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# Evaluation of Chemical Parameters of Agro - Pollutant – Coir Industrial Residue

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**Abstract:** ***Coir pith, an industrial residue categorized under agro-pollutant, being utilized in agriculture and bioenergy generation. This coir pith being abyproduct of the industries should be removed from the production site as its accumulation pollutes the local water body by altering its physico-chemical properties when rain water percolates it. Also, Polyphenol leaching makes it unfit for the normal landfill practices in Agriculture. Fortunately, this coir pith serves as an organic raw material for the production of biogas as it possesses high lignin and cellulose contents. In this study, the samples were drawn from a industry site which was heaped for natural decomposition for several years. The coir pith samples as a function of time - 5 years, 1 year, 6 months, raw (7 days old) were collected and analysed for the chemical parameters. It was observed that the parameters were in the descending order of Raw coir pith > 1 year >6months > 5 years which showed gradual decrease in the contents symbolizing the activity of microbes in degradation naturally; This is the time consuming process due to the presence of lignocellulosic materials, where the chances of microbial degradation using natural consortia is very tough, the alternative step to overcome this issue is by using lignin degrading microbes to bring down polluting parameters.***

**Keywords:** Coir Pith, Leaching, Polluting parameters, Degradation, Raw coir pith

## 1. Introduction

Coir Pith is 100% natural organic byproduct, biodegradable and eco-friendly. It is a byproduct gained during extraction of Coir fibre from coconut husk. It is free from any admixture heavy metals. It is a mixture of corky cellular material and short fibers and has the appearance and feel of peat moss (Rojith G. and Bright Singh I.S, 2013).

### Properties of Coir Pith

The characteristics of coir pith indicates

- Stability of the material for conditioning of the farm and soil
- For retention of moisture in mulching
- As a receptacle for slow release of added nutrients to the crop.
- Coir waste absorbs water in the range of 400-600% its weight and releases it into the soil very slowly (Ajitha V et al., 2015)

### Production Rate

In India, if 10,000 busk of coconuts are utilized for coir extraction; one tonne of coir pith is being obtained as a by-product (Rojith G. and Bright Singh I.S, 2013). It has been reported that only *5* lakh tonnes of coir pith is produced in India annually, on an average 5000 husks are defibred per day, which yielding 1 ton of Coir pith per day while around 5-6 tons is composted or decomposed every 35 days. Usually, much of the coir pith is being washed in the backwaters during the extraction process (Ajitha V et al., 2015).

## 2. Materials and Methods

### Collection of Coir Pith

The coir pith was collected from the industrial area TANCI, Krishnagiri.

### Estimation of Basic Parameters

The basic parameters such as pH, EC, TDS and ash content were determined for all the collected samples and the results were tabulated (ISO 638).

### Estimation of Chemical Contents

The sample is hydrolyzed similar to the standard methods [SCAN-CM 71:09, TAPPI T 249 cm-00], for the estimation of the high lignin content in precipitated lignin samples cause prolonged filtering time. After the hydrolysis, the sample is filtered, the acid-insoluble residue is determined gravimetrically [TAPPI T 222 om-02], and the acid-soluble lignin is determined spectrophotometrically [TAPPI UM 250].

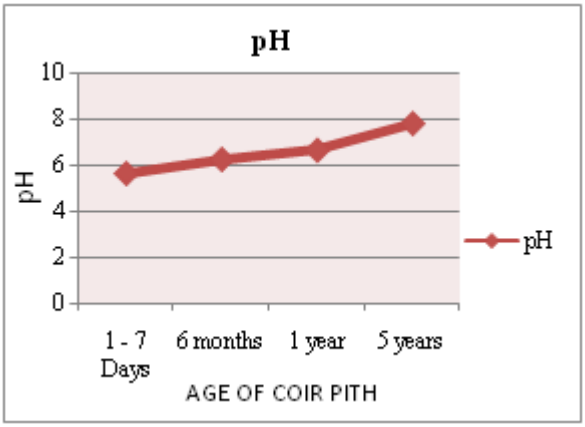
Samples were extracted consecutively with 17.5% and 9.45% sodium hydroxide solutions. The soluble fraction, consisting of beta and gamma celluloses was determined by oxidation with potassium dichromate, and the alpha-cellulose, as an insoluble fraction by T 203 cm-99 method using titration**.**

## 3. Results and Discussion

### Estimation of Basic Parameters in Coir Pith

#### 1. pH

pH was recorded for the collected samples and the results were tabulated.

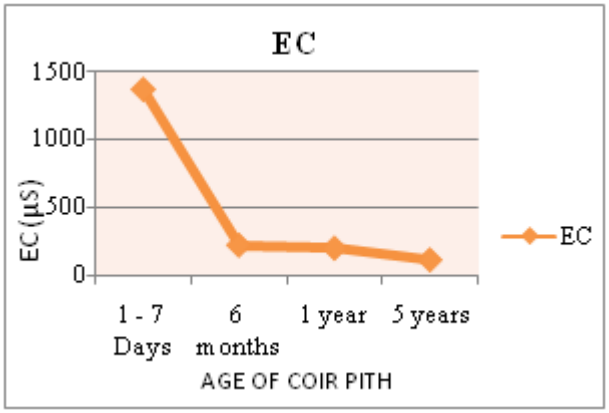



**Graph 1:** Comparison of pH of Coir Pith Heaps

The pH values differed as the function of time. The oldest sample i.e. 5 years old was found to be neutral which is fit for agricultural purpose; 1 year sample was observed to travel towards basic pH; 6 months old sample and raw sample i.e. 7 days old were acidic in nature which is totally unfit for agriculture.

**2. Electrical Conductivity**

The Electrical conductivity in any sample is very important to check the quality of the sample and it fitness for use. In this study, the EC was estimated to know its quality. The higher conductivity changes the chelating properties of water bodies and produces an imbalance of free metal availability (Ajitha V et al., 2015).

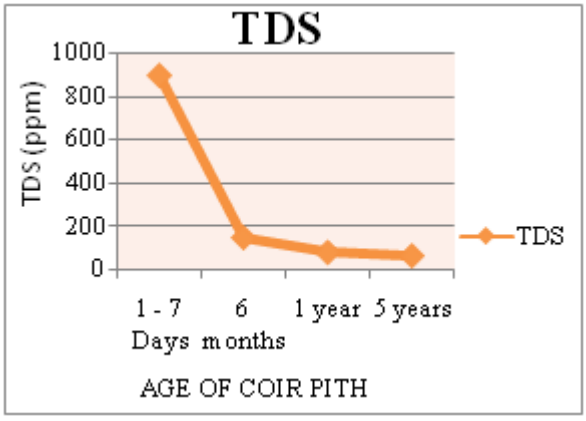



**Graph 2:** Comparison of EC of Coir Pith Heaps

Initially, in the raw sample, the EC was observed to reduce gradually from the fresh sample i.e. 7 days old to the old sample i.e. 5 years old, proving the delayed degradation by natural consortia of microbes which had been used as its substrate.

**3. TDS**

Total Dissolved Solids (TDS) was estimated for the collected samples to know the presence of total salt contents. The large amount of dissolved solids might be due to the presence of inorganic salts and small amounts of organic matter dissolved in water (Rojith G. and Bright Singh I.S, 2013).

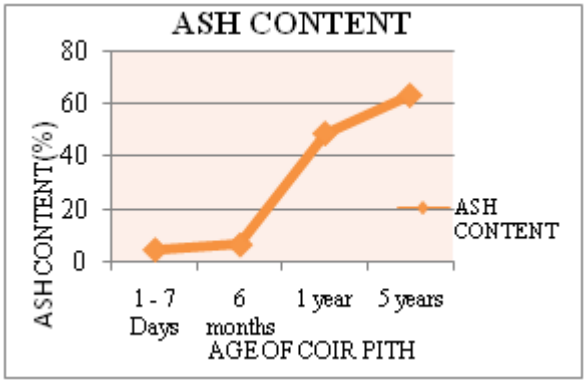



**Graph 3:** Comparison of TDS of Coir Pith Heaps

Initially, in the raw sample i.e. 7 days old, the TDS was observed very high which is not desirable for domestic use, later as it was getting older i.e. 5 years old, the TDS was recorded to have reduced values.

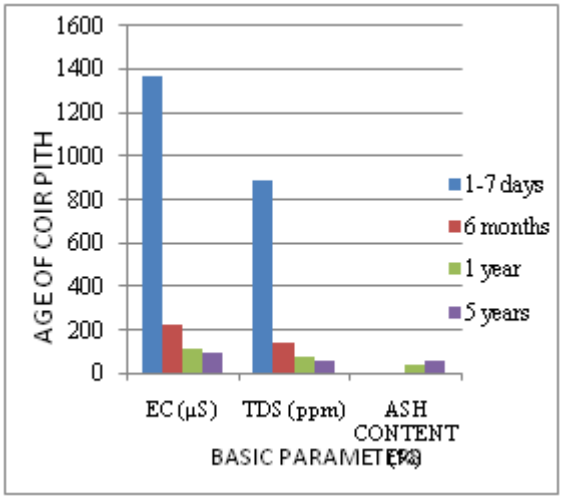
**4. Ash Content:**

The ash content of the samples was tabulated below after drying at the particular temperatures(Ajitha V et al., 2015)




**Graph 4:** Comparison of ASH Content in Coir Pith Heaps

The ash content determined varied so much and the highest ash content was possessed by the oldest sample i.e. 5 years and the least ash content ability was found with raw sample i.e. 7 days old. High ash content in the sample implies the improvement of plant growth and increased organic matter.




**Graph 5:** Graph showing the varying basic parameters in the coir pith samples

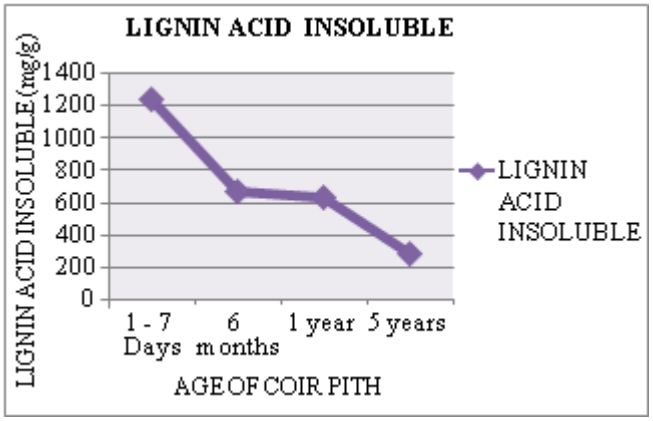
## 4. Chemical Parameters of the Samples

The chemical parameters such as Lignin, cellulose and Hemicellulose contents were estimated and tabulated for all the samples.

### 1. Lignin Content:

- **Lignin Acid Insoluble Residue (AIR):**

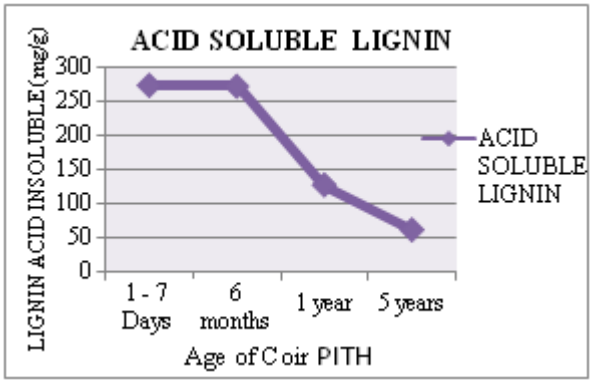
Lignin acid insoluble was calculated using
AIR = m/M x 1000 where
M – Oven dry weight of sample
m – weight increase after drying



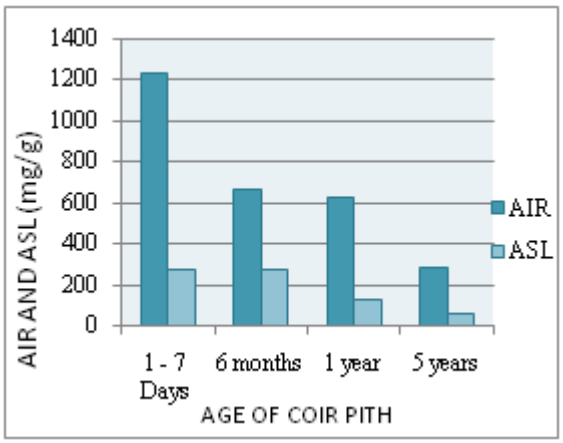

**Graph 6***:* Comparison of Acid Insoluble Lignin in Coir Pith Heaps

- **Acid Soluble Lignin (ASL)**

Acid soluble lignin was calculated by
ASL = AxDxV /axbxM x 1000 where
A = Absorption at 205 nm
D = Dilution factor
V = Volume of the filtrate
A = Extinction coefficient of lignin (110 g/l)
b = cuvette path length
M = weight of the sample

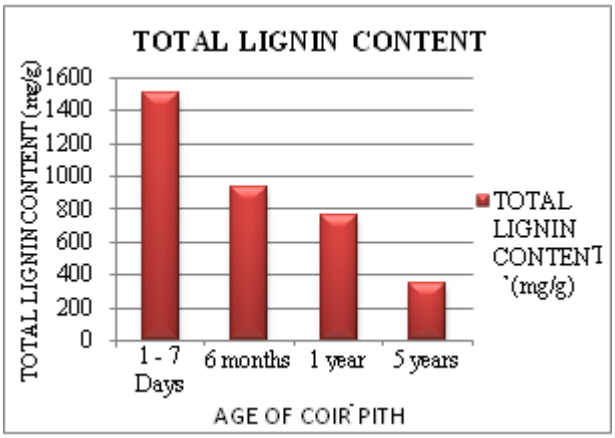



**Graph 7:** Comparison of Acid Soluble




**Graph 8:** Graph showing the Acid soluble and Acid insoluble Lignin content amounts in the coir pith

Total Lignin content – AIR + ASL




**Graph 9:** Graph showing the Total Lignin content amount in the coir pith

High content of Lignin in the coir pith causes slow decomposition leading to leaching (Ajitha V et al., 2015). In the collected samples**, t**he total Lignin content was observed to be higher in the raw coir pith sample i.e 7 days old of 1506.29 mg/g followed by 1 year, 6 months and 5 years. The oldest sample i.e. 5 years old was found to have least lignin content which symbolized the decomposition rate taken was >5 years utilized by the microbes as substrate.

### 2. Cellulose Content:

- **Alpha Cellulose Content:**

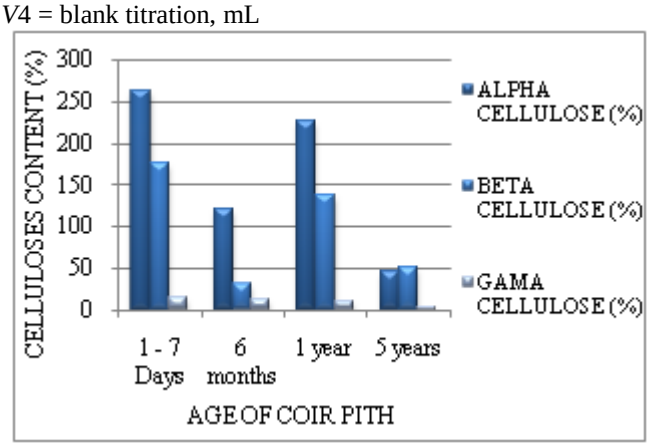
Alpha-cellulose, % = 100 - 6.85 (*V*2 - *V*1) x *N* x 20/ *AxW*
where:
*V*1 = titration of the pulp filtrate, mL
*V*2 = blank titration, mL
*N* = exact normality of the ferrous ammonium sulfate solution
*A* = volume of the pulp filtrate used in the oxidation, mL
*W* = oven-dry weight of pulp specimen, g

- **Beta Cellulose Content**

Beta-cellulose, % = 100 _ (alpha-cellulose % + gamma-cellulose %)

- **Gamma Cellulose Content:**

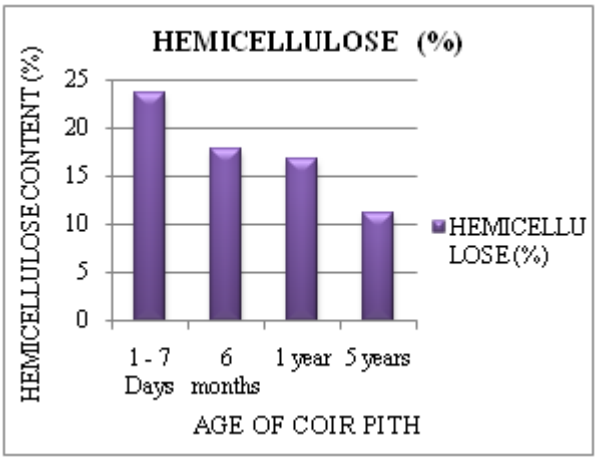
Gamma cellulose, % = [6.85 (*V*4 _ *V*3) x *N* x 20] / [25 x *W*]
where:
*V*3 = titration of the solution after precipitation of beta-cellulose, Ml
*V*4 = blank titration, mL




**Graph 10:** Graph showing the Cellulose content in the coir pith

The alpha, beta, gamma celluloses content was observed to be higher in the raw coir pith sample i.e. 7days old of 261.68 mg/g, 175.88 mg/g, 14.2 mg/g followed by 1 year, 6 months and 5 years. The oldest sample i.e. 5 years old was found to have least celluloses content which was a clear evidence for the decomposition taken place by microbes.

### 3. Hemicellulose Content




**Graph 11**: Graph showing the Hemicellulose content in the coir pith

The hemicellulose content was observed to be higher in the raw coir pith sample of 23.6% followed by 1 year, 6 months and 5 years. The oldest sample i.e 5 years old was found to have least hemicellulose content.

## 5. Conclusion

Coir pith as an organic byproduct can be utilized as a raw material for Biogas production which in turn takes decades for decomposing completely. When the coir is heaped years together, it will end up in causing environmental pollution. Coir pith being a good medium for plant growth in Agriculture must be efficiently used rather causing pollution. Poly phenolic content exudation from the coir may affect Nitrogen release from organic residues by forming complexes with proteins, which thereby stops decomposition. Hence, in this study, 4 samples of coir pith as a function of time were selected and the chemical contents were compared after its slow degradation studies. It was observed that the raw coir pith contained higher polluting parameters. Coir pith can be treated with the help of lignin degrading microbes in the raw stage itself to avoid pollution and can be used as the raw material for Biogas production and plant growth medium in an eco-friendly way satisfying the concept of 'WOW' (Wealth out of Waste).

**Patent Details**
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