Development and Evaluation of the Physical and Chemical Properties of Myanmar Cocopeat Blocks for Horticultural Applications

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Abstract

Cocopeat is a renewable growing medium that has attracted increasing attention as a sustainable alternative to peat moss in horticulture. This study aimed to develop compressed cocopeat blocks from Coconut coir pith using a laboratory-scale hydraulic hot press and to evaluate their physical and chemical properties for horticultural applications. Raw cocopeat was washed, dried, sieved, and compressed into blocks after optimizing the water-to-cocopeat ratio and compression pressure. The chemical properties, including pH, electrical conductivity (EC), and macronutrients (N, P, K, Mg, and Ca), and the physical properties, including bulk density, particle density, moisture content, and water-holding capacity, were determined. The prepared cocopeat blocks were also compared with two commercially available cocopeat block samples.

The results showed that the prepared cocopeat blocks had a slightly acidic and an electrical conductivity within the recommended range for horticultural applications. Essential macronutrients were retained after block preparation, while the blocks exhibited good water-holding capacity and suitable physical properties for use as a growing medium. Compared with the commercial samples, the prepared blocks showed a lower EC value (1350±9 μS cm^{-1}), suggesting that washing the raw cocopeat effectively reduced soluble salts. Although the commercial samples exhibited slightly higher water-holding capacity and macronutrient contents, the differences in most physical properties were relatively small.

Overall, the study showed that compressed cocopeat blocks produced from current coconut coir pith possess suitable physical and chemical characteristics for horticultural applications. The findings also highlight the importance of raw material preparation, particularly washing, sieving, and appropriate compression conditions, in improving the quality of cocopeat blocks.

Keywords: cocopeat, coconut coir pith, compressed cocopeat block, physical properties, chemical properties

1. Introduction

Coconut (*Cocos nucifera L.*) is widely cultivated in tropical and subtropical regions and is an important agricultural crop in many countries. In Myanmar, coconut palms are commonly grown in coastal and delta regions where they contribute to local livelihoods and agro-based industries. During coconut processing, large quantities of husks are generated as agricultural by-products. Traditionally, coconut fibers have been used for making ropes, mats, and brushes. However, the demand for these traditional products has gradually declined with the increasing use of synthetic materials, resulting in the accumulation of coconut processing residues.

Cocopeat, also known as coconut coir pith, is a by-product obtained during the extraction of coconut fibers from the husk. Instead of being discarded, cocopeat has become an important renewable material for horticultural production because of its favorable physical and chemical properties. It has a high water-holding capacity, good porosity, adequate aeration, and the ability to retain nutrients, making it suitable as a growing medium for containerized crops and nursery production (M. Abad et al., 2002). In addition, cocopeat is biodegradable, environmentally friendly, and can be reused for several cultivation cycles, making it an attractive alternative to peat-based substrates (N. Gruda, 2012).

The increasing concern over the environmental impacts of peat extraction has encouraged the use of sustainable growing media derived from renewable agricultural residues. Among the available alternatives, cocopeat has received considerable attention because it is abundant, inexpensive, and readily available in many tropical countries (G. E. Barrett et al., 2016). The use of cocopeat also supports the recycling of agricultural waste and contributes to sustainable resource management and circular bioeconomy practices. For these reasons, cocopeat has been widely incorporated into commercial growing media either alone or in combination with other organic and inorganic materials (G. Schmilewski, 2009).

The quality of compressed cocopeat blocks largely depends on their physical and chemical characteristics. Properties such as pH, electrical conductivity (EC), moisture content, bulk density, particle density, water-holding capacity, and nutrient content directly influence the performance of cocopeat as a horticultural substrate (M. Abad et al., 2002 and G. E. Barrett et al., 2016). Furthermore, proper preparation of raw cocopeat, including washing, drying, and particle size grading, can improve the quality of the final product by reducing soluble salts and impurities while producing a more uniform growing medium.

Although cocopeat has been widely studied and commercial cocopeat blocks are available in the local market, limited information is available on the production and characterization of compressed cocopeat blocks prepared from Coconut coir pith. In particular, there is little published information comparing prepared cocopeat blocks with commercially available products. Therefore, this study aimed to develop compressed cocopeat blocks from cocopeat using a hydraulic hot press and to evaluate their physical and chemical properties. The prepared blocks have to be compared with two commercial cocopeat block samples to assess their suitability for horticultural applications.

2. Material and Methods

2.1. Collection, preparation of cocopeat and characterization of samples

Cocopeat was obtained as a by-product of coir fiber extraction from coconut husks. The collected cocopeat was cleaned to remove impurities and sieved using a sieve shaker to obtain a uniform particle size. The prepared samples were stored in sealed polyethylene bags at room temperature until further analysis.

The chemical composition of the cocopeat was evaluated by determining the cellulose, hemicellulose, lignin, and ash content. Cellulose, hemicellulose, and lignin were analyzed using an in-house analytical method, while the ash content was determined according to the standard laboratory procedure. The results were expressed as a percentage of the oven-dried sample.

The prepared cocopeat samples were further characterized to determine their physical and chemical properties. Physical analyses included moisture content, bulk density, water-holding capacity, and porosity. Chemical analyses included pH, electrical conductivity (EC), and the major lignocellulosic components. All measurements were performed in triplicate, and the average values were used for data analysis.

Two commercially available cocopeat block products were purchased from the local market in Myanmar for comparison with the prepared cocopeat blocks. To avoid commercial bias, the products are referred to as Commercial A and Commercial B throughout this study. The physical and chemical properties of the commercial samples were evaluated using the same analytical methods applied to the raw cocopeat and the prepared compressed cocopeat blocks.

Fig.1. Steps for Preparation of Cocopeat from Coconut Coir Pith

2.2. Determination of Ash Content

The ash content of the raw cocopeat was determined by using Method ASTM D1102-84. Approximately 2 g of the oven-dried sample was accurately weighed into a pre-weighed porcelain crucible. The crucible was initially heated on a hot plate until the organic matter was completely carbonized without flaming. The sample was then transferred to a muffle furnace and incinerated at 550 ± 25°C for 1 h. After ashing, the crucible was cooled in a desiccator to room temperature and weighed. The heating, cooling, and weighing procedures were repeated until a constant weight was obtained. The ash content was calculated using the following equation.

$$\text{Ash Content (\%)} = \frac{W_1}{W_0} \times 100$$

Where,

W_0 = Weight of dry sample (g)
W_1 = Weight of ash (g)

2.3. Determination of Cellulose, Hemicellulose, and Lignin

The cellulose, hemicellulose, and lignin contents of the raw cocopeat were determined using an in-house method based on the procedure described by H. Yang et al.,2006.

The extractive content was first determined by solvent extraction. The extractive-free sample was then used to determine hemicellulose and lignin.

For hemicellulose analysis, the extractive-free sample was treated with 150 mL of 0.5 M sodium hydroxide (NaOH) solution at 80°C for 3.5 h. The residue was washed thoroughly with distilled water until the wash water reached approximately neutral pH. The sample was then dried in an oven at 105–110°C until a constant weight was obtained. The hemicellulose content was calculated from the weight loss after alkaline treatment using the following equation:

$$\text{Hemicellulose Content (\%)} = \frac{\text{B-C}}{\text{Initial weight (g)}} \times 100$$

Where,

B = Oven-dry weight for extractive-free dried biomass (105-110˚C)
C = Oven-dry weight for extractive-free dried biomass after soaking in NaOH (105-110˚C)

For lignin analysis, 30 mL of 98% sulfuric acid was added to the extractive-free sample. The mixture was kept at room temperature for 24 h and then heated at 100°C for 1 h. After heating, the mixture was filtered, and the solid residue was washed thoroughly with distilled water until sulfate ions were no longer detected. The absence of sulfate ions was confirmed using a 10% barium chloride solution. The residue was dried in an oven at 105–110°C until a constant weight was obtained. The final residue weight was recorded as the lignin content.

$$\text{Lignin Content (\%)} = \frac{D}{A} \times 100$$

Where,

A = Total amount of biomass sample (g)
D = Oven-dry weight

The cellulose content was calculated by difference, assuming that the total biomass composition of the oven-dried sample was 1 g, using the following equation:

$$(A-B) + (B-C) + D + E = 1$$

Where,

A = Total amount of biomass sample (g)
B = Oven-dry weight for extractive-free dried biomass (105-110˚C)

C = Oven-dry weight for extractive-free dried biomass after soaking in NaOH (105-110˚C)
D = Oven dry weight (g)
E = Amount of Cellulose (g)

2.4. Preparation of Compressed Cocopeat Blocks

Raw cocopeat was obtained from coconut husks after the separation of coir fiber. The collected cocopeat was soaked in water to remove soluble salts and other impurities and was then thoroughly washed several times with clean water. The washed cocopeat was dried in a laboratory oven until a constant weight was obtained. The dried material was subsequently sieved using a sieve shaker to obtain a uniform particle size before compression.

A preliminary experiment was conducted to determine the appropriate amount of water required for block preparation. For each treatment, 200 g of dried cocopeat was mixed with 200, 300, or 400 mL of water and thoroughly blended to obtain a uniform mixture. The mixtures were placed into a steel mould and compressed using a hydraulic hot press. The optimum water content was selected based on the ease of mixing, block formation, and visual observation of water loss during compression. Among the three treatments, the mixture containing 300 mL of water produced the most stable and uniform blocks with minimal water leakage during pressing. Therefore, this water-to-cocopeat ratio was used in the subsequent experiments

A second experiment was conducted to determine the optimal compression pressure. In this experiment, 200 g of dried cocopeat was mixed with 300 mL of water based on the results of the preliminary water optimization test. The mixture was placed into the mold and compressed using a hydraulic hot press at three different pressures: 10, 20, and 30 tons. The overall procedure for preparing the compressed cocopeat blocks is illustrated in Figure 2.

2.5. Determination of pH and Electrical Conductivity (EC)

The pH and electrical conductivity (EC) of the raw cocopeat, compressed cocopeat block sample, and commercial A and B were determined. For pH analysis, 10 g of each sample was mixed with 50 mL of distilled water (1:5, w/v). The suspension was shaken for 30 min using a laboratory shaker and then allowed to stand for 24 h at room temperature (30 ± 2°C). The extract was filtered, and the pH was measured using a calibrated pH meter.

For EC determination, 40 g of each sample was mixed with 80 mL of distilled water (1:2, w/v). The mixture was shaken for 15 min and allowed to stand for 60 min at room temperature (30 ± 2°C). The liquid extract was separated by vacuum filtration, and the EC was measured using a calibrated portable EC meter.

All measurements were carried out on the raw cocopeat, the compressed cocopeat block sample, and the commercial A and B under the same experimental conditions.

2.6. Determination of Macronutrient Content

The macronutrient contents of the raw cocopeat, compressed cocopeat block sample, and commercial A and B were determined by analyzing the concentrations of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg). The analyses were carried out at the National Analytical Laboratory, Department of Research and Innovation, Ministry of Science and Technology, Myanmar, using standard laboratory procedures.

The results were expressed as the concentration of each macronutrient in the respective samples. They were used to evaluate the nutritional characteristics of the raw cocopeat, compressed cocopeat block, and commercial A and B.

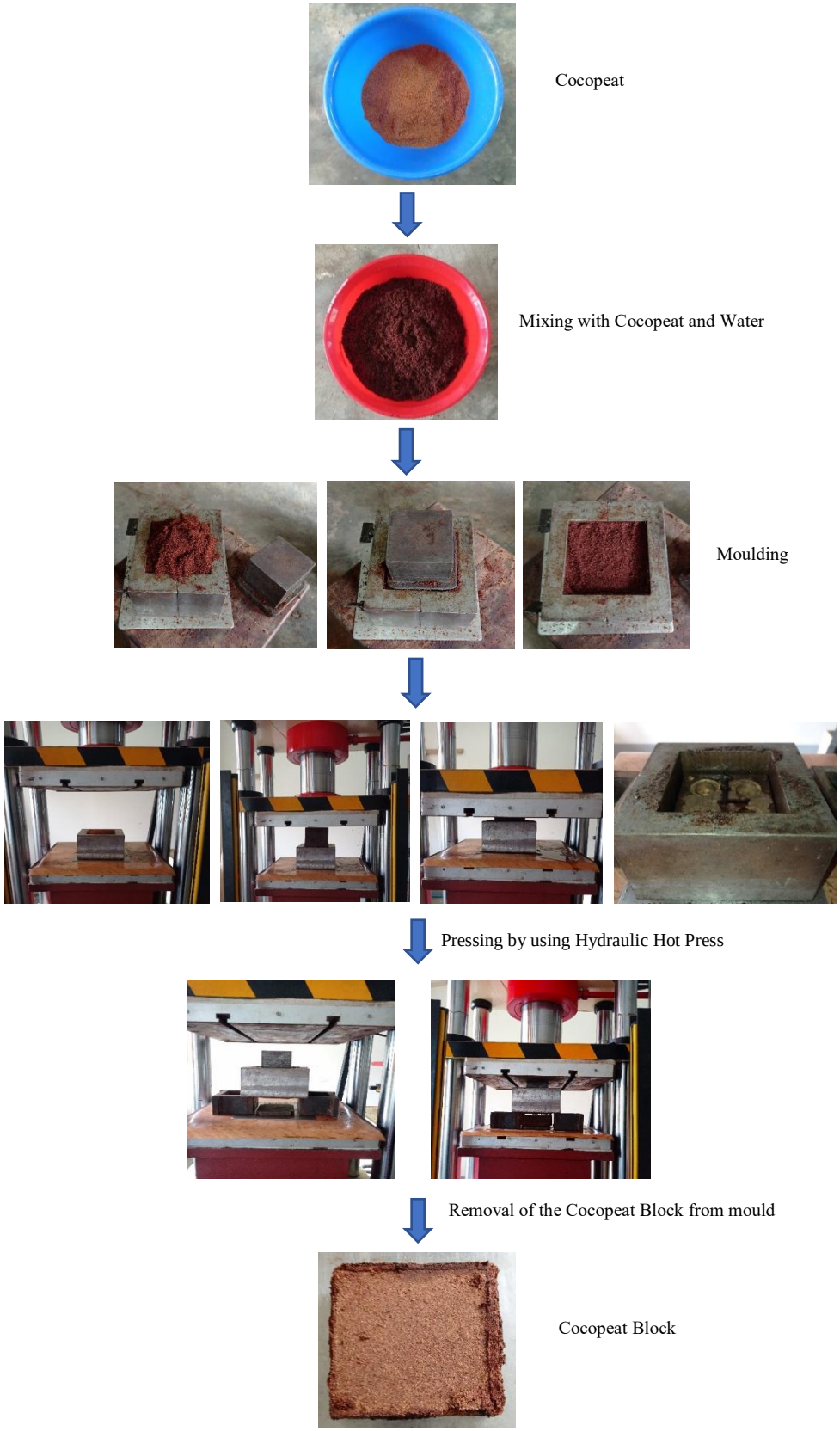

Fig. 2. Steps for preparation of Compressed Cocopeat Blocks

2.7. Determination of Moisture Content

The moisture content of the raw cocopeat, compressed cocopeat block sample, and commercial A and B was determined using a moisture analyzer (Shimadzu, Type- MOC63u). The raw cocopeat was analyzed immediately after sample preparation. For the compressed cocopeat blocks, moisture content was measured after the blocks were air-dried under ambient conditions for two weeks. Approximately the required amount of each sample was placed in the moisture analyzer, and the moisture content was determined according to the manufacturer's operating procedure. All measurements were performed in triplicate, and the results were expressed as the mean ± standard deviation.

2.8. Determination of Particle Density

The particle density of the raw cocopeat, compressed cocopeat block sample, and commercial A and B was determined using the pycnometer method. A clean and dry pycnometer fitted with a stopper was weighed before analysis. A known amount of the sample was placed into the pycnometer, and the weight of the pycnometer containing the sample was recorded.

Distilled water was then added to approximately half of the pycnometer volume. The stopper was removed, and the pycnometer was gently heated to remove entrapped air from the sample. Care was taken to avoid boiling the water. After cooling to room temperature, the pycnometer was filled to the calibration mark with distilled water, fitted with the stopper, dried externally, and weighed.

The sample was subsequently removed, and the pycnometer was thoroughly cleaned and dried. It was then filled with distilled water and weighed again. Particle density was calculated from the recorded weights using the pycnometer equation.

A schematic illustration of the particle density determination procedure is presented in Figure 3.

$$\text{Particle Density} = \frac{\text{Mass of soil(g)}}{\text{Volume of soil (cm}^3\text{)}}$$

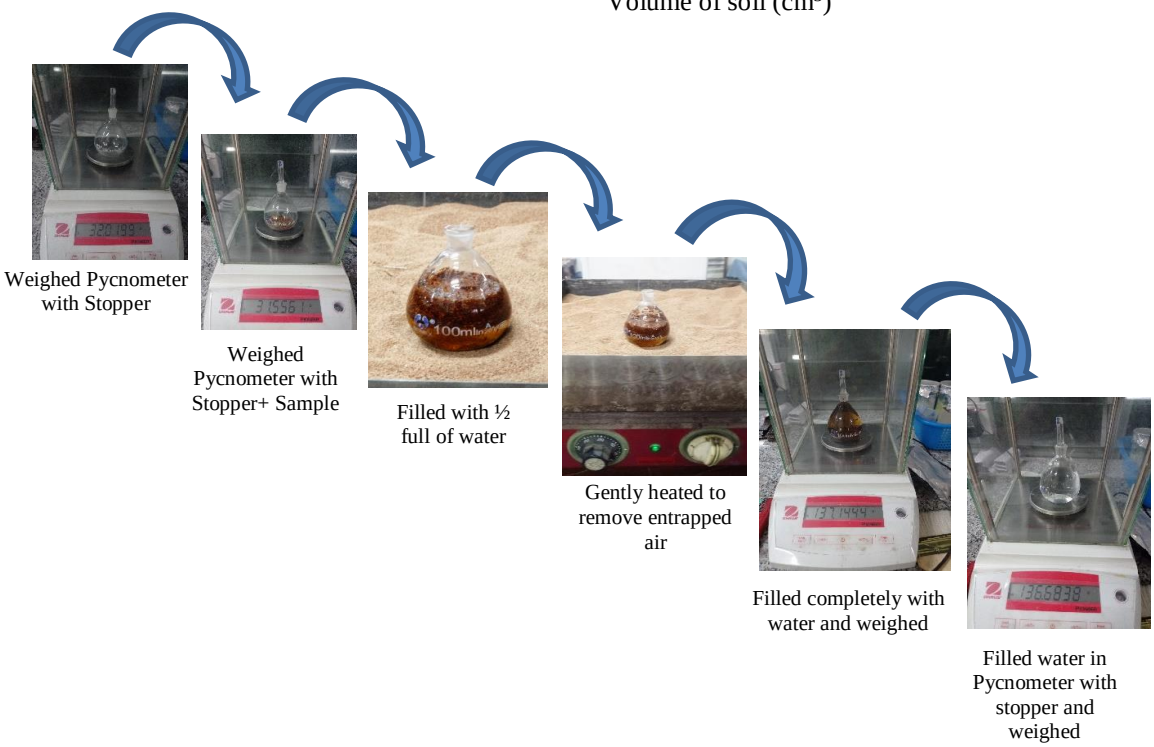

Fig. 3. Steps for the particle density determination procedure

2.9. Determination of Bulk Density

The bulk density of the raw cocopeat, compressed cocopeat block sample, and commercial A and B was determined using the Keen Box method. Before analysis, the samples were dried in the natural convection oven at 105°C for 24 h to obtain a constant weight.

The empty Keen Box was weighed before use. The oven-dried sample was then gradually transferred into the Keen Box. To ensure uniform packing, the box was gently tapped several times on a flat surface until the sample was evenly settled. The sample surface was leveled using a spatula, and the filled Keen Box was weighed.

The bulk density was calculated from the oven-dried mass of the sample and the known volume of the Keen Box using the following equation:

$$\text{Bulk Density} = \frac{\text{Dry weight of the Sample (g)}}{\text{Volume of the dry sample (cm}^3\text{)}}$$

2.10. Determination of Water-holding Capacity

The water-holding capacity (WHC) of the raw cocopeat, compressed cocopeat block sample, and commercial A and B was determined using the Keen Box method. Before analysis, the samples were dried in the natural convection oven at 105°C for 24 h to obtain a constant weight. A filter paper was placed inside a perforated Keen Box, and the combined weight of the Keen Box and filter paper was recorded. The oven-dried sample was then transferred into the Keen Box, and the initial weight was measured. The Keen Box containing the sample was placed in a water tray, and distilled water was added until the water level reached approximately 1 cm above the bottom of the tray. The tray was covered with a lid, and the sample was left to absorb water overnight until fully saturated. After saturation, the Keen Box was removed from the tray, and the weight of the saturated sample was recorded. The sample was then removed, and the weight of the wet Keen Box with the filter paper was measured. A schematic illustration of the water-holding capacity determination is presented in Figure 4. The water-holding capacity was calculated using the following equation:

$$\text{Water-holding Capacity} = \frac{\text{Total water in the wet soil}}{\text{Oven-dry weight of total soil}} \text{ x100}$$

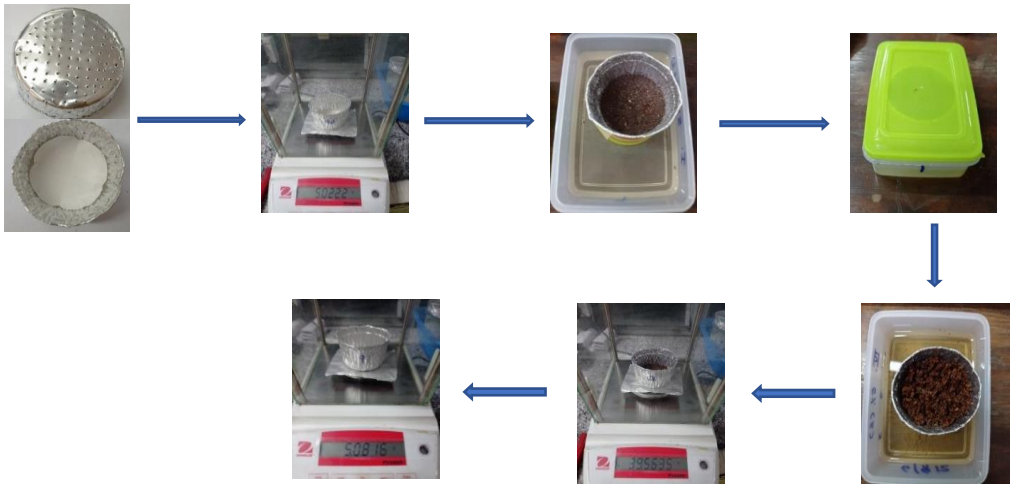

Fig.4. Steps for the Water-holding Capacity determination procedure

2.11. Statistical Analysis

All measurements were performed in triplicate. Data are presented as mean ± standard deviation (SD). Because this study focused primarily on the characterization of the physical and chemical properties of the prepared cocopeat blocks rather than on evaluating statistically significant differences among treatment groups, descriptive statistics (mean ± standard deviation) were used to summarize the experimental results.

3. Results and Discussion

3.1. Chemical Composition of Raw Cocopeat Physical and Chemical Properties of Raw Cocopeat

The chemical composition of the raw cocopeat is presented in Table 1. The raw cocopeat contained 40.20 ± 1.40% cellulose, 13.00 ± 1.20% hemicellulose, 45.10 ± 1.20% lignin, and 8.28 ± 0.05% ash. Among the major structural components, lignin was the most abundant, followed by cellulose and hemicellulose. The relatively high lignin content indicates that the raw cocopeat has a stable lignocellulosic structure, which contributes to its slow decomposition and good physical stability during use as a growing medium. The cellulose content observed in this study is within the range reported for coconut coir materials, while the lignin content is also comparable to values reported in previous studies. These characteristics are considered beneficial for horticultural substrates because they help maintain the physical structure of the growing medium over an extended period (M. Abad et al., 2002; M. R. Evans et al., 1996; and W. R. Carlile et al., 2015).

The ash content of the raw cocopeat was 8.28 ± 0.05%, indicating the presence of mineral constituents remaining after combustion. Ash content may vary depending on the source of the coconut husks and the processing method used to produce cocopeat. Similar variations have been reported in previous studies of coconut coir-based growing media (M. Abad et al., 2002).

3.2. Physical and Chemical Properties of Raw Cocopeat

The physical and chemical properties of the raw cocopeat are presented in Tables 2 and 3. The raw cocopeat had a pH of 5.48, which falls within the slightly acidic range. This pH is generally considered suitable for horticultural growing media because it supports nutrient availability and root development for many ornamental and vegetable crops (M. Abad et al., 2002 and W. R. Carlile et al., 2015). The electrical conductivity (EC) was 1,966 µS cm^{-1}, indicating a moderate level of soluble salts that is acceptable for horticultural applications after appropriate processing.

The raw cocopeat contained 0.55% nitrogen (N), 0.02% phosphorus (P), 0.94% potassium (K), 0.16% magnesium (Mg), and 0.16% calcium (Ca). Among the macronutrients, potassium was present at the highest concentration, consistent with previous reports that coconut coir naturally contains higher levels of potassium than other mineral nutrients (M. Abad et al., 2002 and M. R. Evans et al., 1996).

The physical properties of the raw cocopeat are also shown in Table 3. The bulk density and the particle density were 0.139 g cm^{-3} and 0.704 g cm^{-3}, respectively, while the moisture content was 20.33%. The water-holding capacity reached 895%, indicating excellent water retention capacity of cocopeat. This high water-holding capacity is a major advantage of cocopeat as a growing medium because it helps maintain adequate moisture around plant roots while providing sufficient air-filled pore space (M. Abad et al., 2002 and W. R. Carlile et al., 2015).

Table 1. Chemical composition of raw cocopeat

No.	Parameter	Value (%)
1	Cellulose	40.20 ± 1.40
2	Hemicellulose	13.00 ± 1.20
3	Lignin	45.10 ± 1.20
4	Ash	8.28 ± 0.05

Table 2. Chemical properties of the raw cocopeat

Materials	Chemical properties						
	pH	EC (μS cm⁻¹)	Nitrogen (N) (%)	Phosphorus (P) (%)	Potassium (K) (%)	Magnesium (Mg) (%)	Calcium (Ca) (%)
Cocopeat	5.48±0.04	1966±6	0.55±0.02	0.02±0.01	0.94±0.02	0.16±0.01	0.16±0.01

Table 3. Physical properties of the raw cocopeat

Raw Materials	Physical properties			
	Bulk Density (g cm⁻³)	Particle Density (g cm⁻³)	Moisture Content (%)	Water-holding capacity (%)
Cocopeat	0.139 ± 0.012	0.704 ± 0.05	20.33 ± 1.6	895 ± 5

3.3. Selection of Compression Pressure for Cocopeat Block Production

To determine the optimum compression pressure for producing compressed cocopeat blocks, three pressure levels, 3.2 MPa (10 tons), 6.4 MPa (20 tons), and 9.6 MPa (30 tons), were evaluated. The dimensions and weight of the compressed cocopeat blocks were measured after seven days of air-drying under ambient conditions. The results are presented in Table 4, and representative photographs of the prepared blocks are shown in Figure 5.

At a compression pressure of 9.6 MPa (P-3), the mould cracked during pressing, preventing successful block production. Compared with the blocks produced at 3.2 MPa(P-1), those prepared at 6.4 MPa (P-2) had a smaller volume and lower final weight, indicating greater compaction. Therefore, 6.4 MPa (P-2) was selected as the optimum compression pressure for producing compressed cocopeat blocks and was used in all subsequent experiments.

The greater compaction achieved at 6.4 MPa is expected to improve the structural stability of the compressed blocks without damaging the mould. Similar findings have been reported in biomass densification studies, where increasing compression pressure generally enhances material densification until the mechanical limits of the mould or equipment are reached (N. Kaliyan, R. V. Morey, 2009, and J. S. Tumuluru et al., 2011).

Table 4. Dimensions and weight of the compressed cocopeat blocks

Sample Name	Dimensions (cm^3)	Weight (g)
P-1	655.99 ± 7.4	253 ± 3.5
P-2	440.16 ± 5.5	226 ± 3.2
P-3	-	-

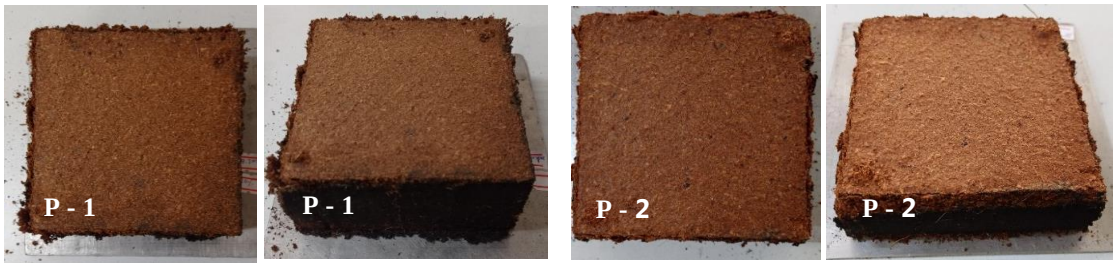

Fig. 5. Compressed cocopeat blocks prepared at 3.2 MPa (10 tons) and 6.4 MPa (20 tons).

3.4. Chemical Properties of the Prepared and Commercial Cocopeat Blocks

The chemical properties of the prepared cocopeat block and the two commercial cocopeat block samples are presented in Table 5. The pH value of the prepared cocopeat block was 6.02, indicating a slightly acidic condition that is generally suitable for horticultural growing media. The pH of Commercial B was slightly higher than that of Commercial A and the prepared cocopeat block. Overall, the measured pH values were within or close to the range commonly recommended for plant growth, where nutrient availability is generally favorable (M. Abad et al., 2002; and W. R. Carlile et al., 2015).

The electrical conductivity (EC) of the prepared cocopeat block was 1,350 µS cm^{-1}, whereas Commercial A and Commercial B showed considerably higher EC values of 5,866 µS cm^{-1} and 8,600 µS cm^{-1}, respectively. The relatively low EC of the prepared cocopeat block suggests a lower concentration of soluble salts compared with the commercial products. This difference is likely related to the washing process applied during raw material preparation, which helps remove excess soluble salts before block production. Similar observations have been reported in previous studies, where washing cocopeat effectively reduced EC and improved its suitability for horticultural applications (M. Abad et al., 2002 and M. R. Evans et al., 1996). According to recommended values reported for horticultural substrates, an EC range of approximately 1,100–5,700 µS cm^{-1} is generally considered acceptable, depending on the crop and production system. The EC of the prepared cocopeat block fell within this recommended range, while Commercial B exceeded the upper limit, indicating a relatively high soluble salt content. High EC may adversely affect seed germination and root development because excessive soluble salts can reduce water uptake by plants (M. Raviv, J. H. Lieth, 2008).

The prepared cocopeat block contained detectable amounts of nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), and calcium (Ca), indicating that essential macronutrients were retained after block preparation. The same macronutrients were also detected in both commercial samples. Although the commercial products had slightly higher nutrient levels than the prepared block, the differences were minor, indicating that all samples could provide the essential nutrients required for horticultural growing media.

Table 5. Chemical Properties of the Prepared and Commercial Cocopeat Blocks

Sample Name	Chemical properties						
	pH	EC (µS cm^{-1})	Nitrogen (N) (%)	Phosphorus (P) (%)	Potassium (K) (%)	Magnesium (Mg) (%)	Calcium (Ca) (%)
Prepared Cocopeat Block	6.02±0.03	1350±9	0.56±0.03	0.01±0.01	0.43±0.03	0.16±0.01	0.15±0.01
Commercial A	5.44±0.02	5866±7	0.63±0.05	0.01±0.01	0.87±0.02	0.21±0.02	0.16±0.02
Commercial B	5.25±0.01	8600±8	0.62±0.04	0.01±0.01	1.47±0.01	0.18±0.02	0.17±0.03

3.5. Physical Properties of the Prepared and Commercial Cocopeat Blocks

The physical properties of the prepared and commercial cocopeat blocks are presented in Table 6. The bulk density, particle density, moisture content, and water-holding capacity (WHC) were determined for all samples. The prepared cocopeat block had a moisture content of 21.14% after 15 days of air drying, whereas Commercial A and Commercial B showed lower moisture contents of 18.43% and 16.67%, respectively. The slightly higher moisture content of the prepared block may be attributed to its shorter storage period before testing.

Both commercial samples exhibited higher water-holding capacities than the prepared cocopeat block, with Commercial B showing the highest value. The bulk density and particle density of all samples were generally comparable, indicating only minor differences in packing characteristics. Since water-holding capacity is strongly influenced by pore structure and particle arrangement, the higher WHC observed in the commercial products may be associated with differences in raw material processing and manufacturing conditions (M. Abad et al., 2002 and W. R. Carlile et al., 2015).

Although the commercial cocopeat blocks exhibited higher water-holding capacity and slightly greater macronutrient contents, they also showed considerably higher EC values than the prepared block. During the physical evaluation, small stones and other foreign materials were observed in the commercial samples, suggesting that the raw cocopeat had not been thoroughly washed before processing. Insufficient washing can leave higher concentrations of soluble salts in the material, resulting in elevated EC values (M. R. Evans et al., 1996 and M. Abad et al., 2002). In contrast, the washing process applied to the prepared cocopeat effectively reduced the EC to a level considered suitable for horticultural applications.

Table 6. Physical Properties of the Prepared and Commercial Cocopeat Blocks

Sample Name	Physical properties			
	Bulk Density ($g\ cm^{-3}$)	Particle Density ($g\ cm^{-3}$)	Moisture Content (%)	Water-holding capacity (%)
Prepared Cocopeat Block	0.175±0.003	0.797±0.03	21.14±1.5	721±4
Commercial A	0.165±0.004	0.893±0.026	18.43±1.2	951±4
Commercial B	0.143±0.005	0.741±0.02	16.67±1.1	1223±3

4. Conclusion

This study demonstrated the feasibility of producing compressed cocopeat blocks from Coconut coir pith using a hydraulic hot press. The results showed that the prepared cocopeat blocks had suitable physical and chemical properties for horticultural applications. The pH and EC values were within the acceptable range for plant-growing media. The blocks also showed good water-holding capacity and contained essential macronutrients, including nitrogen, phosphorus, potassium, magnesium, and calcium. The findings highlighted the importance of the raw material preparation before block production. Washing the cocopeat reduced soluble salts and impurities, while sieving produced a more uniform particle size and improved block quality. A compression pressure of 6.4 MPa produced stable blocks without damaging the mould and was selected as the optimum pressure under these experimental conditions. Air drying was also more suitable than oven drying because it minimized cracking of the compressed blocks. Although the prepared cocopeat blocks contained slightly lower macronutrient levels and water-holding capacity than the commercial samples, they exhibited a considerably lower EC, indicating that the washing process improved the quality of the growing medium by reducing excess soluble salts.

Future studies should quantitatively evaluate the effect of the water-to-cocopeat ratio on nutrient retention, water loss during compression, and the physical properties of the compressed blocks. In addition, the use of an injection moulding system or other industrial-scale compression equipment should be evaluated

to produce denser and more uniform cocopeat blocks and to assess their suitability for large-scale commercial production. Finally, greenhouse or nursery trials are recommended to evaluate the performance of the developed cocopeat blocks under practical horticultural conditions.

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