

HARNESSING SEA BUCKTHORN IN FOOD PROCESSING: OPPORTUNITIES AND INNOVATIONS

Pathiam Srilatha and Vinay G M*

Professor Jayashankar Telangana Agricultural University, Rudrur, Telangana-503188, India

*Corresponding author: vinaygm26@gmail.com

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Introduction

In recent years, the demand for functional foods and natural health products has grown significantly, driven by increasing consumer awareness of nutrition and wellness. Among the emerging superfruits gaining global attention, sea buckthorn (*Hippophae rhamnoides*) stands out as a remarkable resource. Known for its vibrant orange berries (Fig. 1) and exceptional nutritional profile. Sea buckthorn is a thorny deciduous shrub native to cold-temperate regions of Europe and Asia, with a long history in Tibetan and Chinese traditional medicine. This has transitioned from a traditional remedy to a promising ingredient in modern food processing.



Fig.1: A picture of sea buckthorn berries

A Nutritional Powerhouse

Sea buckthorn berries are often referred to as a “nutrient treasure” due to their rich composition of bioactive compounds (Table 1). They are an excellent source of vitamins, particularly vitamin C, vitamin E, and provitamin A carotenoids. Carotenoids such as lutein, zeaxanthin, cryptoxanthin, lycopene and xanthophylls (Wang *et al.*, 2022a). Uniquely, sea buckthorn also contains omega fatty acids (omega-3, -6, -7, and -9), which are rarely found together in a single plant source (Wang *et al.*, 2022b).

In addition, the berries are packed with polyphenols, flavonoids, and antioxidants that contribute to various health benefits, including improved immunity, lower cholesterol & blood pressure, cardiovascular health, and skin nourishment (Zhou *et al.*, 2022). Sea buckthorn has been used for the prevention of liver fibrosis and its treatment (Sun *et al.*, 2003). Sea buckthorn oil contains omega-6 and omega-9 fatty acids, which support skin health and oxygenation, improve blood circulation, and aid blood removal (Zielińska and Nowak, 2017). This dense nutritional profile makes sea buckthorn an ideal candidate for incorporation into functional food products.

Table 1: Nutrition profile of sea buckthorn berry

Parameter	Values (%)
Moisture	81.90
Protein	3.12
Fat	2.50
Fiber	6.55
Total sugars	4.45
Total carbohydrates	11
Ash	1.47
Minerals (mg/100 g)	
Phosphorus	110.72
Sodium	155.31
Manganese	0.98
Potassium	793.43
Copper	0.43
Vitamins (mg/100 g)	
Vitamin C	275

Vitamin E	3.54
Niacin	68.4
Vitamin A	432.4
Pantothenic acid	0.85

Challenges in Utilization

Despite its immense potential, the utilization of sea buckthorn in food processing presents several challenges. The berries have a highly acidic and astringent taste, which may limit direct consumption. Moreover, their delicate nature and high perishability require efficient post-harvest handling and processing techniques.

Another constraint is the presence of small seeds and the difficulty in juice extraction, which necessitates specialized equipment and optimized processing conditions. Addressing these challenges is key to unlocking the full potential of sea buckthorn in the food industry.

Innovative Processing Techniques

Advancements in food processing technologies have paved the way for effective utilization of sea buckthorn. Techniques such as enzymatic treatment, membrane filtration, and high-pressure processing are increasingly being explored to improve juice yield, clarity, and shelf life.

Enzyme-assisted extraction enhances juice recovery by breaking down cell walls, while preserving bioactive compounds. Similarly, non-thermal technologies like high-pressure processing, pulsed electric field, and oscillating magnetic field help in retaining heat-sensitive nutrients and antioxidants, ensuring product quality and safety (Gómez-López *et al.*, 2022).

Drying methods, including freeze drying and spray drying, are also used to convert sea buckthorn into powders (Li *et al.*, 2024). These powders can be easily incorporated into beverages, bakery products, and dietary supplements, offering convenience and extended shelf life.

Value-Added Products

Sea buckthorn has found applications across a wide range of food products due to its versatility and health benefits. Some of the most popular value-added products include:

- Beverages: Juices, smoothies, herbal teas, wine and fermented drinks enriched with sea buckthorn are gaining popularity for their refreshing taste and nutritional benefits.
- Bakery and Confectionery: Incorporation into biscuits, cakes, and energy bars enhances both nutritional value and sensory appeal.
- Dairy Products: Yogurt, ice cream, and flavored milk infused with sea buckthorn offer functional benefits along with unique flavor profiles.
- Nutraceuticals: Sea buckthorn oil and extracts are widely used in capsules, syrups, and health supplements.
- Dried buckthorn pulp and freeze-dried powders

These innovations not only diversify product portfolios but also cater to health-conscious consumers seeking natural and functional ingredients.

Sustainability and Economic Potential

Sea buckthorn is not just nutritionally valuable but also environmentally sustainable. The plant is highly resilient, capable of growing in harsh climatic conditions and poor soils. It plays a significant role in soil conservation, erosion control, and ecological restoration, particularly in hilly and arid regions.

From an economic perspective, sea buckthorn cultivation and processing can provide livelihood opportunities for rural communities, especially in Himalayan regions. The development of processing industries around this crop can enhance value addition and support local economies.

Future Prospects

The future of sea buckthorn in food processing is promising, with ongoing research focusing on improving processing techniques, product development, and consumer acceptance. Innovations in flavour masking, blending with other fruit juices, and formulation strategies are helping overcome sensory challenges. Furthermore, sea buckthorn oil can be used in making several functional and nutraceutical food products.

Conclusion

Sea buckthorn represents a unique convergence of nutrition, functionality, and sustainability. While challenges in processing and sensory acceptance remain, advancements in

food technology are steadily overcoming these barriers. By harnessing its full potential through innovative processing and product development, sea buckthorn can play a significant role in shaping the future of functional foods. As consumers continue to seek natural and health-promoting ingredients, this “golden berry” offers immense opportunities for the food processing industry, making it not just a fruit of the past, but a superfood of the future.

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