

From Waste to Wealth: The Hidden Value of Snail Shells

Virbhan, Kumar Gaurav*, Aditya Singh, Sikan Shubhankar Nayak, Anjali Takhellambam

College of Fisheries, Central Agricultural University (I), Lembucherra, Tripura, India

*Corresponding author

Email address: kgcof201921@gmail.com

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Abstract

The snail industry has experienced rapid growth, and this has led to economic benefits, but it has also led to a large amount of waste from the snail shells, which is a major environmental concern. The waste is normally disposed of in landfills or water bodies, causing pollution and resource wastage. This paper demonstrates how the waste from snail shells can be turned from an environmental concern to an economic benefit. The waste from snail shells is a rich source of calcium-based materials, and this makes it feasible to recycle the waste into valuable materials that can be utilized in various ways. The recycling of the waste has proved successful in agriculture, where it has been used to improve soil quality, as a supplement in animal and fish foods as a calcium source, and in water treatment, where it has been used to remove toxic metal pollutants. Apart from environmental uses, the waste from snail shells can be utilized in the construction industry and in the health and medical field, specifically in bone and dental works. This recycling technique of the waste from snail shells encourages sustainability, prevents pollution, and ensures that waste is turned to wealth through the circular economy approach.

Keywords: Snail shell waste; Circular economy; Sustainable recycling; Calcium-based resources

Introduction

The growing use of snails in the food, cosmetic, pharmaceutical, and agricultural sectors, particularly due to their nutritional and skin care values and the growth of the circular economy, is expected to fuel the global snail market, which was valued at USD 647.4 million in 2024, to USD 1.4 billion by 2034 (CAGR 8.5%) (Ahuja and Pulidindi, 2025). However, the increasing consumption of snails and other shellfish has also resulted in the production of massive amounts of shell waste. Each year, the world produces 8 million tons of trash crab, shrimp, and lobster shells, as well as 10 million tons of trash oyster, clam, scallop, and mussel shells. The dumping of these shells, either in the ocean or by transporting them to landfills, leads to a massive effect on soil quality, water bodies, and the ocean (Topić Popović et al., 2023). Therefore, the need for waste management has become a major global concern. The recycling of mollusk shells is a significant move towards the protection of the environment because food waste includes materials that were originally intended for human consumption that are lost, contaminated, discarded, or degraded along the supply chain (Potorti et al., 2024; Yadav et al., 2025).

What are Snail Shells made of?

Snails and seashells are examples of biological shells that are abundant in hard materials like calcium carbonate and calcium oxides. As a result, these biomaterials could be used as reinforcing components in the production of composites. The use of these biological seashells as a replacement for ceramic-based reinforcements is actually rather appealing. The robustness and quantity of bioshells after their life cycle make them a very useful resource for industrial applications (Podaralla et al., 2024).

Turning Waste into a Useful Resource

The snail shells collected were first washed with water to remove any dirt. The shells were then dried using an oven to remove any moisture. The shells were then crushed and ground into a fine powder using grinding tools. The powder was then sieved using a fine sieve to ensure that the particles were of equal size. The final powder was then stored in a clean, tightly closed container for use in the study (Owoyemi and Owoyemi, 2020).

Benefits for Agriculture

When soil pH rises above 5.5, some nutrients that plants need become harder for roots to absorb because they change into forms that do not dissolve easily. At the same time, elements like manganese and aluminum can become too soluble, which may slow down or damage root growth. Adding calcium oxide (CaO) at a rate of 5.0% proved to be the most effective treatment, as it improved soil pH from 6.6 to 7.4 and helped make essential nutrients more available to plants (Azlan et al., 2025).

Use in Animal and Fish Feed

Crushed shells are an excellent source of calcium (CaCO₃) and can be added to animal feed as a supplement. Calcium is an important supplement that maintains the health of animals, especially by ensuring that their bones are strong. Calcium supplements are also important for laying hens, as they help to strengthen eggshell walls (Potortì et al., 2024). Likewise, shrimp shell flour has been employed as an extra source of minerals in vaname shrimp (*Litopenaeus vannamei*) reared in freshwater environments. Research indicates that this supplement is highly effective in improving shrimp growth, but it has no effect on their survival rate.

Cleaning Water the Natural Way

Another eco-friendly method of pollution control is the conversion of waste shells into natural cleaning agents for polluted water. Shell dust has been identified as a biosorbent, which has the ability to trap and remove toxic metal ions from polluted water. Research has indicated that shell dust derived from the waste shells of *F. bengalensis* and *P. globosa* is highly effective in removing metals such as cadmium, cobalt, chromium, and copper from polluted water (Paul and Aditya, 2024).

Applications in Construction and Industry

Shell wastes, like snail shells, are being repurposed for use in the construction industry. Research has demonstrated that powdered snail shells can be employed as a substitute for fillers in asphalt without compromising their physical properties (Modupe et al., 2021). Calcium-rich shell powders can also be employed in place of limestone fillers in cement products without affecting their strength, providing a sustainable alternative for the construction industry (Rux et al., 2025).

Health and Medical Applications

Shell waste has also been identified as a potential resource in the health sector. Researchers have successfully extracted hydroxyapatite nanoparticles from *Atactodea glabrata* snail shell biowaste. Repurposing shell waste for health applications is significant since shell waste is biocompatible and can potentially solve issues like antibiotic resistance (Ahmed et al., 2022; Sharma et al., 2026). Shell waste is primarily composed of calcium carbonate, which can be utilized to produce dental and bone-related products such as hydroxyapatite (HA), which promotes bone growth and healing and is a common material in the health and dental sectors (Muntean et al., 2024).

Conclusion

The development of the snail industry has led to the generation of a substantial amount of shell waste, which has raised environmental issues related to disposal and pollution. However, the snail shell, which is rich in calcium carbonate and calcium oxide, is a valuable biological resource that fits well within the framework of the circular economy. The processed shell waste has been found to have different uses, such as the adjustment of soil pH in agricultural uses, calcium supplementation in animal and aquaculture feeds, removal of heavy metals from polluted water, and partial replacement of conventional fillers in construction materials. Moreover, the calcium compounds obtained from snail shells have been found to possess immense potential in biomedical uses, such as the preparation of hydroxyapatite for bone and dental uses.

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