

COCONUT SHELL AND ITS VALUABLE POTENTIAL USES

Aishwarya Rajkumar Ingole¹, Aniketkumar L. Bijewar², Dukchuk Tamang³,
Sayan Debsingha⁴ and Ujjwal singh⁵

Introduction

Coconut shells are often seen as byproducts or waste in the coconut industry. Still, recent innovations and research are transforming them into an eco-friendly resource with a diverse array of uses. With high durability, rich carbon content, and natural fire- and water-resistant properties, coconut shells are emerging as a sustainable and versatile raw material. From activated carbon production and sustainable building materials to artisanal crafts and biodegradable packaging, coconut shells are finding new roles across multiple industries. In this article, we'll explore this remarkable resource's science, sustainability, and future potential.

1. Composition and Properties of Coconut Shells

Coconut shells predominantly comprise lignin, cellulose and hemicellulose, natural

polymers that provide strength and resilience.

These shells are lightweight yet strong, water-resistant and naturally fire-resistant, making them ideal for numerous applications. Their carbon-rich structure also makes them an excellent raw material for activated carbon, which is widely used for filtration purposes. Additionally, coconut shells decompose more slowly than other organic materials, meaning they can serve as long-lasting components in various products. This extended durability has encouraged researchers and industries to explore ways to integrate coconut shells into products ranging from construction materials to sustainable consumer goods (Dhamodaran and Babu, 2011).

2. Activated Carbon Production for Filtration

One of the most valuable industrial applications of coconut shells is the production

**Aishwarya Rajkumar Ingole¹, Aniketkumar L. Bijewar², Dukchuk Tamang³,
Sayan Debsingha⁴ and Ujjwal singh⁵**

¹Ph.D Scholar, Department of Floriculture and Landscape Architecture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra.

²Ph. D Research Scholar, Department of Floriculture and Landscape Architecture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra.

³Ph. D Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, Bidhan Chandra Krishi Viswavidyalaya, West Bengal.

⁴Ph. D Research Scholar, Department of Soil Science, UBKV, West Bengal.

⁵Ph. D Research Scholar, Department of Horticulture, School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland.

of activated carbon. Coconut shell-derived activated carbon is highly porous, with millions of tiny pores that allow it to trap pollutants and contaminants effectively. Activated carbon made from coconut shells is now widely used in water filters, air purifiers, and even gas masks, as it can remove impurities, odors, and harmful chemicals from water and air

Additionally, coconut shell carbon can be regenerated and reused, making it an even more sustainable option (Demirbas *et al.*, 2006)

3. Coconut Shell as a Sustainable Building Material

Coconut shells have shown promise as a sustainable aggregate material in the construction industry. Traditionally, concrete



(a)



(b)



(c)

(a) As received coconut fibrous unclean, (b) cleaned, and (c) powdered coconut shell

The process of creating activated carbon from coconut shells involves heating them in an oxygen-free environment, a process known as carbonization. This produces a material with a large surface area and a highly porous structure, capable of absorbing pollutants efficiently. Studies show that coconut shell-based activated carbon performs as well or better than coal-derived alternatives while being more environmentally friendly. The environmental advantages of using coconut shells in activated carbon production are significant, as it helps reduce dependence on fossil fuels and non-renewable resources.

research has demonstrated that crushed coconut shells can partially replace these materials. Coconut shell concrete is lighter than traditional concrete, reducing the load on structures without compromising strength. Studies have found that coconut shell concrete has suitable compressive strength for non-load-bearing structures, road pavements, and lightweight construction. The use of coconut shells in construction reduces dependency on mined aggregates, which has positive environmental implications by reducing land degradation and resource depletion. In tropical



regions where coconuts are abundant, coconut shell concrete provides a low-cost, sustainable alternative to traditional concrete. This has the potential to contribute to infrastructure development in low-income areas while supporting local economies and promoting sustainable building practices (FAO, 2019).

4. Biodegradable Products: Tackling Plastic Pollution

Plastic pollution is a global environmental crisis, with single-use plastics filling up landfills and polluting oceans. Coconut shells offer an eco-friendly solution by providing a biodegradable alternative for various disposable items, such as cutlery, bowls, and cups. Companies are producing tableware from coconut shells, which decompose naturally and can be composted after use. Biodegradable coconut shell products offer an eco-friendly alternative to single-use plastics. These products not only reduce waste but also encourage more

sustainable consumption patterns. In addition, coconut shells are being used in the packaging industry as a natural, biodegradable alternative to plastic and foam packaging, especially for cosmetics and small consumer goods.

In gardening, coconut shell pots are gaining popularity as natural planters. These planters allow for air circulation around plant roots, promoting healthier growth, and can decompose directly into the soil when no longer in use, creating a closed-loop system that minimizes waste (Muralidharan and Jayashree, 2011).

Tackling Plastic Pollution!



NEW AGRICULTURE MAGAZINE

5. Artisanal and Craft Applications: Functional and Decorative Uses

Coconut shells have been used for centuries by artisans to create functional and decorative items, from kitchen utensils to jewelry and musical instruments. In tropical regions, coconut shell craftsmanship holds cultural and economic significance, with many communities relying on these handicrafts for income. The unique texture and durability of coconut shells allow artisans to create intricate designs and patterns that are both eco-friendly and stylish.

The rise of eco-friendly and sustainable products has brought renewed interest in coconut shell crafts, particularly among consumers seeking handmade, natural items. Coconut shell jewelry, such as bracelets, necklaces, and earrings, is lightweight and hypoallergenic, making it popular in the global market. Beyond traditional products, modern designers are incorporating coconut shells into innovative art pieces, furniture, and decorative home items, blending sustainability with creativity (Navin *et al.*, 2019).



6. Health and Beauty Applications: A Natural Ingredient in Skincare

Coconut shells are also making an impact in the health and beauty sectors, particularly as a natural exfoliant in skincare products. Ground coconut shells can be used as a gentle exfoliant in facial and body scrubs, replacing harmful plastic microbeads that contribute to ocean pollution. The rough texture of coconut shells makes them effective for removing dead skin cells without causing harm to marine ecosystems.

Additionally, coconut shell charcoal is gaining popularity in dental care products for its natural whitening and detoxifying properties. Activated charcoal toothpaste made from coconut shells helps remove surface stains and absorbs toxins, offering an alternative to chemical-based teeth whiteners. The antimicrobial properties of coconut shells also make them ideal for toothbrush handles and combs, catering to a growing demand for eco-friendly hygiene products (Ramakumar, 2001).

7. Coconut Shell Charcoal: A Low-Emission Fuel Source

Coconut shells are also used to produce charcoal, which serves as a cleaner-burning alternative to traditional firewood. Coconut shell charcoal has high calorific value and low emissions, making it ideal for household heating and cooking in regions where access to clean energy is limited. In the production process, coconut shell charcoal emits significantly less smoke than firewood, reducing indoor air pollution and providing a healthier cooking environment.

In addition to household use, coconut shell charcoal briquettes are becoming popular as an ecofriendly fuel source for outdoor grilling and barbecuing, offering a low-smoke, long-lasting alternative to traditional charcoal. This application helps reduce the impact of deforestation while offering a sustainable

solution for cooking and heating (Welewanni and Bandupriya, 2007).



8. Agricultural Benefits: Soil Enrichment and Biochar

Coconut shells can also benefit agriculture as biochar, a type of charcoal used to enrich soil. Biochar from coconut shells is produced by heating the shells at high temperatures, creating a carbon-rich material that, when added to soil, improves its fertility and moisture retention capabilities. Biochar can also help sequester carbon, reducing greenhouse gas emissions and improving soil health.

Coconut shell biochar has shown promise in improving crop yields and reducing the need for chemical fertilizers, making it an attractive option for sustainable agriculture. By promoting soil fertility and enhancing water retention, coconut shell biochar can also help farmers in arid regions combat the effects of drought and soil degradation (Varghese and Jacob, 2017).

9. Innovative Industrial Applications: Reinforced Polymers and Composites

In the materials science sector, coconut shells are being used to create reinforced polymers and composites. Coconut shell powder can be added to polymers to improve their strength, durability, and heat resistance, creating. Coconut shell-reinforced polymers are a sustainable alternative to traditional materials, reducing the demand for synthetic additives.

Research shows that coconut shell composites perform well in applications that require high durability and resilience, and they provide a cost-effective, eco-friendly alternative to conventional fillers in the plastics industry. The development of coconut shell-reinforced composites supports a more circular economy by utilizing natural materials and reducing the reliance on non-renewable resources (Loomba and Jothi, 2013).

10. Conclusion: A Future Full of Potential for Coconut Shells

As industries and consumers become more conscious of sustainability, coconut shells are emerging as a valuable resource that can contribute to a circular economy. Their diverse applications, ranging from activated carbon and biodegradable products to construction materials and biochar, highlight their potential to reduce waste and environmental impact. In addition to

promoting eco-friendly practices, the use of coconut shells also supports local economies in coconut-producing regions, creating opportunities for economic growth.

With further research and innovation, the potential uses for coconut shells are likely to expand, offering sustainable solutions to some of the world's most pressing environmental challenges. From filtering pollutants to reducing plastic waste, coconut shells are proving that this humble byproduct has much to offer as a natural, renewable resource in the quest for a greener planet (Appaiah, 2015).

Coconut Shells: An Eco-Friendly Powerhouse of Potential

References

1. Aravind, M., Liyanage, D., Gunathilake, C., & Rathnayake, H. (2022). Exploring Coconut Shell's Environmental and Industrial Potential. *International Journal of Sustainable Materials*.
2. Demirbas, M. F., & Balat, M. (2006). Recent advances on the production and utilization trends of bio-fuels: a global perspective. *Energy Conversion and Management*, 47(15-16), 2371-2381.
3. FAO, "Production of Coconut in Malaysia: Understand the global production of Coconut in Malaysia." UN FAO: Food and Agriculture Organization., FAO2019, Available: <https://www.tridge.com/markets/coconut-MY/production>, Accessed on: 5/12/2019
4. Muralidharan, K. Jayashree, A. (2011). Value addition, product diversification and by-product utilization in coconut
5. Navin, K.R. (2019). New technologies for value added products from coconut residues. *Materials Research Forum*, 11, 295-301.
6. Ramakumar, R. (2001). Costs and margins in coconut marketing: some evidence from Kerala. *Indian Journal of Agricultural Economics*, 56(4), 668-682.
7. Welewanni, I., & Bandupriya, D. (2017). Coconut cryopreservation: present status and future prospects. *Cord*, 33(1), 21-21.
8. Varghese, A., & Jacob, J. (2017). A study of physical and mechanical properties of the Indian coconut for efficient dehusking. *Journal of Natural Fibers*, 14(3), 390-399.
9. Loomba, S. Jothi, V. (2013). *Cocos nucifera*: Its properties and contributions to dentistry. *International Journal of Scientific Study*, 1(3), 138-140.
10. Appaiah, P., Sunil, L., Kumar, P. K., & Krishna, A. G. (2015). Physico-

chemical characteristics and stability aspects of coconut water and kernel at different stages of maturity. Journal of food science and technology, 52(8), 5196-5203.

11. Dhamodaran, T. K., & Babu, S. (2011). Potential of community level utilization of coconut shell and stem wood for charcoal and activated carbon in Kerala. Journal of the Indian Academy of Wood Science, 8(2), 89-96.

