core of this groundbreaking tape lies gelatin, a protein-based substance sourced from collagen. Gelatin has been a staple in both culinary and pharmaceutical sectors, valued for its distinctive gelling and adhesive characteristics (Luo et al., 2022). It serves as foundation material for the edible tape, providing the crucial structural framework and adhesive strength vital for packaging and sealing food items. Besides its practical qualities, gelatin holds a captivating chemistry. It is primarily comprised of amino acids, characterized by a notable abundance of glycerin praline, and hydroxyproline. These amino acids play a crucial role in forming the triple-helix structure of collagen, responsible for giving gelatin its ability to form a gel. Because gelatin's rich in praline and hydroxyprolineimparts the tape with elasticity, making it adaptable and easy to use. This property is necessary for producing a versatile packaging solution that can accommodate various food items (Mroczkowska et al., 2021). Furthermore, the sticky properties of gelatin, affected by its glycerin content, ensure that the tape adheres efficiently to several surfaces. Its chemistry facilitates it to securely seal packages and secure the contents within. Gelatin's taste-neutral nature is a huge benefit, allowing for the incorporation of several flavors and ingredients to boost its palatability and versatility to various cuisines.

Pomegranate peel is another remarkable ingredient that provide to the development of this organic edible tape. Pomegranate peels are frequently disposed of as waste, but they are rich in bioactive compounds, mostly tannins and antioxidants (Akhtar et al., 2015). Tannins have astringent properties and can reduces the chances of microorganism proliferation, making them an ideal for longing the tape's food preservation capabilities (Chen et al., 2020). Antioxidants in pomegranate peel, like polyphenols, gives extra protection against oxidative damage, which can cause to food deterioration. By using pomegranate peel, this tape obtain both antimicrobial and antioxidant properties, sustaining food safety and prolonging the shelf life of packaged products, also antioxidants are acknowledged tocombat oxidative stress and inflammation, making them important in the prevention and controlling of numerous diseases, including, diabetes, cardiovascular diseases and certain types of cancer(Salim et al., 2023)

Potato starch, a byproduct of potato processing, supplements further depth to the tape's composition. Its chemistry involves amylose and amylopectin, two kinds of polysaccharides that form a network of intermolecular bonds, resulting in a semi-crystalline structure. This characteristic imparts crucial binding and adhesive properties to the tape. The tape turn into more robust and durable, with the capability to withstand mechanical stresses and variations

in temperature. Additionally, potato starch is an recyclable alternative to conventional starch sources, decreasing environmental effect (Niu et al., 2021).

Glycerin, a polyol compound, aids to improve the tape's flexibility and avoid it from becoming brittle or simply fragile (Niu et al., 2021). The hydroxyl groups in glycerin form hydrogen bonds with other compounds, contributing to the tape's ability to sustain its integrity even under various environmental circumstances. Its chemistry allows the tape to tolerate bending and stretching without cracking, certifying reliable wrapping.

Gums are incorporated for their capability to advance the tape's adhesive strength. These gums comprise of high molecular weight polysaccharides, contributing to the tape's cohesive and adhesive properties (Hi el at., 2016). Their chemistry permits the tape to tightly seal packages, avoiding leakage and contamination and works as a stabilizing agent due to its anionic nature. Its chemistry lets it to interact with water molecules, establishing a colloidal structure. This property guarantees the tape's structural reliability, inhibiting it from decomposing when open to moisture or humidity. It plays a vital role in conserving the tape's functionality and value in various environmental conditions.

Aims and Objectives

- The objective is to deliver a description of an adhesive tape that is edible and can be utilized to hold food products together or secure them while being consumed.
- Another objective is to consume discarded pomegranate peels to produce an environmentally friendly final product.
- Another goal is to create an edible tape that can be loved as a snack, initiating a new trend.
- It is yet another object of the present invention to describe an edible adhesive tape which can be created in numerous flavors and which can provide a unique means of adding flavor to a food product.

MATERIALS & METHOD

Plant material collection:

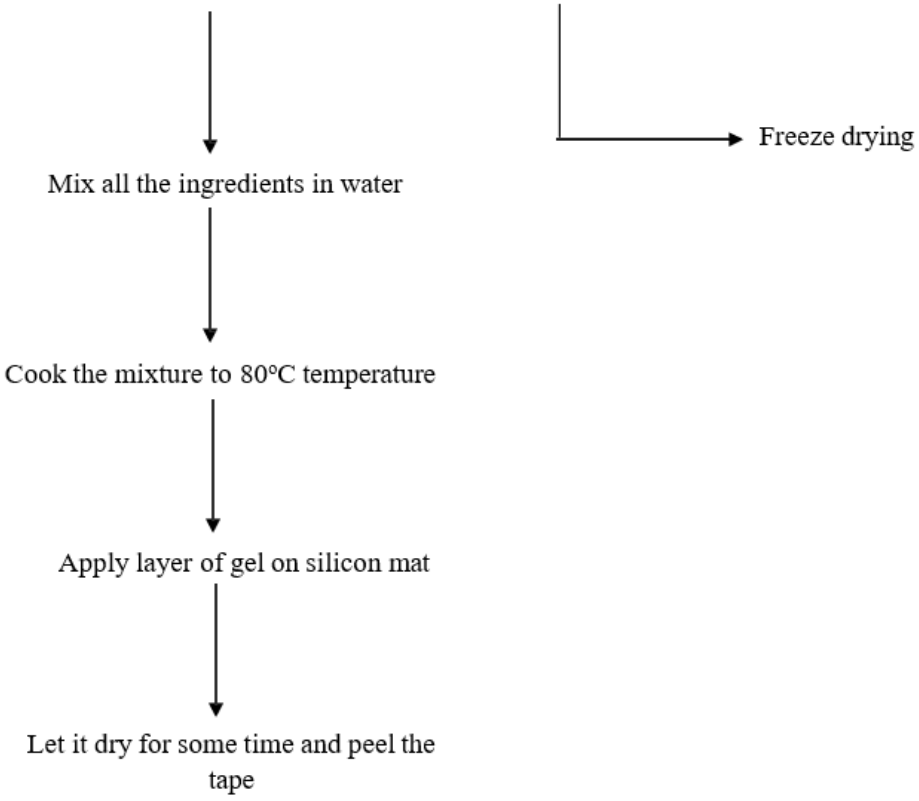
Gather the ingredients from local include:

Gelatin, Glycerin, Gums, Starch, Pomegranate peel, Flavor.

Product Development

The steps of developing edible tape are

Weighing of raw material (Water, gelatin, glycerin, gums, starch, pomegranate peel powder, flavor)



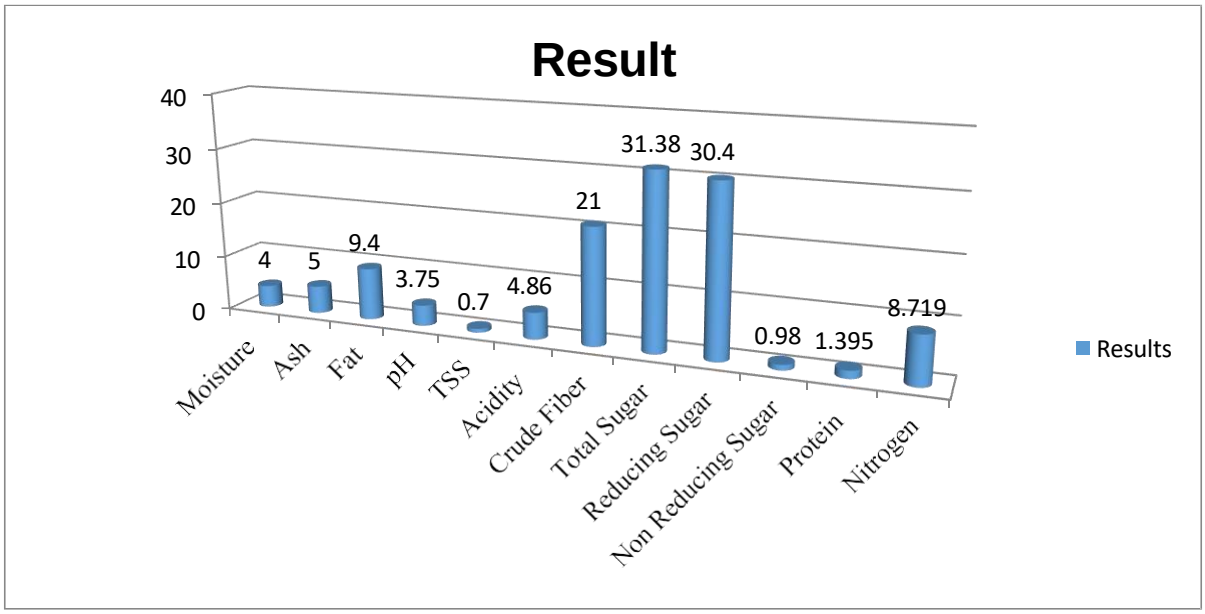


Figure 1. Proximate analysis of pomegranate peel powder.

Proximate and Physiochemical Analysis of Product

Total Moisture

Moisture content of edible tapes was determined by using AACC Method 44-15.02 of oven drying. The drying time required to achieve removal of moisture content of tape were 3 hours at 100°C.

Crude Fat

Fat content were estimated by AOAC official Method 948.22.

Crude Protein

Protein content was estimated by using K jeldahl's method as described in Method No.981.10 AOAC.

Ash content

Ash is an inorganic residue remaining after the material has been completely burnt at temperature of 550°C in a muffle furnace that is based on AOAC Method tagged as 942.05.

Total Carbohydrates

Carbohydrate content was estimated by% carbohydrates = 100 - % moisture - % protein -

% lipid - % mineral.

Nitrogen free extract (NFE)

The total percentage NFE in edible tape were determined by the difference method.

% NFE = 100 – (% moisture + % crude + % protein + % lipid + % ash)

Water permeability

Water permeability test was determined by magnetic stirrer ACS.

Tensile Strength and Elongation at Break

The tensile strength of tape were determined by tensile test ASTM E-123-45

Table 1. Qualitative Phytochemical analysis of Extract used for making tape snack.

S. No	Constituents	Tests	Observation	Results
1	**For Alkaloids**	Iodine test	rusty coloration	+ve
2	**For Carbohydrates**	Molish's test	Violetring	+ve
		Fehling's test	Red precipitates	+ve
3	**For Reducing sugars**	Benedict's Test	Mustard yellow	+ve
			color	
4	**For Protein and amino**	Biuret Test	pink color	-ve
	acids			
		Ninhydrin test	purple color	+ve
5	**For Flavonoids**	Alkaline	Intense yellow	+ve
		Reagent test	color	
		Lead acetate	yellow precipitates	+ve
		Test		
6	**For phenolic**	Iodine test	transient red color	+ve
	compounds			
7	**For Tannins**	Braymer's Test	blue green	-ve
			coloration	

Figure 2. Qualitative Phytochemical analysis of Extract used for making Tape Snack.

RESULT & DISCUSSION

The creation of organic edible tape, sourced from repurposed materials, represents a significant stride towards sustainability and ingenuity. By converting pomegranate peel, typically discarded as waste, into a valuable component of this versatile product, (Khan, Patel, & Bhise, 2017) the focus on waste reduction and environmental awareness is evident. Key attributes such as sustainability, health benefits, and versatility

position the organic edible tape as a transformative player in eco-friendly packaging and nutritious snacking alternatives. This innovation not only fosters a greener and healthier future but also serves as a compelling model for transforming waste into a valuable resource, paving the way for further advancements in sustainable product development. In the domain of innovative food items, the introduction of nutritional edible tape signifies an intriguing intersection of nutritional science, serving as both a flavor binder and a nutritional powerhouse. Unveiling the layers of this edible tape exposes a narrative of meticulous formulation and a dedication to redefining snacking habits. Notably, its impressive nutritional profile, featuring a 21 ± 0.6% crude fiber content, positions it as a potential source of dietary fiber, addressing the demand for functional snacks.Breaking down the total sugar content (31.38 ± 0.3%) into reducing (30.40

± 0.11%) and non-reducing (0.98 ± 0.12%) sugars offers insights into sweetness levels and potential health benefits. The protein content, measured at 1.395 ± 0.30% and supported by nitrogen analysis at 8.719 ± 0.10%, enhances the nutritional appeal of the edible tape. With a

moisture content of 1.5%, it not only remains fresh but challenges conventional snacks relying on higher moisture levels. Notably, the substantial ash content at 11.7% suggests a product extending beyond mere indulgence, providing essential minerals for nutritional value. Beyond these fundamentals, a series of tests reveal the tape's prowess in the nutritional arena. From protein content analyses highlighting its potential as a protein-rich snack to water permeability tests demonstrating resilience, this tape transcends its adhesive role, making a statement about functionality and versatility. Tensile strength tests attest to its robust nature, showcasing structural integrity. The presence of flavonoids, amino acids, and carbohydrates transforms the tape into a nutritional powerhouse, with flavonoids adding antioxidants, amino acids contributing to life's building blocks, and carbohydrates offering sustained energy. In the evolving landscape of sustainable consumer goods, the nutritional edible tape stands out as an eco-friendly innovation. Beyond adhesion, it artfully combines flavors, functionality, and nutrition, providing a seamless and enriched consumer experience. Its commitment to eco-conscious practices, crafted from biodegradable materials, not only reduces pollution but also addresses environmental concerns (Bangar et al., 2021). Utilizing waste for positive impact on both health and the environment, this product aligns with the demand for healthy snacks while contributing to a cleaner and more sustainable future. This innovation reflects a dedication to driving positive change, fostering a shift towards convenient, nutritious, and environmentally responsible food choices.

CONCLUSION

In conclusion, the rising interest in nutraceutical products and their influence on human health has led to the emergence of inventive solutions. The introduction of a groundbreaking tape snack not only fulfills practical adhesion needs but also imparts a delightful burst of flavor. Crafted from environmentally friendly materials, this tape aligns with sustainability objectives, presenting a fresh answer to concerns associated with non-biodegradable packaging. The nutritional analysis of the pomegranate peel powder incorporated into the tape underscores its abundant composition, amplifying the product's health advantages. With its edible and flavorful characteristics, this gelatin- based tape not only securely wraps items but also delivers a pleasurable snacking experience, seamlessly combining functionality and taste. This pioneering approach, amalgamating usability, sustainability, and nutrition, provides a promising solution for both consumers and environmental advocates alike.

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