International Journal of Pure and Applied Zoology
Vol. 1, Issue 3, pp: 231-234, 2013

ISSN (Print) : 2320-9577
ISSN (Online): 2320-9585
http://www.ijpaz.com

Research Article

INFLUENCE OF SEQUENTIAL WASHING ON THE pH AND ELECTRICAL CONDUCTIVITY OF GRADED COIR PITH

J. Paramanandham, P. Ronald Ross*, J. Vaidehi and K.S. Abbiramy

Department of Zoology, Faculty of Science, Annamalai University,
Annamalai Nagar-608 002 Tamil Nadu, India

Article History: Received 21st August 2013; Revised form 1st September 2013; Accepted 3rd September 2013; Published online 4th September 2013

ABSTRACT

Coir pith is being considered as a waste generated during the separation of fibres from the husk. It is a light weight spongy material, and has lignin, cellulose, hemicelluloce and protein in substantial amount. In the present study, the pH and electrical conductivity (EC) were analyzed in the sieved coir pith during sequential washing. The results indicated that the hydrogen ion concentration was low in unwashed and first washed coir pith and high in final wash and simultaneously EC was high in unwashed and low in seventh washed coir pith extract. The final washed coir pith could be taken to future studies, because a suitable pH and EC had been achieved in the final wash. The results suggest that, pH and EC are the major influencing factors that determine the quality of any soilless media and the ways to bring them to an optimum level.

Keywords: pH, electrical conductivity, coir pith, sieves, soilless.

INTRODUCTION

Coir pith is a highly porous substance generated during the extraction of coconut fibres from the husk. These husks are being utilized as a raw material for the production of coir fibre. During the extraction of coir fibre from the husk, a light weight spongy material is being released called coir pith, which accounts 50-60% of the total mass of the husk. In India huge quantities of coir pith are generated, which are considered as waste (Mathew *et al.,* 2000). Namasivayam *et al.* (2001) have stated that coir pith is the name given to the short fibres and dusts left behind after the extraction of industrially valuable long fibre of coir from the husk and is a lignocellulosic biomass, which is recalcitrant under ordinary conditions. This lignocellulosic waste material is consisting of lignin 20-40%, cellulose 40-50%, hemicelluloses 15-35% and protein 2.04%. It has a sizable percentage of combustible matter along with low ash content. It is a fluffy and spongy material with highly significant and unique water holding capacity, and is extremely compressible. Large amounts of coir pith (approximately 7.5 million tons annually in India) accumulate nearby coir processing units, causing severe disposal problems, fire hazards and ground water contamination due to the release of phenolic compounds from the matrix.

Prior to the utilization of coir pith as a soilless medium, it has to achieve a suitable pH and electrical conductivity (EC) with the help of quality water. Considering the abundant scope for utilizing coir pith as a soilless media in many countries, especially in terrace gardening operations with vegetable crops and ornamental plants, it is understandable that such soilless medium's primary function largely depends on the pH and EC of the particle involved. The pH plays a significant role in the availability of nutrients especially micronutrients (Landis, 1990) and consequently it reveals upon plant growth and yield (Rippy *et al.,* 2004). Murali *et al.* (2011), Kasthuri *et al.* (2011) and Ross *et al.* (2012) have revealed the significance of pH and EC in coir pith. Thus the present investigation was initiated to find out the impact of sequential washings on the pH and EC of the various particular grades of coir pith.

*Corresponding mail: r_ross1971@yahoo.co.in

MATERIALS AND METHODS

Coir pith required for the present study was collected from the coir mounds in the vicinity of a coir industry at Old Town, Cuddalore, Tamil Nadu, which is about 50 km away from Annamalai University. It was then transported to the laboratory and subsequently long fibres and extragenous materials, if any, were removed by hand sorting. As the collected coir pith mass was formed of assorted particles of varied size it was sorted out into different grades (Savithiri *et al.*, 1991) based on the particle size using brass test sieves of varied pore size (Agnew and Leonard, 2003).

Coir Pith Extract

Graded coir pith extracts were prepared as per the procedures followed by Ross (2002) and Edsor (2005), which were the modified procedures of Landis *et al.* (1989) and Lang (1996). The sieved pith was taken in a glass tray. It was wetted by spraying distilled water until one or two drops came out on squeezing with hand. In a measuring cylinder, distilled water was taken up to 333 mL mark. Then the wetted pith was introduced into the same cylinder till the total level reached 500 mL mark. The contents were continuously stirred with a glass rod for 20 minutes. The mixture was then transferred to a glass tray and squeezed with the help of cloth. The resultant extract was collected and filtered through a Whatman No. 1 filter paper. The filtered extract was used for the analysis of pH and EC in sequential washing.

pH and conductivity measurements were made on the aqueous extracts of graded raw coir pith using pH meter (HI2215pH/ORP Meter) and conductivity meter (Conductivity meter 304) expressed as mS/cm.

Statistical Analysis

All the values were statistically analyzed using SPSS package 11.5 at 5% level of SNK (Student–Newman–Keuls) method ANOVA.

RESULTS AND DISCUSSION

pH of Coir Pith in Sequential Washing

The pH of the coir pith extracts ranged from 5.97 to 8.02, 5.98 to 8.05, 6.74 to 8.24 and 6.52 to 8.38 respectively in four different grades (0-200µm; 200-500µm; 500-850µm and above 850µm) of coir pith in sequential washing with distilled water and is illustrated in Table 1. The pH of the graded coir pith was moderately acidic in nature in first wash and it reached near alkaline after the final wash. Similar results had been reported by several authors who stated that; pH plays an important role in the availability of nutrients especially micronutrients to the cultured plants (Landis, 1990; Krishnasamy *et al.*, 2002; Pardo *et al.*, 2003).

Pennisi and Thomas (2005) reported that if pH is too low (<4), micronutrients become more mobile and are absorbed in excess by the plant, resulting in a state of potential toxicity. If it is too high (>9), micronutrients are less mobile and the plant cannot absorb enough that result in deficiencies. Rippy *et al.* (2004) also suggested the same concept with respect to the plant growth and yield. Recently, Ross and Paul Raj (2010) revealed the same parameter after sequential washing, which reached alkaline and stated that the pH of the graded coir pith indicated a mild inverse relationship with the size of the particles.

Table 1. pH of the coir pith in sequential washing (Mean ± SD).

Groups	0-200µm	200-500µm	500-850µm	>850µm
I Wash	5.97±0.18	5.98±0.51	6.74±0.01	6.52±0.04
II Wash	6.70±0.08	6.49±0.01	7.17±0.04	7.25±0.01
III Wash	6.97±0.02	7.24±2.65	7.69±0.07*	7.85±0.07
IV Wash	7.46±0.02*	7.65±0.03*	7.78±0.15*	8.15±0.04*
V Wash	7.47±0.03*	7.81±0.14*	8.24±0.07*	8.12±0.04*
VI Wash	7.59±0.04	7.92±0.04	8.24±0.08*	8.37±0.04
VII Wash	8.02±0.02	8.05±0.03	8.24±0.04*	8.38±0.06

* Non significant at 5% level of ANOVA (SNK).

Electrical Conductivity of Coir Pith in Sequential Wash

Electrical conductivity of the coir pith extracts ranged between 5.20 and 0.21, 6.50 and 0.14, 2.70 and 1.82 and 9.00 and 1.84 respectively in four different grades (0-200µm; 200-500µm; 500-850µm and above 850µm) of coir pith in sequential washing with distilled water and is revealed in Table 2.

Table 2. Electrical Conductivity of coir pith in sequential washing (Mean ± SD).

Groups	0-200µm	200-500µm	500-850µm	>850µm
I Wash	5.20±0.07	6.50±0.01	2.70±0.01	9.00±0.05
II Wash	1.50±0.02	2.30±0.02	2.30±0.05	4.00±0.07
III Wash	0.53±0.01	0.70±0.01	2.20±0.04	2.50±0.06
IV Wash	0.39±0.01	0.29±0.01	2.00±0.07	2.10±0.10
V Wash	0.23±0.02*	0.14±0.01*	1.90±0.01	1.92±0.04*
VI Wash	0.21±0.02*	0.14±0.01*	1.82±0.01*	1.92±0.03*
VII Wash	0.21±0.02*	0.14±0.01*	1.82±0.02*	1.84±0.02*

* Non significant at 5% level of ANOVA (SNK).

Electrical conductivity of the various grades of coir pith was observed to be high in higher grade of coir pith (9.0 mS/cm) and low in 500-850µm (2.70 mS/cm). The ideal EC was reported to be 0.2 to 0.5 mS/cm. The task of the output was also out shown by several researchers and indicated that low electrical conductivity was ideal for further utility (Chin, 2001; Chauhan, 2001; Feil, 2001). Earlier, Bunt (1988) and Cox and Smith (1997) have reported the salt level of coir pith samples from Mexico and Thailand as significantly high, which adversely affected the growth of certain salt sensitive plants and reduced the nutrient availability. Mak and Yeh (2001) revealed that the high EC of the coir pith based medium caused high physiological stress to *Spathiphyllum* when grown under sub-irrigation conditions.

CONCLUSIONS

The above all facts and the outcome of the present study substantiate the significance of a balanced pH and EC in coir pith which only could lead to its further utilization as a potential soilless medium. A detailed study is being suggested to subject the above treated coir pith for vermicomposting using congenial earthworm species so that it could be converted into a valuable biomass that could support any kind of culture operations. Moreover, microbial degradation can also be carried out in coir pith to enhance the microbial population which could increase the yield of vegetable crops if grown at large. Further studies need to be conducted on the above mentioned aspects in near future.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests associated with this article.

ACKNOWLEDGEMENTS

The authors gratefully thank the University Grants Commission, Govt. of India, for the financial support rendered to execute the project and the authorities of Annamalai University for their kind gesture that enabled to carry out this work and publish the findings.

REFERENCE

Agnew, J.M., and Leonard, J.J., 2003. The physical properties of compost. *Comp. Sci. Util.* 11: 238-264.

Bunt, A.C., 1988. Media and mixes for container-grown plants. A manual on the preparation and use of growing media for pot plants (2nd Ed.) Unwin Hyman Ltd, London, UK. P. 307.

Chauhan, G.C., 2001. Substrate culture- Roses and Gerberas. *In: Proc. India Int. Coir Fair* 12th Oct., 2001, Coir Board, Cochin, India.

Chin, A., 2001. Cocopeat media for agricultural application experiences in Israel and India.

In: *Proc. India Int. Coir Fair*, 12th Oct., 2001, Coir Board, Cochin, India.

Cox, J.D.L., and Smith. I.E., 1997. The interaction of air-filled porosity and irrigation regime on the growth of three woody perennial (Citrus) species in pine bark substrates. *SNA Res. Conf.* 1000, Johnson Ferry Road, Suite-130, Marietta, GA-30068-2100. 42: 169-174.

Edsor, C., 2005. Performance of chosen earth-worm species on the vermicomposting of coir pith. *Ph.D., Thesis*, Madurai Kamaraj University, Madurai, India.

Feil, H., 2001. Coir peat products for agriculture in relation to Dutch quality standards. *In*: *Proc. India Int. Coir Fair*, 12th Oct., 2001, Coir Board, Cochin, India.

Kasthuri, J., Cholarajan, A., Vijayaumar, R., and Muthuumaran, P., 2011. Physico-chemical and Microbial analysis of coir industry effluent. *Asian J. Res. Pharm. Sci.*, 1: 44-46.

Krishnasamy, R. Somasundram, J., and Savithiri. P., 2002. Sewage sludge-coir pith pellets: A source of organic manure. *17th World Congress of Soil Science.* 14-21 August, Bangkok, Thailand, Paper no. 344:1-11.

Landis, T.D., 1990. The container tree nursery manual: Containers and growing media. USDA Forest Service, Washington D.C. 2, pp: 1-54.

Landis, T.D., Tinus, R.W., McDonald, S.E., and Barnett, J.P., 1989. The container Tree Nursery Manual: Vol. 4 Seedling Nutrition and Irrigation. USDA Forest Serv. *Agric. Handb*. 674: 171-179.

Lang, H.J., 1996. Growing media testing and interpretation. In: D.W. Reed (Ed) Water. Media and nutrition for greenhouse crops. Ball Publishing Inc., Batavia, Illinois, pp. 123-139.

Mak, A.R.Y., and Yeh, D.M., 2001. Nitrogen nutrition of *Spathiphyllum* sensation grown in sphagnum peat and coir based media with two irrigation methods. *Hort. Sc.* 36: 645-649.

Mathew, A.C., Singh, T.V., and Bosco, S.J.D., 2000. Technology to produce biogas from coir pith. *Indian Cocon. J.,* 31(3): 46-48.

Murali, M., Bharathiraja, A., and Neelanarayanan, P., 2011. Conversion of coir waster (*Cocos nucifera*) into vermicompost by utilizing *Eudrilus eugeniea* and its nutritive values. *Indian J. Fund App. Life Sci.*, 1: 80-83.

Namasivayam, C., Dinesh Kumar, M., Selvi, K., Ashruffunissa Begum, R., Vanathi, T., and Yamuna, R.T., 2001. Waste coir pith a potential biomass for the treatment of dyeing wastewaters. *Biom. Bioen.*, 21(6): 477-483.

Pardo, A., Juan, J.A.D., and Pardo, J.E., 2003. Characterisation of different substrates for possible use as casing in mushroom cultivation. *Food Agri. Environ.*, 1: 107-114.

Pennisi, B.V., and Thomas, P.A., 2005. Essential pH management in greenhouse crops. Bulletin 1256. Issued in furtherance of co-operative Extension work, Acts of May 8 and June 30, 1914, The University of Georgia College of Agricultural and Environmental Sciences and the U.S Department of Agriculture Co-operating.

Rippy, J.F.M., Peet, M.M., Louws, F.J., and Nelson, P.V., 2004. Plant development and Harvest yields of greenhouse tomatoes in six organic growing systems. *Hort. Sci.*, 39: 1-7.

Ross, P.R., 2002. Studies on coir pith as an artificial soil medium. Ph.D., Thesis, Madurai Kamaraj University, Madurai, India.

Ross, P.R., Paramanandham, J., Abbiramy K.S., and Muthulingam. M., 2012. Determination of physico-chemical properties of coir pith in relation to particle size suitable for potting medium. *Int. Res. Environ. Sci. Tech.*, 2: 45-47.

Ross, P.R., and Paul Raj, S., 2010. Utilization of coir waste as a soilless medium. *Adv. Biol. Res.*, 4: 198-200.

Savithri, P., Subbiah, S., Nagarajan, R., Mani, S., and Gopalswamy, A., 1991. Effect of composted coir pith and gypsum applications on soil properties and yield of rice in sodic soil. *In: Proceedings of Seminar on "Utilization of Coir Pith in Agriculture"* 20th Nov. Tamil Nadu Agricultural University, Coimbatore, India, pp: 129-135.