Advances in Biological Research 4 (4): 198-200, 2010
ISSN 1992-0067

Utilization of Coir Waste as a Soilless Medium

[1]P. Ronald Ross, [2]P. Thenmozhi and [3]S. Paul Raj

[1]Department of Zoology, Annamalai University, Annamalai Nagar - 608 002
[2]Department of Zoology, St. Joseph's College, Cuddalore - 607 001
[3]Department of Natural Resources and Waste Recycling, Madurai Kamaraj University, Madurai - 625 021

Abstract: After the removal of the nuts, the coconut husks are being used as raw material for manufacturing coir fibre. The coir waste, bye-product of the coir extraction process is considered as a reject and no value addition to it is so far known. Huge quantities of coir waste generated during coir extraction are being dumped in huge mounds. These coir waste had been collected from East Coast and West Coast of Tamil Nadu, India, for EC and pH studies. The EC was as high as 11.25 mS/cm in the East Coast and 8.08 mS/cm in the West Coast. The pH was 6.75 in the East Coast and 7.88 in West Coast. The coir waste causes air, water and soil pollution and poses a huge threat to the vegetation as well. The methods to transport, treat and utilize this coir pith in a constructive way are discussed.

Key words: Retting · Coir pith · Mounds · Electrical conductivity · Surface area · Bulk density

INTRODUCTION

Coir waste or coir pith is generally a mixture of dust, bits and fibres of lesser length which are rejected during the process of coir extraction. This coir pith accounts for about 50-60 percent of the total weight of the husk [1].

Coir extractions are being carried out either by retting method or through mechanical process. The retting is carried out by two methods in which salinity and periodical flushing are the pre-requisites. They are

- The husks are immersed in saline backwaters stagnated in coastal trenches of 2 mts depth for 4 to 12 months.
- The husks are bundled in nylon nets and suspended in backwaters for 4 to 12 months.

In the mechanical process, the fresh unretted husks are directly deployed for coir fibre extraction using fibre extracting machine.

In both the processes, huge quantity of coir pith is being generated which are piled up as giant mounds since they are not effectively utilized for any value added applications. These mounds are considered nuisance and widely referred to as soiled wastes. These coir pith mounds occupy a lot of space in the vicinity of the factory. It is assessed that around 7.5 million tonnes of coir pith is being produced annually [2] in India. The accumulation of this rejected coir pith around coir fibre processing centers year by year is creating disposal problems. Being a light weight dust, it is easily blown by wind causing air pollution. It cannot be fired and disposed due to high level of ash and because of the emission of fugitive gases continuously for several days. The leaching from the dumping yards during monsoon are also considered to create environmental pollution. Due to the high moisture content, it cannot be used as a fuel as well. Ultimately it poses fire hazard, space problem, health hazard and disposal problem if an appropriate solution is not found.

In the present study coir pith samples were collected along the East Coast and West Coast of Tamil Nadu and subjected for EC and pH studies. A suitable method for the bulky transportation of the coir pith, the way of disposal of coir pith by utilizing it as a soilless medium were suggested.

MATERIALS AND METHDOS

The coir pith required for the present study were collected from the coir mounds closer to the coir industries located in various places of East Coast and

Corresponding Author: P. Ronald Ross, Department of Zoology, Annamalai University, Annamalai Nagar - 608 002

West Coast of Tamil Nadu State. In each place, five mounds were sampled. Always fresh mounds were sampled as aged materials would loose their original quality. During collection, the surface layer of the mound was scrapped out and around 1 kg of unexposed coir pith was collected. All the five samples were pooled and sealed in a polyethylene bag. These bags were transported to the laboratory within 24 h of collection for further studies.

Coir pith was graded and analysed for Electrical Conductivity (EC) and pH. The above analysis was made on distilled water extracts of 1 1.5 ratio using conductivity meter and pH meter respectively.

Another constraint in frequent usage of coir pith by a normal farmer is the herculian task of transportation due to its advantageous bulk density. Hence the dusty pith material during transportation is made suitable by compressing the coir pith to a desirable dimension. For this a low cost compression unit was fabricated in our laboratory. After reaching the field, the compressed material is easily made to expand to its original form by adding water.

High electrical conductivity (EC) of coir pith is the other major constraint in using it as a soilless medium. The higher level of EC in pith can be easily rectified by washing it with good quality fresh water. Hence in the present study, attempt was made to reduce the EC of coir pith, to make ease its transportation and to utilize it as an effective soilless medium.

RESULTS AND DISCUSSION

Irrespective of the sampling location, the electrical conductivity was found relatively higher in the smaller grade. Retted coir pith of West Coast had a lower EC compared to that of the retted coir pith of East Coast. As the total surface area and the bulk density are high in the smaller particles, they may tend to absorb more saline water within them during retting and that might be the reason for the higher level of EC in smaller grades (Table 1).

The pH of the graded coir pith indicated a mild inverse relationship with the size of the particles. Generally lower pH has been preferred in soilless medium since most of the macro and micro nutrients needed for the growth of the plants are available only at low pH.

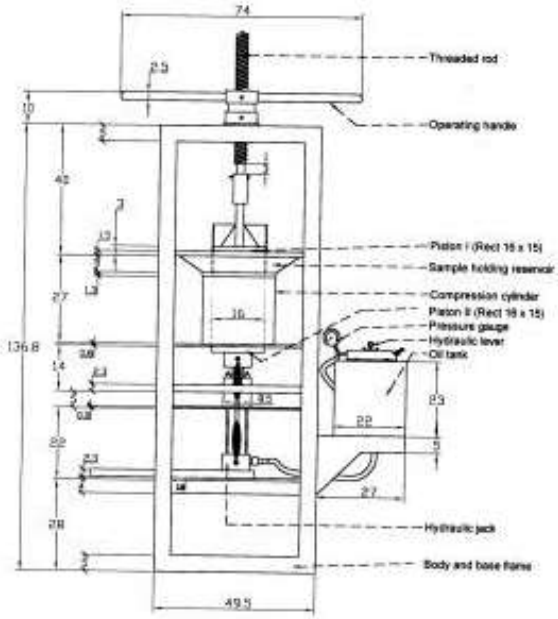

Fig. 1: Sectional view of the coir pith compression machine

Table 1: Electrical Conductivity (EC) and pH of retted coir pith collected from various places (Analysis made on the distilled water extract of 1: 1.5 ratio)

EC (mS/cm)	100-200	11.25±4.17	8.41±4.36
	200-500	11.05±5.16	8.31±4.16
	500-1000	10.64±5.09	8.17±4.13
	1000-2000	10.15±4.95	8.08±4.08
PH	100-200	6.75±0.21	7.88±0.57
	200-500	6.71±0.19	7.67±0.74
	500-1000	6.62±0.31	7.59±0.88
	1000-2000	6.43±0.25	7.52±0.89

For the purpose of transportation of coir pith, a simple compression machine was fabricated and the design is given in Fig. 1.

The compression study revealed that the volume and the weight of the compressed coir pith were higher in the smaller grades which decreased with the increase in the particle size (when identical volume of pith was compressed under identical pressure). The percentage of compression achieved was low in the smaller grades and high in the bigger grades. This compression could be explained as a packing effect of a mass of material by applying a mechanical force [3]. The application of this packing effect automatically decreased the volume of the material subjected to mechanical compression. As bigger grade coir pith has more pore space (vacant spaces), the packing effect decreased the volume occupied by pores

Table 2: Compressibility of coir pith of different grades

Compression applied (kg/cm^3)	Coir pith particle size (micron)	Volume of coir pith used for compression (cc)	Volume of compressed coir pith (cc)	Dimension of compressed coir pith (cc)			Weight of compressed coir pith (g)	Compression (%)
				l	b	h		
400	100-200	5400	1680	16	15	6.7	769	70.22
400	200-500	5400	1560	16	15	6.5	576	71.11
400	500-1000	5400	792	16	15	3.3	402	85.33
400	1000-2000	5400	720	16	15	3.0	327	86.67

Table 3: Effect of sequential washing with water on the electrical conductivity (EC) of different grades of coir pith

Parameter	Coir pith particle size (micron)	Unwashed	I wash	II wash	III wash	IV wash	V wash
EC (ms/cm)	100-200	3.80	0.8	0.2	0.1	0.1	0.1
	200-500	3.74	0.8	0.2	0.1	0.1	0.1
	500-1000	3.49	0.7	0.2	0.1	0.1	0.1
	1000-2000	3.41	0.7	0.2	0.1	0.1	0.1

and hence those particles attracted higher percentage of compression. The packing effect also increased the density and strength of the material mass (Table 2).

As the bulk density is inversely proportional to the quantum of volume reduction achieved, bigger particles which were low in bulk density were greatly compressed which would cause reduced infiltration of water and restriction of root growth.

It is also evident that electrical conductivity being an index of the dissolved salt position, governs the suitability of a soilless medium for plant growth. In the sequential washing of coir pith, the electrical conductivity reached a constant value of 0.1 mS/cm from the 3rd wash onwards. Even in first washing, massive EC reduction was achieved in bigger particles as bigger pores between the particles allowed more water to pass through. Chin [4]; Chauhan [5] and Feil [6] also stated that the EC of the coir pith could be brought down by washing it with quality water (Table 3).

CONCLUSION

In the present study, the coir pith which had a very high EC at the time of collection were tested prone to massive EC reduction on washing with quality water and this serves as a favourable sign of utilizing it as a soilless medium for the culture of ornamental as well as vegetable crops. More over, as land space is also dwindling day by day due to excessive urbanization, coir pith could be used for terrace gardening also. Nutrient supplementation can be provided through modified irrigant supply to the cultured crops. A suitable method of transporting coir pith after compressing to a desirable dimension was also achieved.

REFERENCES

1 Bhowmic, B.B. and C.R. Debnath, 1985. Coir fibre, Part II. Potentiality of coir fibre products. Indian Cocon. J., 16(3): 7-10.

2. Kamaraj, C.M., 1994. Exportable coir products in Tamil Nadu. The Coconut Wealth, 1(6): 6-8.

3. Abu-hamdeh, N.H. and J.A. Amayreh, 2001. Effect of tyre inflation pressure, wheel load and basic tillage systems on root density and soil compaction. J. Indian Soc. Soil Sci., 49(1): 42-50.

4. Chin, A., 2001. Cocopeat media for agricultural application experiences in Israel and India. In: Proceedings of India International Coir Fair, 12th Oct., 2001, Coir Board, Cochin, India.

5. Chauhan, G.C., 2001. Substrate culture-roses and gerberas. In: Proceedings of India International Coir Fair, 12th Oct., 2001, Coir Board, Cochin, India.

6. Feil, H., 2001. Coir peat products for agriculture in relation to Dutch quality standards. In: Proceedings of India International Coir Fair, 12th Oct., 2001, Coir Board, Cochin, India.