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Value-added products from Litchi (*Litchi chinensis* Sonn.): A review

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Abstract
Litchi (*Litchi chinensis* Sonn.) is a highly valued tropical and subtropical fruit known for its distinctive flavor, pleasant aroma, and nutritional richness. Despite its popularity, litchi is extremely perishable and exhibits a short postharvest life, resulting in substantial postharvest losses during peak harvesting seasons. Value addition through processing offers an effective strategy to enhance shelf life, reduce wastage, improve farmer income, and diversify market opportunities. This review presents a comprehensive overview of value-added products derived from litchi, including beverages, preserved products, dried forms, fermented products, and functional foods. The utilization of litchi processing by-products such as peel and seed is also discussed in the context of sustainability and circular economy. Furthermore, the review highlights processing technologies, nutritional and functional properties, challenges in commercialization, and future prospects for litchi value addition.

Keywords: Litchi, value addition, processing, beverages, by-products, sustainability

Introduction

Litchi (*Litchi chinensis* Sonn.), belonging to the family Sapindaceae, is an important fruit crop cultivated extensively in countries such as China, India, Thailand, Vietnam, and South Africa. India is one of the largest producers of litchi, with major cultivation concentrated in Bihar, West Bengal, Uttar Pradesh, and Jharkhand (National Research Centre on Litchi [NRCL], 2023) [2]. Litchi is prized for its sweet, juicy aril and high content of vitamin C, polyphenols, and antioxidants.

However, the fruit is highly perishable due to its thin pericarp, high moisture content, and susceptibility to enzymatic browning and microbial spoilage. Under ambient conditions, litchi has a shelf life of only 2–3 days, leading to considerable postharvest losses estimated at 20–30% (Wu *et al*., 2014) [3]. Value addition through processing is therefore essential to extend shelf life, stabilize market supply, and enhance economic returns.

Need for Value Addition in Litchi

Value addition refers to the transformation of raw agricultural produce into processed products with enhanced shelf life, consumer appeal, and market value. In litchi, value addition is driven by several factors

- Short harvesting season and market glut
- Rapid postharvest deterioration
- Limited cold storage facilities in producing regions
- Growing demand for processed and functional fruit products

Processing litchi into diversified products such as juices, canned fruits, dried snacks, and nutraceutical ingredients helps reduce losses and promotes year-round availability (NRCL, 2023).

Beverage-Based Value-Added Products

1. Litchi Juice and Pulp

Litchi pulp is widely processed into juice and pulp, which serve as base materials for various beverages. The pulp is extracted by peeling and deseeding, followed by homogenization and pasteurization. Preserved pulp can be stored under refrigerated or frozen conditions for extended periods. Litchi juice retains much of the fruit's flavor and nutritional components and is used extensively in beverage industries (Zhao *et al*., 2020) [5].

2. Ready-to-Serve (RTS) Drinks and Squash

RTS beverages and squash are popular value-added litchi products. RTS drinks typically contain 10–12% fruit juice, while squash is a concentrated product requiring dilution before consumption. These products are sweetened, acidified, and preserved to ensure microbiological safety and sensory acceptability (NRCL, 2023).

3. Fermented Beverages

Litchi juice can be fermented to produce alcoholic beverages such as litchi wine. Controlled fermentation using *Saccharomyces cerevisiae* produces wine with a pleasant floral aroma and alcohol content ranging from 10–18%. Fermented litchi products have growing market potential due to consumer interest in novel fruit wines (Wu *et al*., 2014) [3].

Preserved and Canned Products

1. Canned Litchi

Canned litchi is one of the most commercially successful value-added products. Whole peeled and deseeded arils are packed in sugar syrup and subjected to heat sterilization. Canned litchi has a shelf life of up to one year and is widely exported, especially from China and India (Wu *et al*., 2014) [3].

2. Frozen Litchi

Freezing is an effective method to preserve fresh litchi flavor and texture. Frozen arils and pulp are used in desserts, beverages, and confectionery products. Freezing minimizes enzymatic and microbial spoilage while retaining nutritional quality (Zhao *et al*., 2020) [5].

Dried and Dehydrated Products

Drying and dehydration significantly extend the shelf life of litchi. Traditional sun drying and modern techniques such as hot air drying and osmotic dehydration are employed. Dried litchi, often referred to as "litchi nut," is consumed as a

snack or used as an ingredient in breakfast cereals and bakery products. Drying reduces moisture content, inhibiting microbial growth, but may lead to some loss of heat-sensitive nutrients (Wu *et al*., 2014) [3].

Confectionery and Sweet Products

Litchi pulp is used in the preparation of jams, jellies, syrups, candies, and desserts. Due to its delicate flavor, litchi is often blended with other fruits to improve gel formation and sensory balance. These products have good consumer acceptance and offer opportunities for small-scale processing units (NRCL, 2023).

Functional and Nutraceutical Products

Recent research highlights the potential of litchi as a source of functional ingredients. Litchi contains bioactive compounds such as flavonoids, anthocyanins, and phenolic acids, which exhibit antioxidant, anti-inflammatory, and anti-diabetic properties (Yao *et al*., 2021) [4].

Litchi pericarp extract, particularly oligonol (a low-molecular-weight polyphenol), has been commercialized as a nutraceutical ingredient. Functional beverages, fortified foods, and dietary supplements incorporating litchi extracts are emerging as high-value products.

Utilization of Processing By-Products

1. Litchi Peel

Litchi peel constitutes approximately 15–20% of the fruit weight and is rich in phenolic compounds with strong antioxidant activity. Peel extracts have potential applications as natural food preservatives, functional ingredients, and cosmetic additives (Jiang *et al*., 2013) [1].

2. Litchi Seed

Litchi seeds contain starch, proteins, and bioactive compounds. Seed starch can be utilized as a thickening agent or biodegradable material, while seed extracts show pharmacological potential. Effective utilization of peel and seed contributes to waste reduction and sustainability.

Processing Technologies and Quality Considerations

Key challenges during litchi processing include enzymatic browning, flavor loss, and microbial spoilage. Techniques such as blanching, sulphitation, controlled atmosphere storage, and non-thermal technologies are used to preserve quality. Adoption of good manufacturing practices (GMP) and hazard analysis critical control point (HACCP) systems ensures product safety and export compliance.

Challenges and Future Prospects

Despite significant potential, commercialization of litchi value-added products faces challenges such as inadequate processing infrastructure, high capital investment, and limited awareness among farmers. Future research should focus on clean-label processing, development of functional foods, and improved cold chain logistics. Promoting small-scale and women-led processing enterprises can enhance rural livelihoods.

Conclusion

Value addition plays a crucial role in enhancing the economic and nutritional value of litchi. A wide range of products including beverages, preserved fruits, dried snacks, fermented drinks, and functional ingredients can be developed from litchi and its by-products. Sustainable processing and waste valorization aligned with circular economy principles can significantly reduce postharvest losses and increase profitability. Continued technological innovation and market development are essential to fully exploit the potential of litchi value-added products.

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