

## Coir Pith: Composting Technology, Nutritive Value and Key Features

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### Introduction

Coir pith, a residual product of coir industries, consists of short fibres and the pith left over after extracting long fibres from either fresh or recycled coconut husks. The natural ratio of fibres to pith in the coconut mesocarp is 30:70 by weight. India utilizes husks from 40-60% of its coconut production for coir fibre, resulting in an annual production of 0.5 to 1 million tonnes of coir pith waste that requires effective utilization. Coconut husks yield coir fibre, leaving behind coir dust or pith as a significant byproduct, totalling 7.5 million tons annually from India's coir industry, with Tamil Nadu alone contributing 500,000 tons. Coir pith, rich in lignin and with a high carbon-to-nitrogen ratio, is unsuitable as a direct agricultural carbon source. However, it finds value in horticulture due to its composting potential, which reduces bulkiness, enhances nutrient availability, and improves its suitability as a soil conditioner. Known for its high porosity and ability to retain up to 500% of its weight in moisture, coir pith is a distinctive soil amendment. It also contains significant amounts of potash, enhancing its agricultural value. However, its high polyphenolic content in raw form can be detrimental to plant roots. Therefore, composting is a beneficial method to mitigate these polyphenols and improve the availability of nutrients for plants, making coir pith more suitable for agricultural use.

### Composting technique of Coir pith

- 1. Raw Material Collection:** Coir pith is gathered from coir industries ensuring it is free from fibrous content. Any fibrous materials present are sieved out either during collection or after composting at the designated yard. These fibres do not decompose well and can disrupt the composting process. It is recommended to use coir pith devoid of fibres to facilitate effective composting.



**Fig.1: Raw materials collected from coir industries**

- 2. Site selection for composting:** For effective composting of coir pith, designate a specific area that is elevated and shaded, ideally under coconut trees or any tree that provides ample shade. This shaded environment helps conserve moisture in the composting material. Ensure the ground where composting will take place is level; if it's an earthen floor, compact it well or apply cow dung slurry to strengthen it. Having a roof over the composting area is beneficial as it shields the material from rain and intense sunlight. Coir pith undergoes aerobic composting and should be piled above ground level without the need for pits or cement tubs. Spread the coir pith in layers measuring 4 feet long and 3 feet wide, starting with a layer 3 inches high that is thoroughly moistened. Following moisture application, evenly distribute a nitrogen source like urea or fresh poultry litter. For urea, apply 5 kg per ton of coir pith, dividing it into five equal portions to be alternately layered with the coir pith. If using poultry litter, apply it at a rate of 200 kg per ton of coir pith, proportionally layered over the material. Incorporate microbial inoculums such as *Pleurotus* and TNAU biomineralizer (2%) into the composting layers. Build the compost heap to a minimum height of 4 feet to retain the heat generated during the composting process. Avoid exceeding 5 feet in height, as managing taller heaps may require machinery and excessive height could lead to heat dissipation, affecting the composting efficiency.

- 3. Proper Turing of raw material:** To maintain aerobic conditions during composting, it's essential to turn the compost heap every 10 days. This process allows stale air within the compost to escape and fresh air to penetrate, supporting the metabolic activity of composting organisms that rely on oxygen. Turning the material effectively aerates the substrate indirectly. Another method to promote aeration is by inserting perforated unused PVC or iron pipes vertically and horizontally into the composting material. This technique enhances airflow throughout the heap, aiding in the decomposition process and ensuring optimal conditions for microbial activity.
- 4. Maintenance of adequate moisture:** To achieve consistent and effective composting, it is crucial to maintain the ideal moisture level. Keeping the compost material at around 60% moisture ensures it remains uniformly damp. However, it's important to avoid excess water drainage. To check moisture levels, take a handful of composting material and squeeze it between your palms. If no water drips out, the moisture content is suitable for optimal composting conditions.
- 5. Time of compost maturity:** The duration of composting varies depending on the type of material being composted. When all recommended conditions are maintained, composting typically takes about sixty days (60 days) for certain physical changes to become evident. Initially, there is a noticeable reduction in the volume of the compost heap, typically by around 30%. Secondly, the composted materials turn black in colour and their particle size decreases. Thirdly, mature compost emits an earthy odour. Chemical assessment of compost maturity involves laboratory analysis. Key indicators include a narrower CN ratio (around 20:1), reduced oxygen consumption, lower microbial activity, increased availability of nutrients, and enhanced cation exchange capacity. These factors collectively indicate that the composting process has successfully transformed the raw materials into mature compost suitable for agricultural use.
- 6. Harvesting:** Once the sieved composted material is obtained, it is ready for immediate use. If not used right away, store it in a cool, open area to preserve moisture and maintain the viability of beneficial microorganisms present in the compost. It is recommended to sprinkle water over the compost material once a month to sustain optimal moisture levels.

**Table.1: Nutritive composition of Coir Pith compost**

Parameters	Raw coir pith (%)	Composted coir pith (%)
Lignin	30.00	4.80
Cellulose	26.52	10.10
Carbon	26.00	24.00
Nitrogen	0.26	1.24
Phosphorous	0.01	0.06
Potassium	0.78	1.20
Calcium	0.40	0.50
Magnesium	0.36	0.48
Iron(ppm)	0.07	0.09
Manganese(ppm)	12.50	25.00
Zinc(ppm)	7.50	15.80
Copper(ppm)	3.10	6.20
C:N ratio	112.1	24:1

(Source: TNAU Agritech portal, Organic farming)

**Fig. 2&3: Coir pith compost (Final product, ready for market)**

### Urea-free composting of coir-pith

ICAR-CPCRI (Indian Council of Agricultural Research- The Central Plantation Crops Research Institute) has developed a straightforward and farmer-friendly composting



technology for coir pith that eliminates the need for urea or mushroom fungi to adjust the C N ratio and aid substrate decomposition. Instead, they employ co-composting, combining organic materials rich in nitrogen with a low C N ratio, such as animal manures, with coir pith, which has a high C N ratio and low nitrogen content. This blending facilitates enhanced microbial decomposition of the materials. This innovative approach is cost-effective, uncomplicated, and swift, utilizing locally available resources. It is well-suited for adoption by farmers and small-scale entrepreneurs in cottage industries.

### **Preparation of urea free Coir-Pith**

- Choose a location with ample shade and protection from direct rainfall for the composting site.
- Alternatively, use greenhouse nets draped over wooden poles to create shaded conditions.
- Thoroughly mix 90 kg of coir pith with 10 kg of high-quality poultry manure, along with 0.5 kg of lime and 0.5 kg of rock phosphate.
- Spread the mixture evenly over an area measuring 2 meters in length, 1 meter in breadth, and 0.5 meters in height.
- For larger compost heaps weighing 500 kg (450 kg coir pith + 50 kg poultry manure + 2.5 kg each of lime and rock phosphate), spread them over an area measuring 4 meters in length, 2 meters in breadth, and 1 meter in height for optimal composting.
- Regularly sprinkle water using a watering can to maintain adequate moisture throughout the coir pith heap, ensuring it does not become overly wet or dry.
- Cover the heap with gunny bags, greenhouse nets, or dry grasses to prevent moisture loss.
- Turn the entire heap thoroughly every 15 days to accelerate decomposition, indicated by the change in colour from reddish-brown raw coir pith to dark brown.
- Continue watering and covering the heap as described above.
- After 45-60 days, the coir pith will transform into a dark brown to black colour, signalling the completion of the composting process.
- The final product can be air-dried in the shade and packed for subsequent use.

The compost made from coir pith without urea using this co-composting method developed by ICAR-CPCRI is now available under the brand name 'Kalpa Soil Care'.

#### **Key features of composted coir pith**

1. It promotes better soil aggregation and significantly boosts water holding capacity, absorbing more than five times its dry weight in moisture.
2. Composted coir pith enhances soil texture, improving cohesion in sandy soils and workability in clayey soils.
3. Composted coir pith increases the cation exchange capacity of soils where it is applied.
4. It enriches soil microflora by introducing beneficial humic substances, fostering a healthier soil ecosystem.
5. Enhanced microbiological activity from coir pith compost improves processes like ammonification, nitrification, and nitrogen fixation, enhancing soil fertility and nutrient cycling.
6. Application of composted coir pith reduces the bulk density of subsurface soils (15-30 cm depth).
7. It contains essential plant nutrients and complements the effects of inorganic fertilizers.

#### **Method of application of coir pith compost**

1. When preparing potting mixtures for nursery development in poly bags or mud pots, incorporate 20% composted coir pith with soil and sand.
2. For established trees such as coconut, mango, banana, and other fruit-bearing trees, a minimum of 5 kg of composted coir pith is required per tree.
3. It is recommended to apply 5 tons of composted coir pith per hectare of land regardless of the crop being cultivated.
4. Composted coir pith should be applied as a basal application before sowing seeds.

#### **Limitations**

- Before purchasing composted coir dust, ensure it has undergone complete composting and is accompanied by a quality analysis certificate.
- Immature compost, if applied to soil, continues decomposing and absorbs nutrients from the soil, potentially impacting the current crop.

- Purchasing composted coir pith for large farm areas is not cost-effective; preparing compost on-site is preferable.

### **Conclusion**

In conclusion, coir pith emerges not only as a significant byproduct of the coconut industry but also as a versatile resource with various agricultural applications. From its role in enhancing soil structure and water retention to its potential as a nutrient-rich compost, coir pith proves invaluable in sustainable farming practices. It has an immense potential to contribute to soil health and crop productivity without relying on synthetic additives. As we continue to explore and refine its uses, coir pith stands poised to play a pivotal role in promoting eco-friendly and efficient agricultural practices globally.

