

Research Article

Teaching and Learning Innovation in Management of Technology and Innovation: An Edible, Dissolvable Seasoning Sachet

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Abstract: This project introduces an innovative edible dissolvable seasoning sachet designed to improve convenience and reduce packaging waste in instant meal preparation. Unlike traditional plastic or foil seasoning packets, the sachet is made from a food-grade, water-soluble film that dissolves quickly in boiling water, releasing seasoning evenly without tearing, spilling, or direct contact. The tasteless and safe-to-consume film leaves no residue, providing a hygienic and user-friendly experience. This eco-friendly solution supports the growing demand for sustainable and zero-waste packaging in the convenience food industry. By combining practicality, hygiene, and environmental responsibility, the project offers strong potential for future commercialization and sustainable food packaging innovation.



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1. INTRODUCTION

The global reliance on convenience food products such as instant noodles, soups, and ready-to-eat meals continues to grow, driven by rapid urbanization, lifestyle changes, and increased demand for affordable, time-saving meals. While these products offer unmatched ease of preparation, they also generate considerable plastic waste through single-use seasoning sachets containing powders, oils, or sauces. These sachets are typically made from multilayer plastic films, which are not only difficult to recycle but also frequently escape waste collection systems, contributing to the growing environmental crisis of microplastics and packaging waste (Kurniawan et al., 2023).

The continued use of traditional plastic-based seasoning sachets in the instant food industry presents several critical challenges that necessitate urgent intervention. These challenges include significant environmental impact, user inconvenience, and hygiene concerns, each of which hinders progress toward a more sustainable and health-conscious food system.

To address this challenge, this study explores the potential of dissolvable seasoning packaging made from edible or biodegradable films. These materials, derived from starch, alginate, polyvinyl alcohol (PVA), and hydroxypropyl methylcellulose (HPMC), are designed to dissolve entirely in hot water, releasing seasonings directly into the meal without leaving waste. This innovation promises not only environmental benefits but also enhanced food safety and consumer convenience.

This innovation is timely and relevant, as it directly supports key targets within the United Nations Sustainable Development Goals (SDGs). Specifically, it aligns with SDG 12 (Responsible Consumption and Production) by reducing reliance on single-use plastics; SDG 13 (Climate Action) by mitigating the environmental impact of plastic manufacturing and disposal; and SDG 14 (Life Below Water) by addressing marine pollution.

2. LITERATURE REVIEW

Globally, over 380 million tonnes of plastic are produced annually, yet less than 10% is successfully recycled (Yeo et al., 2022). In Southeast Asia alone, food packaging waste exceeds 1.5 million tonnes each year, with instant noodle products contributing significantly due to their plastic-based, non-recyclable seasoning packets (Zhao et al., 2023). For example, in Vietnam, approximately 85% of noodle products still utilize non-biodegradable sachets (Zhao et al., 2023). Despite their small size, the frequency and volume of use make these sachets a persistent environmental burden.

From an environmental perspective, the use of plastic sachets in ready-to-eat meals contributes significantly to global plastic waste. These sachets are composed of multi-material laminates that are extremely difficult to separate and recycle, leading to their accumulation in landfills and aquatic environments. As these plastics degrade, they release microplastics and leach harmful chemicals into ecosystems, threatening biodiversity and food security (Yeo et al., 2022; Zhao et al., 2023). The environmental urgency is further underscored by global estimates indicating that a significant proportion of ocean-bound plastics originates from poorly managed food packaging. This not only undermines the achievement of SDG 14 (Life Below Water) but also exacerbates carbon emissions associated with waste disposal, contradicting the goals of SDG 13 (Climate Action).

In addition to environmental concerns, traditional sachets present practical usability issues. These packets are often difficult to open, especially for children, the elderly, or individuals with disabilities. They can be messy and inconvenient, with users frequently experiencing spillage, oily fingers, or contamination of cooking surfaces. Dissolvable films offer a clear improvement in this regard by enabling consumers to simply drop the seasoning directly into hot water without handling or tearing, thereby improving ease of use and accessibility (Haq et al., 2023).

Another pressing issue lies in food safety and hygiene. Manual handling of sachets during preparation increases the risk of microbial contamination, especially in public or foodservice settings. Furthermore, heating plastic sachets in hot liquids or oils can lead to the migration of hazardous substances such as phthalates, bisphenol A (BPA), and styrene into food. These substances are known to be endocrine disruptors and are associated with various chronic health conditions (Chen et al., 2021). The use of food-grade, edible materials in dissolvable packaging can significantly reduce such risks, offering a safer alternative for consumers and improving compliance with food safety regulations. Recent studies have confirmed that starch-based edible films possess the necessary mechanical

strength, water solubility, and grease resistance to function as viable packaging materials (Haq et al., 2023; Khwaldia et al., 2023).

Given these multidimensional challenges, the development and adoption of dissolvable seasoning sachets represent a crucial innovation. This approach not only addresses waste reduction and hygiene but also meets growing consumer demand for sustainable and user-friendly food packaging. By exploring materials that are safe, functional, and environmentally friendly, this study aims to bridge the gap between technological innovation and real-world application in the instant food industry.

Furthermore, the global water-soluble packaging market is projected to reach USD 3.78 billion by 2024, reflecting rising demand for sustainable alternatives in the packaging industry (Fortune Business Insights, 2024). Despite such promising developments, the integration of water-soluble films in the instant food industry, particularly for seasoning applications, remains minimal, indicating a clear gap between technological potential and commercial implementation.

3. METHODOLOGY

This innovation introduces a dissolvable seasoning sachet developed to enhance the preparation of instant meals while addressing sustainability and convenience. The sachet is made from edible, food-grade water-soluble film, using biodegradable materials such as starch-based polymers or seaweed-derived compounds. Inside, it contains a pre-measured amount of powdered seasoning, specifically portioned to suit standard servings of instant noodles, soups, or ready-to-eat meals.

The consumer simply drops the entire sachet into boiling water. The film dissolves completely within seconds, releasing the seasoning evenly into the meal. This eliminates the need to tear or squeeze open traditional plastic or foil packets, reducing mess and improving hygiene. The film is tasteless, transparent or semi-transparent, and leaves no residue behind after dissolving.

The sachet is designed to remain stable under dry storage conditions, with a moisture-proof outer layer protecting it until use. It fits seamlessly into existing packaging formats, requiring no significant changes to current production or distribution systems, making it commercially feasible for food manufacturers.

This innovation is particularly beneficial for on-the-go users, such as students, travellers, or outdoor enthusiasts. It also improves ease of use for children, the elderly, or individuals with limited hand strength. Additionally, future variations may include dual-compartment sachets for combining seasoning powder with oil or sauces in one dissolvable unit.

By integrating sustainable packaging with user-friendly functionality, this product offers a modern solution that aligns with both consumer needs and environmental responsibility. It addresses growing consumer demand for eco-conscious alternatives while maintaining ease of use, cleanliness, and practicality in food preparation. This dual focus not only enhances the overall user experience but also supports broader goals of reducing plastic waste and promoting circular packaging systems in the food industry.

4. FINDINGS

4.1. Functional Specifications of Product Innovation

This product innovation introduces a dissolvable seasoning sachet designed to enhance the user experience in preparing instant meals while significantly reducing the environmental footprint of food packaging. It integrates principles of edible material science, sustainable design, and user-centred functionality, offering a practical and superior alternative to conventional single-use plastic or foil seasoning sachets commonly used in the food industry.

The sachet is made from food-grade, water-soluble film derived from natural starches like potato, tapioca, corn, or seaweed-derived polymers like sodium alginate or carrageenan. These materials are recognised as safe for consumption and commonly used in the food and pharmaceutical industries (Han, 2013). They are selected for their fast solubility in hot water, non-toxic profile, and minimal impact on food taste or texture. The film is transparent or semi-transparent, non-toxic, and completely tasteless, ensuring it does not interfere with the appearance, aroma, or flavour of the meal.

Each sachet contains a pre-measured amount of powdered seasoning, carefully formulated to match standard serving sizes for instant noodle or cup meals. The design of the sachet ensures accurate portion control and reduces the risk of over-seasoning or waste. Future development may include more complex versions that combine multiple flavour components such as powder and oil in a multi-layer dissolvable format.

Unlike conventional seasoning packets made of foil or plastic, which require tearing, squeezing, and can lead to spills or greasy hands, this dissolvable sachet offers maximum user convenience without any need to tear open the seasoning package. The user simply drops the sealed sachet directly into boiling water; within seconds, the film dissolves completely, releasing the seasoning without any need to tear open the seasoning package. This eliminates common frustrations associated with traditional sachets especially for children, the elderly, or people with limited hand strength and also reduces contact between hands and food, improving hygiene.

The film dissolves rapidly in hot water at temperatures above 80°C, with an average dissolution time between 3 to 10 seconds, depending on the film thickness and temperature. It leaves no residue, taste, or visual trace once dissolved. The sachet remains stable under normal storage conditions and is packaged inside a moisture-proof outer layer to preserve its integrity during transportation and shelf life ensuring product stability and safety until use.

In terms of design, the sachet is flat, compact, and heat-sealed to prevent leakage and contamination. Its flexible dimensions are optimized to fit inside existing food packaging formats, such as noodle cups or pouches, without requiring changes to the packaging and existing manufacturing processes. The material is about 30–50 microns which is thin enough to dissolve quickly and thick enough to protect contents from tearing. The overall design ensures portability, hygiene, and easy integration into current production systems while enhancing the consumer's cooking experience.

This innovation supports a zero-waste model, as there is no leftover packaging to discard after use. Traditional seasoning sachets, which are often made of mixed materials are rarely recyclable and frequently end up in landfills (Carrington, 2024). The dissolvable sachet, by contrast, is fully consumed during preparation, contributing to efforts toward sustainable consumption and circular packaging systems.

Functionally, this product addresses all four essential goals of effective packaging: protection, preservation, portability, and preparation efficiency. It protects the seasoning from moisture and contamination, preserves its flavour and quality, is easy to store and transport, and makes the preparation process simpler, cleaner, and more user-friendly (Flanagan, 2025).

In summary, the dissolvable seasoning sachet is not just a sustainable alternative, but also a convenient upgrade to the traditional way of handling food seasoning. By eliminating the need to tear, squeeze, or dispose of a separate packet, this innovation enhances daily routines while aligning with global efforts to minimise plastic waste and improve the everyday cooking experience.

4.2. Details of the Product Innovation

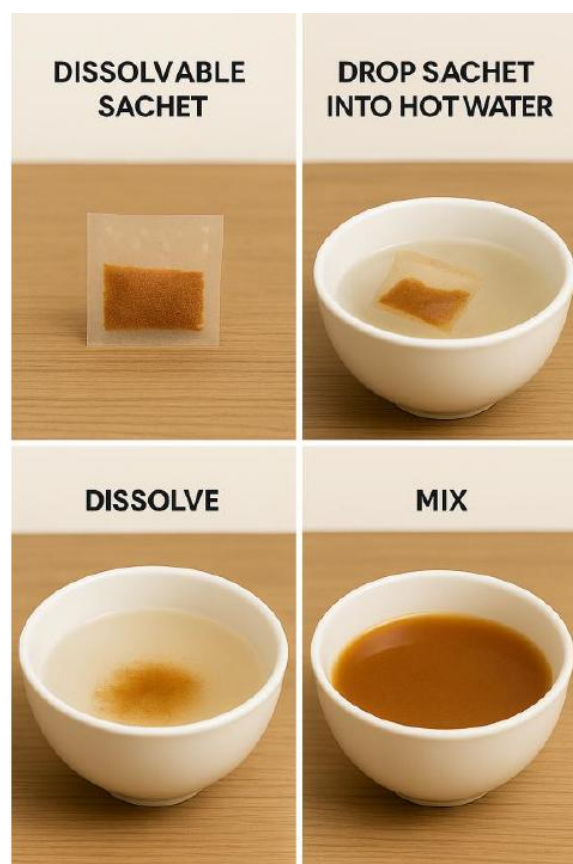


Figure 1. Step-by-Step Process for Dissolvable Seasoning Sachet.



Figure 2. Comparison of Dissolvable Sachet vs. Traditional Sachet.

5. DISCUSSION

5.1. Novelty and Uniqueness of Product Innovation

This product innovation stands out as a first-of-its-kind solution in the field of instant meal packaging. Unlike typical plastic or foil seasoning packets, this sachet dissolves completely in hot water, leaving no waste and making cooking cleaner and easier. It combines sustainability and user convenience, two features that are rarely achieved together in affordable food packaging. It introduces a dissolvable seasoning sachet made from natural, food-safe materials such as starch or seaweed-derived polymers, which fully dissolve in hot water. This eliminates both physical waste and common user frustrations associated with traditional seasoning packets. Seaweed-based packaging has gained attention for its potential to replace single-use plastic in various applications, including food packaging, due to its composability and zero-waste impact. Companies like Notpla have successfully commercialized edible seaweed films, proving both scalability and consumer acceptance (Paslier, 2024).

One of the most novel aspects of this product is its ability to solve two major consumer pain points simultaneously: environmental impact and usability. In most budget-friendly food packaging, products tend to favour either sustainability (such as compostable paper) or convenience (such as easy-tear sachets), but not both. However, this innovation achieves zero-waste delivery while remaining mess-free, hygienic, and incredibly easy to use. The user simply drops the sachet into boiling water without needing to tear, no spilling, no clean-up required.

Water-soluble films are not new. They are already used in pharmaceuticals (oral dissolving strips), detergents (laundry pods), and some novelty drinks (like broth pearls or cocktail drops). Their application in seasoning for mainstream instant foods remains largely unexplored. This innovation introduces that concept into the everyday food preparation space, where it can have immediate,

practical, and scalable impact. As such, it offers a first-mover advantage in a sector that has seen little disruptive packaging innovation.

Next, traditional seasoning sachets often lead to messy, frustrating user experiences such as spills, greasy hands, difficulty tearing, and end up in a mess. This product eliminates all of that in one step. The dissolvable sachet allows users to handle food with zero direct contact, maintaining hygiene and ease, especially in scenarios such as outdoor camping, schools, military field kitchens, or fast-paced home cooking.

Another strength of the product lies in its universal design. It is especially accessible for children, the elderly, and people with reduced hand strength or disabilities, who often struggle with traditional plastic or foil sachets. The product simplifies meal preparation without compromising safety or usability.

In addition, while many eco-friendly alternatives struggle with cost-efficiency, shelf life, or manufacturing complexity, this sachet is practical, scalable, and compatible with existing food production lines. It can be inserted directly into current packaging formats such as instant noodle cups or soup packs, without requiring significant changes to the outer packaging or production flow.

Importantly, the innovation also addresses the environmental issue of sachet waste, which has become a global concern. It is estimated that over 855 billion single-use sachets are sold globally each year, most of which are made from multi-layered plastics that are non-recyclable and contribute significantly to landfills (Break Free from Plastic, 2024). By being fully consumable, this product eliminates post-use waste entirely and supports zero-waste goals and circular packaging systems.

In summary, this dissolvable sachet introduces a new packaging category in the food industry. It is a solution that is edible, functional, mess-free, and entirely waste-free. It represents a rare combination of user-centred design, material innovation, and sustainability which make the product a truly novel and impactful advancement in the field of instant meal preparation as well as the food industry.

5.2. Benefits to Mankind

In terms of environmental benefit, this innovation greatly helps the environment by cutting down the use of plastic waste that is dumped in landfills and the ocean. We can avoid the long-term pollution from non-biodegradable plastics which can remain in nature for years. It can be avoided by relying less on single-use plastic packaging and utensils. Actually, this type of waste poses a threat to wildlife which can lead to ingestion, entanglement, and disruption of habitats. Besides, it also can pollute soil and water resources. So, this innovation encourages more responsible consumer behaviour and supports a circular economy by promoting the use of recyclable, compostable or biodegradable alternatives while aiding in reducing the carbon emissions that are linked to the extraction, production and burning of traditional plastics. Thus, adopting this innovation will pave the way to more sustainable and environmentally friendly alternatives.

This innovation is designed in order to help reduce the direct hand contact with food and surfaces in the kitchen. This will help lower the risk of cross-contamination during food preparation. While handling the raw ingredients especially meat, poultry, or seafood, it can easily spread harmful bacteria such as *E. coli*, *Salmonella* and *Listeria*. These can lead to serious foodborne health issues. So, this innovation will help in creating a safer and cleaner cooking environment by ensuring indirect hand contacts with surfaces that are likely to be contaminated. It is not just about cleanliness but it also protects people's health. This innovation helps in promoting better sanitary practices while cooking.

Real people were carefully considered when creating this innovation especially for those who experience physical difficulties in the kitchen. Whether someone with arthritis, an older person with chronic weakening fingers or someone recovering from a surgical procedure, their day-to-day cooking can now be an activity that is pleasant rather than a tiring chore. This innovation makes every day cooking not just possible but enjoyable again. It is intended to ease the burden of routine kitchen tasks that can become challenging with age or physical limitations such as handling heavier appliances, chopping materials or opening jars. In doing so, it allows this type of individual to perform simple tasks without requiring extra assistance. Most significantly, it enables an individual to fully take part actively in as meaningful an activity as preparing one's own meal. No matter what physical obstacles one may encounter, cooking becomes more than simply a chore.

This invention is meant to make every day cooking easier and more effective. It merges multiple kitchen tasks into a single user-friendly tool, reducing both time and effort while cooking. For busy people and family, this translates to more time to relax and enjoy the company of friends and family. By reducing the number of utensils needed, it also makes cleanup quicker and easier as no more sinks fill off dirty dishes. Its ease of use and practical design make cooking seem less like a task, motivating individuals to prepare meals at home more frequently.

5.3. Potential of Commercialization

This innovation has potential to be marketed by instant noodles and soup manufacturers. As we know, instant noodles and pre-packaged soups have become popular choices for individuals globally seeking fast and easy meals. Nonetheless, they are frequently contained in disposable plastic cups, bowls or pouches which are not beneficial for the environment. That is where the idea for this innovation comes in. It offers a smarter and more sustainable packaging solution that is not only easier to use but also better for the planet. As global consumers continue to actively seek sustainable practices when buying groceries, we can tell that this packaging concept is what the manufactures want to preserve their edge.

In addition to sustainability, food companies are facing increasing demand to enhance safety and user experience. Typical packaging options for wet or hot foods can be dangerous, messy, not manageable, and more difficult to prepare. This innovation helps solve those issues by being safer, cleaner, and more comfortable to use. Plus, it may assist brands in differentiating themselves in a competitive market where they not only attract eco-aware consumers but also by possibly lowering material expenses and waste. Overall, it will be a win-win for both brands and consumers.

Moreover, meal kits and frozen food brands and businesses also have potential to use this innovation. These companies are rapidly expanding as consumers seek convenience. This has led to the growth of meal kit delivery services and frozen food companies that offer convenience with no preparation. This is a positive development in this sector as it offers the potential for more efficient and sustainable packaging options for items that need to be refrigerated or frozen. For example, meal kits often come with a lot of components which can result in a lot of waste including single-use plastics and non-recyclable materials. These advancements may assist the industry in addressing its sustainability issues by providing packaging options that are environmentally friendly and functional. Besides, as the clean-label products grow with consumers demanding transparency and the absence of artificial additives or preservatives, this innovation may assist these brands in fulfilling the rising needs of consumers for more natural, non-toxic and environmentally friendly products.

Next, we can target the camping and outdoors suppliers. These are the strong candidates for this innovation because of the unique packaging needs of outdoor and camping users. When individuals go camping or hiking, they often seek convenient, portable and tidy food choices that are simple to prepare, eat and clean up. The usual packaging of food meals for outdoor use frequently relies

on single-use plastics or cumbersome materials which are both wasteful and impractical. So, this innovation could offer a solution that meets these criteria by providing lightweight and biodegradable packaging that is suitable for outdoor use. With the rising consciousness of the environmental effects of outdoor tourism and the surging demand for sustainable products, this innovation could attract individuals who value sustainability.

Lastly, the hospital and institutional catering. These sectors demand specialised packaging that adheres to high hygiene standards, preserves food quality and is easy to dispose of or recycle. Hospitals, nursing homes and large-scale institutions such as schools and prisons are meal services at scale and deal with risk issues of food safety, contamination, and waste. This innovation may benefit various industries by providing packaging that decreases contamination concerns, facilitates meal delivery and is easy to reuse. As the focus becomes more on ensuring health or safety for institutional food services, there will certainly be demand for innovations that reduce contamination risk and hygiene assurance.

6. CONCLUSION

The dissolvable seasoning sachet represents an innovation that addresses both environmental concerns and user convenience in food packaging. By replacing the traditional plastic or foil sachets with edible, water-soluble materials, this product introduces a sustainable, zero-waste alternative that simplifies the meal preparation process. It not only reduces plastic waste but also improves hygiene, accessibility, and overall user experience specifically for individuals with limited ability or those cooking in time-sensitive environments.

This product innovation demonstrates how material science and user-centred design can be combined to create practical and scalable solutions for everyday problems. While dissolvable films have seen limited use in pharmaceuticals and specialty products, their application in instant food packaging is still unexplored. This sachet pushes the boundary of that potential, offering first-mover advantages and high relevance to current global goals in sustainability.

Overall, the product demonstrates how small packaging innovations can have a significant impact not only by enhancing user convenience but also by contributing to broader efforts to reduce single-use plastic in the food industry.

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