

ADVANCES IN PITH CAKE: A REVIEW OF KEY DEVELOPMENTS AND IMPLICATIONS

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ABSTRACT

The popularity of terrace gardening has led to a growing interest in various methods for growing plants, including the use of organic fertilizers. One such method is to grow plants using pith cake in conjunction with soil. Pith cake is made from coconut husk and is a versatile growth medium that has a high porosity and a good water retention capacity. Bagasse, a fibrous substance made from sugarcane, is another material that has potential for use in the growth of plants. Energycane, a hybrid sugarcane species, has a higher proportion of fiber compared to regular sugarcane and can be utilized in the manufacturing of cellulosic biofuel and as a feedstock. This review paper discusses the process of pith cake manufacturing, the advantages of using coco peat in gardening, and the chemical composition of energycane, sugarcane, and coir. The study finds that energycane and sugarcane have a higher cellulose content compared to coir, making them suitable for plant growth.

KEYWORDS :- Sugarcane Bagasse , Energycane Bagasse , Coir Pith , Water holding capacity , Pith cake , Plant growth.

1. INTRODUCTION

Nowadays, terrace gardening is quickly gaining popularity. However, there are many other methods that can be used to grow plants, including organic fertiliser. One such method is to grow plants using pith cake in conjunction with soil. This material has a high porosity and a good water retention capacity, which can provide enough water and nutrients to plants, potentially enhancing their growth.

Bagasse made from sugarcane is a fibrous substance with cellulose as its primary constituent. It is made in great numbers all throughout the world. It is a type of waste product that is produced by the sugar industry. Although researchers have proposed that various mechanical and chemical processes can aid in the extraction of cellulosic fibres, pure cellulose, cellulose nanofibers, and cellulose nanocrystals, they are most frequently used in the paper industry. In the creation of composite materials and regenerated cellulosic fibre, these extracted components have a variety of uses.

A hybrid sugarcane species in the genus *Saccharum* is called energycane. As opposed to regular sugarcane, energycane contains a higher proportion of fibre than sucrose. It can be utilised directly as a feedstock (burned directly in the combustion of biopower), but it can also be utilised in the manufacturing of cellulosic biofuel. In sugar mills, bagasse is occasionally utilised as the main fuel for producing heat and electricity. Glycerol, sometimes referred to as glycerin, is the main byproduct of the synthesis of biodiesel.

2. PITH CAKE

A versatile growth medium made of coconut husk is called cocopeat. The tough coconut husk is pre-washed, mechanically dried, sieved, and made free of sand and other impurities including plant and animal waste. A superior substitute for traditional peat moss and rock wool is cocopeat. It is the perfect growing medium for plant crops due to its air-filled porosity and high water retention capacity. It is completely organic, environmentally friendly, and weed- and pathogen-free. It has a pH between 5.7 and 6.5 and an appropriate EC level of 1 mS/cm for plant growth.

2.1 PITH CAKE MANUFACTURING PROCESS

- Bagasse drying & Graining: Bagasse is firstly dried and then the bagasse is grained in to fine particles
- Water soaking: The fine particles of bagasse is water soaked for 2-3 times to remove the high sodium and potassium content that may affect the growth of the plant. Thus conductivity of pith cake is also maintained.
- After water soaking the particles are dried and then fine particles are sieved to remove the dust particles and to get the extract the right sized particles for the pith cake manufacturing.
- Then moved to hydraulic press to the formation of pith cake.

2.2 HYDRALIC PRESS MACHINE FOR PITH CAKE PREPARATION

- The automatic hydraulic press machine is used to compress the pith of the coir and this is mainly for transportation purpose.
- The block may be either compressed in 5kg or 650 gram.
- For 5kg block specifications are size-30*30*13cm , compression ratio 5:1, moisture content less than 20% and electrical conductivity less than 0.5millimhos/cm
- For 650g block specifications are size-20*10*5cm , compression ratio 8:1, moisture content less than 20% and electrical conductivity less than 0.5 millimhos/cm.

3. COCO PEAT USED IN GARDENING

- As a soil additive, it strengthens soil structure and enriches the soil with organic matter.
- Coco peat aids in retaining water and also helps to prevent wet and waterlogged situations at the same time, unlike soil, which allows excess water to percolate below the root zone.
- It expels more water while holding 7-8 times its weight in water.
- It enhances drainage and aeration for healthier root growth.
- As it holds onto nutrients and delivers them gradually to the plants, it also stops nutrient leaching. This promotes improved nutrition absorption.
- Coco peat is a pathogen- and weed-seed-free organic material that is sterile and biodegradable.
- The coco peat used for gardening typically has a pH of 5.5 to 6.8 and a low EC.

3.1 CHEMICAL COMPOSITION OF ENERGYCANE, SUGARCANE AND COIR

Cellulose content is used to enhance the cell growth cellulose content of energycane and sugarcane is 43% and 42% so it may used for plant growth.

Table -1 : Chemical composition of energycane, sugarcane, coir

PARTICULARS	ENERGYCANE	SUGARCANE	COIR
Cellulose	43%	42%	27%
Hemicellulose	24%	25%	15%
Lignin	22%	20%	42%
Wax/Ash	0.8%	5%	10%

4. TESTING FOR PITH CAKE

- ❖ EC Test
- ❖ pH Test
- ❖ Moisture Test
- ❖ Water holding capacity
- ❖ Growth analysis

4.1 EC TEST

EC Test can be in two ways

➤ Wet method

- Utilize a hand-held EC metre that has been calibrated to determine the EC of demineralized or RO water (EC_w). Combine the ideal quantity of demineralized water with the cocopeat to fully expand the compacted particles. One approach is to combine three times as much cocopeat as will be evaluated (30ml of water with 10g of cocopeat). 150 ml of demineralized water should be added to 100 ml of this combination.
- Stir thoroughly and let sit for approximately 15 minutes. Put the cocopeat through a strainer, and then save the liquid in a glass or plastic container. Using a spoon, press the cocopeat during the straining process. Utilize the EC metre to determine the solution's EC (EC_c) Make sure there is enough solution to completely submerge the EC meter's measuring tip; otherwise, the readings will be inaccurate.
- The EC of cocopeat is measured by the formula $EC_c - EC_w$ (mS/cm).

➤ Dry method

- Another name for it is the 1:5 method.

- The dust is not wet with water in this process once the fibre has been separated. Five parts of demineralized water are combined by volume with one part of dry dust (100 ml to 500 ml). Stir the solution, let it sit, strain it, then take an EC reading (ECc).
- The formula $ECc-ECw$ (mS/cm) is used to calculate cocopeat's EC.
- Less water should be used when measuring the raw materials for quality control because EC rises with drying and compression.

4.2 pH TEST

pH (Potential Hydrogen): Using a handheld pH metre, pH is determined using the same technique as EC. However, the 1:5 dry approach is the most widely used pH method. However, the 1:1.5 wet approach provides a more accurate pH value. Make that the water being used to measure pH is neutral (7.0). The pH of the cocopeat can be determined immediately from the pH reading of the solution.

Add 5 times the weight of the cocopeat to pH-neutral water as another way to measure pH. (500 ml to 100 grams). The cocopeat mimicking growth conditions would be entirely submerged in this amount of water. Allow the item to soak for 15 minutes, then squeeze it to determine the pH of the solution. Compared to other procedures, this one typically yields a lower pH reading.

4.3 MOISTURE TEST

The weight-loss approach is adopted. The sample is weighed at 50 grammes. The sample is baked for 90 seconds to remove moisture, and the resulting coco peat is weighed (w_1). Once more, the coco peat is warmed in the oven for 30 seconds before being weighed (w_2). Moisture is $((50-w_1)/50)*100\%$ if ($w_1=w_2$) The coco peat sample is heated for another 30 seconds if w_1 and w_2 are not equal, and the process is repeated until the two weights are equal. The moisture content is equal to $((50-W_f)/50)*100\%$ if W_f is the final weight. Moisture is guaranteed to be under 15%. The blocks are carefully checked to make sure they are not adhering to one another.

4.4 WATER HOLDING CAPACITY

The amount of water the substrate can hold or retain is called the water holding capacity.

These values are calculated

Dry Weight
Saturated Weight

The formula is used to calculate the water holding capacity
(Saturated Weight) – (Dry Weight) = WHC

4.5 GROWTH ANALYSIS

- Comparison is done with existing coir pith cake and developed bagasse pith cake by planting the seed using pith cake in different proportions.
- The plant tray with different proportions of pith
 - 100% Sugarcane bagasse pith
 - 100% Energycane bagasse pith ,
 - 100% Coir pith ,
 - 70% bagasse pith and 30% coir pith ,
 - 50% sugarcane pith and 50% coir pith ,
 - 50% sugarcane bagasse pith and 50% energycane bagasse pith.
- The growth of the seed is analysed and the growth is measured.

4.6 Importance of maintaining the pH and conductivity

A plant's root system develops and operates in a growing substrate, also known as medium. The chemical characteristics of the substrate, such as its pH and conductivity, must be appropriate for the crop you plan to cultivate. In order to achieve optimal growth, each crop requires a substrate with a specified pH and conductivity value. All nutrients are readily available from pH 5.4 to 6.2, which has an impact on how much are available to plants. Conductivity reveals the nutrients or salt concentrations (salinity) influencing plant growth and health. With a 1:2 dilution method and a pour through approach, the ranges of substrate conductivity that are good for seedlings, bedding plants, and salt-sensitive plants are 0.26 to 0.75 mS/cm and 1.0 to 2.6 mS/cm, respectively.

5. LATEST DEVELOPMENTS

The pith block is used for various purpose like mulching, bedding in various forms

- Coco discs
- Coir pots
- Coir mulch mats
- Coir climbing poles
- Coir planter liners
- Coco chips

6. CONCLUSION

The use of pith cake, made from bagasse and coco peat, in terrace gardening has gained popularity in recent years due to its high porosity and water retention capacity, which can enhance the growth of plants. The manufacturing process of pith cake involves drying and graining bagasse, water soaking, and compressing it using a hydraulic press machine. Coco peat is a versatile growth medium that is environmentally friendly, weed- and pathogen-free, and helps improve soil structure, water retention, aeration, and nutrient absorption. The chemical composition of energycane, sugarcane, and coir, indicates that energycane and sugarcane have higher cellulose content, which is important for cell growth. In inference, pith cake and coco peat are potential alternatives to traditional peat moss and rock wool for terrace gardening.

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