

INSTANT FRUIT DRINK POWDER UNDERUTILIZATION OF FRUIT PEEL: A REVIEW

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ABSTRACT

Fruit peel waste is created as a by product in home kitchens and by the food industry. Despite being rich in nutrients and bioactive chemicals, fruit peel debris generated at the food industry level is increasing daily. Peel waste poses a significant problem that needs to be addressed. Peels are safe to eat but are frequently thrown out, even though they are full of essential nutrients that support human health and well-being by preventing diabetes, heart disease, and cancer. Utilizing fruit peels to develop value-added products for food and industrial applications is a sustainable way to reduce peel

waste. The approach improves the product's nutritional value and provides additional income for the industrial sector. Modern people prefer to consume feasible, efficiently served products like powdered drinks. Powdered drinks are dried versions of commercial beverages, categorized as instant food since they require minimal rehydration work before usage. This paper will overview the different types of instant fruit drinks made from fruit peels and their constituent components.

Keywords: *fruit peel, instant drink, waste utilization, value-added product, powdered drink*

INTRODUCTION

The concept of "waste-to-wealth" signifies turning waste into a production that has to be discarded into possible goods with additional value. Approximately one-third of the edible portions of food produced for human consumption, or anywhere from one to three billion pieces, are predicted to be wasted globally. Tons annually, or 842 million servings produced, is the quantity of food made in Africa's sub-Saharan region. There needs to be more food for everyone. Food waste complicates environmental issues. It has implications for public health that negatively impact people's quality of life and their environment's joy. *et al.* (2022). On an annual basis, consumers waste 68 kg of food, 49 per cent of which might have been avoided. (FAO, 2018) Huho *et al.* (2020)

Fruits are a fundamental component of a healthy diet and are essential for overall well-being. Frequently cooked in several ways, such as fully, partially, or eating raw, fruit and vegetable-based companies and home kitchens produce a significant quantity of peel waste. Fruit peel has been exposed to

a sizable amount of waste; roughly 25–30% of the entire yield is produced during the preparation of fruits. Remarkably, rinds, seeds, pomace, and peels are the most common garbage in this situation. When utilized properly, they may help solve environmental issues and provide a sustainable way to improve health by generating food high in nutrients and containing substances that promote health. Kumar *et al.* (2020)

The fruit industry faces significant losses due to inadequate handling techniques and infrastructure, with a surge in production and expansion aggravated by a lack of management techniques, particularly in developing countries. These losses affect the entire processing supply chain, highlighting unintended consequences within the food production and processing system. Parfitt *et al.* (2010) Fruit waste, including rind, seeds, pomace, and skin, offers beneficial bioactive compounds such as vitamins, enzymes, carotenoids, dietary fibers, and polyphenols. Fruit peel, or the outer layer that protects the fruit within, is rich in dietary fiber, carbs, and antioxidants, particularly pectin. Peels are safe to

eat but are frequently thrown out, even though they are full of essential nutrients that support human health and well-being by preventing diabetes, heart disease, and cancer. Jung *et al.* (2006). Fruit peel is a byproduct that makes up about 50 to 65 percent of the total weight of the fruit Gunwantrao *et al.* (2016)

Despite being rich in a diverse range of nutrients and bioactive compounds, the increasing accumulation of fruit peels at the industrial level has become a significant cause for concern. The rising volume of fruit peel waste presents a critical problem that demands immediate attention. Considering the health-enhancing attributes of fruit peels, there is an increasing need for creative solutions to integrate them into various products. Wadhwa *et al.*'s (2015) research indicates that fruit peels have superior biological activities compared to other fruit parts, increasing their application's popularity. Moon *et al.* (2009)

LITERATURE REVIEW

Modern people prefer to consume feasible, easily served-up products like powdered beverages. Powdered drinks are dried versions of commercial drinks, categorized as instant food since they require minimal rehydration work before usage. T. A. Shittu *et al.* (2007)

FRUIT PEEL WASTE UTILIZATION

Due to the growing production and processing of fruit, one of the most challenging issues worldwide today is the waste utilization of fruit processing businesses. The availability of fruits and vegetables is increasing due to the plant material's susceptibility to microbiological deterioration, thereby preventing additional use. However, the expense of storing, shipping, and drying byproducts limits the economy. Kodagoda *et al.* (2017). Fruit peel is one of the most significant byproducts from which a wide range of active substances have been extracted; it has a high value and is used to increase the rate at which raw materials are utilized and turn trash into treasure. Chaojin Wang *et al.* (2016).

After processing, the peel makes approximately 50 to 60 percent of the total citrus fruit mass discarded as trash. This peel can create value-added goods or fortify food items to improve their nutritional profile. Young L. (2006). Food scraps are resources meant for human

consumption but are often removed, misplaced, degraded, or contaminated. Food waste is an issue that continues to grow. It is severe and affects every aspect of waste management, from collection to disposal. Everyone involved in the food supply chain, especially agribusinesses, industries, retailers, and end-users, actively seeks practical solutions to address this problem. Giroto *et al.* (2015)

Vegetables and fruits are the most frequently consumed foods as horticultural products. However, they also generate waste items, such as peels and seeds. In the juice extraction business, pomegranate peels and seeds are left as waste, which can contribute to environmental pollution. Lucarini *et al.* (2021)

POMEGRANATE PEEL

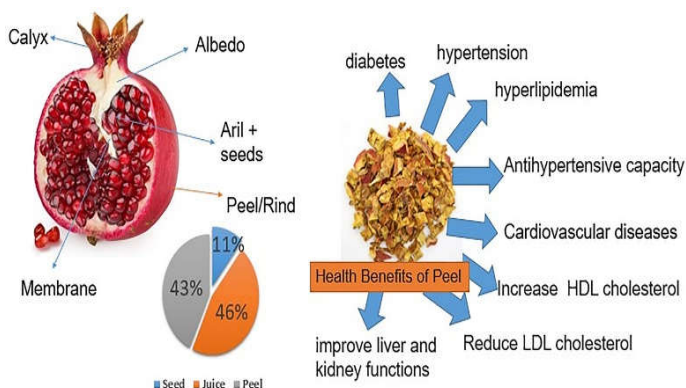
The most popular horticultural products to eat are fruits and vegetables. However, they also generate waste items, such as peels and seeds. In the juice extraction business, pomegranate peels and seeds are left as waste, which can contribute to environmental pollution. Lucarini *et al.* (2021)

Pomegranate (*Punica granatum L.*) holds significant economic value as a fruit crop and is widely grown in various regions of Asia, North Africa, and the Middle East. Tehranifa *et al.* (2010). The pomegranate fruit is characterized by its berry-like structure, featuring a leathery rind (husk or peel) that encases numerous seeds enveloped by juicy arils. The husk comprises the pericarp and the mesocarp (albedo). (Rafraf *et al.*, 2017).

A pomegranate shall consist of three distinct parts: the peels, juice, and seeds. The pomegranate peel is considered a byproduct or inedible portion obtained during the extraction of pomegranate juice. It is characterized by tannins and flavonoids associated with the peel's biological properties. Faria *et al.* (2010)

The pomegranate peel (*Punica granatum*) is rich in phytochemicals. About half of the weight of a pomegranate is made up of its peel, which is also rich in minerals, particularly potassium, calcium, phosphorus, magnesium, and sodium. Discovering creative uses for leftover pomegranate peels may be more viable, environmentally responsible, and economically advantageous. Magangana *et al.* (2021) Biologically active compounds found in pomegranate peel include anthocyanins, phytochemicals, organic acids, quercetin, and catechin, along with gallic acid,

minerals, vitamins, antioxidants, and caffeine, and there are numerous potential advantages. (Li *et al.*,2014)



BENEFITS OF POMEGRANATE PEEL

Source: Ain *et al.* (2023)

CITRUS PEEL

Numerous health benefits can be obtained from the citrus fruit (*Citrus sinensis*), which is rich in antioxidants and phytochemical nutrients. A single orange contains 170 phytonutrients and more than 60 with anti-tumor, anti-inflammatory, blood clot-inhibiting, and antioxidant properties. However, orange peels are often wasted, and suitable methods must be adopted to convert them into value-added products. India produces 25 lakhs of oranges annually, and the peels are nutrient-rich. Ravali *et al.* (2021)

Orange peels, a significant byproduct of the citrus industry, are filled with pectin, cellulose, pigment, hemicellulose food fibers, and oil, and they have several bioactive substances like polyethoxylated flavanones, phenolic acids, flavones, and flavonols; these substances are likewise used as organic antioxidants for the food, pharmaceutical, and biotechnology sectors. Ahmudi F *et al.* (2014)

Byproducts such as peel and pomace are produced after sweet limes (*Citrus limetta*) are processed for juice extraction. After extracting the juice, they are made up of residue and the fruit's outer peel. These frequently consist of vitamin C, essential oils, flavonoids, pectin, and dietary fiber—both soluble and insoluble. D-limonene, naringin, and hesperidin are significant substances in the peel and pomace of flavorful limes. Chavan *et al.* (2018)

Novel techniques such as microwave steam distillation have been developed to extract essential

oils from citrus peel, resulting in significant time and energy savings. Sweet lime peel has been used to enhance the functional properties of items like cookies and jam. Economic and environmental benefits may be gained by utilizing the potential of byproducts from sweet lime juice production, such as peel and pomace. Younis *et al.* (2016)

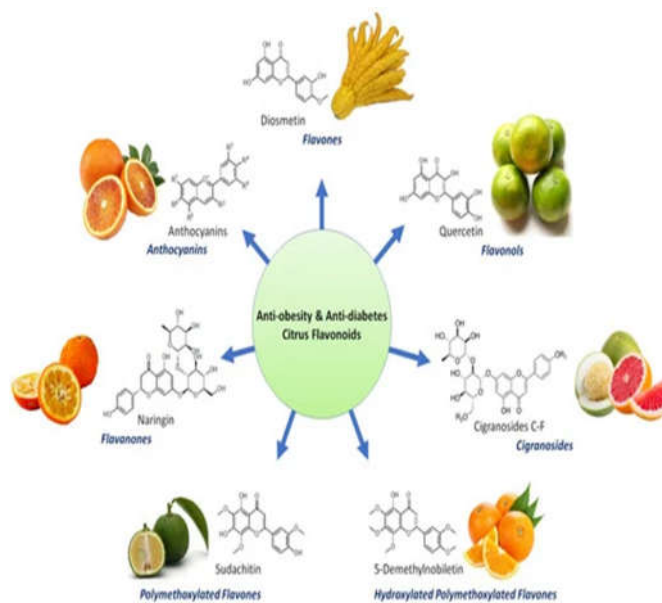


FIGURE 2.2.2: REPRESENTING FLAVONOIDS WITH ANTI-OBESITY AND ANTIDIABETIC PROPERTIES

Source: Lu *et al.* (2023)

| Fruit waste | Phenolic compounds | References |
|------------------|--|-----------------------------|
| Pomegranate peel | anthocyanins, phytochemicals, organic acids, quercetin, and catechin, along with gallic acid, minerals, vitamins, antioxidants, and caffeine | Li <i>et al.</i> (2014) |
| Orange peel | polyethoxylated flavanones, phenolic acids, flavones, and flavonols | Ahmadi <i>et al.</i> (2014) |
| Mango peel | antioxidants, polyphenols, flavonoids, anthocyanins, and vitamin C | Ahmed <i>et al.</i> (2020) |

TABLE: PHENOLIC COMPOUNDS OF FRUIT WASTE

MANGO PEEL

The mango, a fruit with a pulp content of 33–70%, seeds of 7–24%, and peels of 15–20%, is processed into peels and kernels, which are often discarded as waste due to their high nitrogen, phosphorus, sugar, and water activity content. Sogi *et al.* (2013).

The nutritional qualities of the instant drink and the powdered mango peel were studied using proximate and physiochemical analysis. The most affordable source of valuable components and bioactive compounds, including antioxidants, polyphenols, flavonoids, anthocyanin, and vitamin C, may be an instant drink made with powdered mango peel. Ahmed *et al.* (2020)

PINEAPPLE PEEL

Pineapple is a tropical fruit consumed worldwide for its pleasant aroma and flavour, and it can be consumed fresh, in juice, jams, canned, and dehydrated, among other presentations. (Polanía *et al.*, 2023) (Hikal *et al.*, 2021)

The global harvest of pineapple (*Ananas comosus*) has expanded globally over the past ten years, reaching 25.4 million tons in 2019. The top three producers, in a million metric tons, are Brazil (2426), the Philippines (2747.86), and Costa Rica (3328.1). (FAO) This fruit contains vitamins, minerals, other nutrients, and antioxidants. Freitas, (2015) and D.R. Morai (2017)

The most significant number of pineapples cultivated for human consumption are utilised in fresh preparations at the agro-industrial level. Large volumes of trash are produced during processing, mainly from the peel, centre (core), and crown, constituting around 25–35% of the fruit's weight. (M. Selani, 2014). During processing, 45–65% of the product is wasted, with the peel making up most of this loss. (Difonzo *et al.*, 2019)

WATERMELON RIND

Despite the edible rinds of watermelon and containing many undiscovered minerals, their flavour turns off most people. They are commonly eaten like vegetables. They are stewed, stir-fried, or, more frequently, pickled in China. In the Southern US, pickled watermelon rind is a popular food. Rattray and Diana, 2012)

INSTANT DRINK POWDER

Health benefits can also known from instant beverages that have high bioactive components and natural ingredients. Nowadays, people consume useful and simple-to-serve products like powdered instant coffee. Powdered drinks are dry versions that are made and classified as quick food. It takes very little work to reconstitute the supper before eating it. (Shittu *et al.*, 2007)

Many now opt for non-dairy, probiotic-based meals and beverages over dairy products. The main reason for this shift is related to dairy products, such as lactose

intolerance, dairy sensitivities, a vegan diet, and the limited shelf-life of probiotics in dairy products. Customers who face these issues choose non-dairy alternatives. Ranadheera *et al.* (2017)

The growing recognition among customers of the significance of leading healthier lifestyles has rapidly expanded the market for functional foods in recent years. Utilizing non-dairy foods such as fruits, vegetables, grains, legumes, and agricultural waste combined with probiotics and prebiotics to generate probiotic and symbiotic powders and drinks has drawn much attention. Chaturvedi *et al.* (2021)

SNAKE-FRUIT PEEL DRINK

The tropical fruit plant known as the snake fruit (*Salacca zalacca*) grows in Indonesia. It has an oval form with up to 10–14% brownish, scaly skin. The phytochemicals in salak bark, such as flavonoids, phenols, alkaloids, and tannins, are helpful or healthful for tea beverages and anti-aging products. Furthermore, salak-peel antioxidant activity observations were 229.27 ± 6.35 ($\mu\text{g}/\text{MI}$). In addition to adding salak bark and completing the fermenting process, butterfly pea flower essence is added to prepare the kombucha tea for consumption. Damayanti *et al.* (2022)



KOMBUCHA TEA PRODUCTS FROM SNAKE FRUIT PEEL AND BUTTERFLY PEA FLOWER

Source: Damayanti *et al.* (2022)

POMACE DRINK

Peels after pre-treatment or the leftover pomace after juice production can frequently be sources of bioactive chemicals that are more concentrated than in the finished goods. Surek *et al.* (2016). Bober and Oszmianski discovered that the pomace infusion had a superior taste and more polyphenols than the entire fruit infusion. Anthocyanins and procyanidins, in

particular, are abundant in phenolic compounds found in chokeberries as a raw material. Grunovaitè *et al.* (2016). Chokeberry pomace added to an infusion can help increase the quality of health-promoting components while delivering the ideal hue from the consumer's perspective. Kidon *et al.* (2023).

MANGO PEEL DRINK

Because of the fruit's high nutritional fiber content, instant powdered drinks derived from fruit-based products like mango peel powder are healthy and a great option for instant drink formulation. Ajila *et al.* (2013)

Additionally, companies that process mangoes typically suffer high transportation expenses to remove these byproducts. From production processes to preventing waste's harmful effects and cross-contamination of the area, it has the mango processing sector's future market prospects. According to recent studies, mango peel is a high source of many vitamins and other phytochemicals. Additionally, there are more antioxidants in the mango peel than in the pulp. Ajila (2007)

ORANGE PEEL DRINK

Peels are the main byproduct of preparing citrus fruit for juice. Peels that have yet to be appropriately treated end up as waste and can harm the environment. Citrus peels are a great source of health-promoting phytochemicals such as flavonoids, carotenoids, and pectin. The drink used sour orange peels to produce nutritional powder drinks, considering the medicinal properties of acidic orange peels and the importance of the problems associated with waste disposal in the food processing industry. Hussain *et al.* (2010)

MANGOSTEEN PEEL DRINK

Natural or functional foods and beverages typically have an odd flavor. Similar to the sour taste of rose petals or the bitter flavor of mangosteen peel. It is anticipated that the bitter and sour taste combinations will work in concert to improve the product's functionality and mask its peculiar flavor. Due to the presence of chemicals with pharmacological action, such as antioxidants, anti-inflammatories, heart disease treatment, antibacterial, antifungal, and HIV medication therapy, mangosteen peels are presently being developed as medical treatments. The enhanced antioxidant capacity of functional instant drinks

results from their higher phenol and tannin content. Mangosteen peels and Rosalind flowers were combined to create an instant drink with the highest antioxidant content. Dan Lu *et al.* (2015)

JOMBALON PEEL DRINK

The tropical edible fruit Jambolan (*Syzygium cumini*), often referred to as Jambolo, Jambul, Jamun, or java plum, can be found in Indonesia. Jambolan fruits have purple-dark skin. High concentrations of many phenolic groups, including flavonols, flavanonols, and anthocyanins, have been found in jambolan fruit. Tavares *et al.* (2016)

Jambolan fruits are often eaten raw or processed into wine, juice, and yogurt with freeze-dried fruit, spray-dried fruit juice powder, and powdered fruit used as a natural coloring substance. Santhalakshmy *et al.* (2015). Bezerra *et al.* (2015), Santiago *et al.* (2016). The fruit peel of jambolan, which has a high anthocyanin content, can continue to be utilized to produce tea and other culinary products through a straightforward drying procedure. Sari *et al.* (2012). The drying process can be experimented with using a dryer, such as an oven or the sun. Sari *et al.* (2019).



Sun drying Oven drying (50°C) Oven drying(60°C)

JAMBOLAN TEA INFUSIONS BY BREWING

Source: Sari *et al.*, (2019)

2.3.7 SWEET LIME DRINK

Most tea consumed in recent years has been instant tea blends, such as tea bags. Tea bags are becoming increasingly popular since they are easy to use, readily available, and can incorporate various components in the desired amounts. The infusion conditions regulate the bioactive ingredient that is extracted from tea bags. Bassi *et al.* (2023)

The byproducts of extracting juice from sweet lime fruit pulp include sweet lime peel and pomace. Sweet lime peel and pomace byproducts can be valuable

materials for making herbal tea by utilizing their advantages in the economy and the environment.

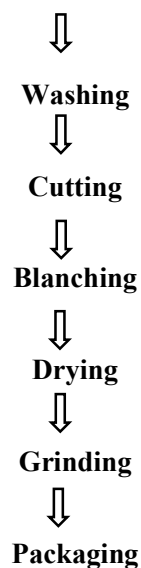


CITRUS TEA PREPARED WITH SWEET LIME PEEL-POMACE POWDER DIPPED IN HOT WATER

Source: Shaik *et al.* (2023)

METHODOLOGY

Collecting raw material
(Different fruit peels)



Before processing, the ripe and fresh fruit peels are collected . The peels undergo thorough washing to remove dirt, dust, pesticide residues, and any contaminants. This step is vital in ensuring that the final product is free from harmful substances. Washing can be done using clean water or by soaking the peels in a solution of water and mild food-grade disinfectants such as vinegar or baking soda. Proper washing preserves the

natural flavors and bioactive compounds present in the fruit peels.

Once cleaned, the peels are sliced into smaller, uniform pieces. This step allows for even drying and efficient grinding later in the process. The slicing can be done manually using a sharp knife or with specialized cutting equipment for large-scale production. The size of the slices plays a role in determining the drying time and the efficiency of the grinding process. The slicing can be done manually using a sharp knife or with specialized cutting equipment for larger-scale production. The size of the slices plays a role in determining the drying time and the efficiency of the grinding process. Once dried, the peels are ground into a coarse texture using a milling machine. Initially, a coarse grind may be achieved and further processing ensures a finer uniform consistency. During incorporating fruit peel powder into drinks, experimenting with different ratios is essential to achieve the perfect taste and balance. Some fruit peels have naturally strong flavors, so blending them in the right proportions ensures a pleasant taste. Additionally, combining different fruit peels enhances the nutritional value of the drink, as each type of peel contributes unique bioactive compounds, vitamins, and antioxidants.

CONCLUSION

The instant drink powder made from fruit peel is a sustainable solution for repurposing natural resources and addressing food waste. It offers a quick, easy beverage suitable for various occasions and contains vitamins, antioxidants, and fiber. The fruit peel-based drink powder appeals to consumers who prioritize wellness and dietary preferences. Including antioxidants in fruit peels supports the body's defense against oxidative stress, enhancing its nutritional value. The product's versatility makes it a convenient choice for consumers, while its dietary benefits contribute to its appeal as a health-conscious option.

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