Global Science Research Journals

Global Journal of Medicinal Plant Research

Extended Abstract Open Access

Development of biodegradable plant nursery polybags from industrial lignocellulosic wastes

Elwin M1 and Sreenivasan E2

1Depatmentof Wood Science and Technology, Mangattuparamba Campus, Kannur University, Kannur,Kerala, India

2R & D Division, The Western India Plywoods Ltd, Baliapatam, Kannur,Kerala, India

Abstract:

In India, lignocellulosic wastes are generated in huge quantities from various wood-based industries and the management of these materials has not yet gained the much needed attention, although the use of these low cost, abundant biomass resources has recently been projected to play an important role in our sustainable development. Finding new methods of waste utilization could help in our efforts to mitigate global climate change by reducing emissions as well as decreasing dependence upon fossil fuels. In order to address the environmental concerns regarding the use of plastic nursery polybags, the present study was undertaken to explore the possibility of using industrial biowastes for making nursery polybags. Biodegradability, root coiling and difficulty in the removal of stocks without shock are some of the major attributes considered during the development of biodegradable plant nursery polybags from industrial lignocellulosic waste materials.

Key words: nursery polybags, lignocellulosic wastes

Introduction:

In India, use of plastic nursery polybags plays a vital role in the early stages of our plant cultivation. During 2000-01, polybags produced in forest department nurseries alone constitutes 20,914.47 lakhs and during 2001-02 it was about 19,977.48 lakhs. Polybags of 10,000 to 15,000 lakhs per year and 2500 to 10,000 lakhs per year of plastic root trainers are being used in Indian forest nurseries. Apart from environmental concerns plastic nursery polybags cause spiralling of roots and improper growth of tap root which results in poor plant resistance towards stress conditions. Another plant growth related concern is the removal of stock which may imparts shock to the root system of the seedlings, which affect plant development. Hence, the present study was carried out to use various easily available biowastes for making nursery polybags in order to address the environmental and other concerns regarding the use of plastic nursery polybags.

Fig.1: Sample polybags with Swietenia macrophylla seedlings

Methods:

Various industrial lignocellulosic waste materials such as sawdust, softboard trimming waste, tree bark, coconut fibre, shredded currency notes and paper mill sludge (PMS) were collected from the campus of The Western India Plywoods Ltd. PMS was converted to a binder solution and the sample polybags were prepared accordingly:

S1.Sawdust + PMS binder solution

S2.Sawdust + Softboard trimming waste + PMS binder solution

S3.Sawdust + Coconut fibre + PMS binder solution

S4.Bark + Shredded currency notes + PMS binder solution

S5.Shredded currency notes + PMS binder solution

S6.Shredded currency notes + Coconut fibre + PMS binder solution

The plant growth and durability study is conducted in five samples excluding the first one using the seedlings of Swietenia macrophylla. Water retention is determined in four samples which exhibit better plant growth and durability, excluding the first and fifth samples. Water retention is determined by the weighing of each sample polybags in an electronic weighing balance in five sets sequentially with one hour of time interval. To study the root growth and root coiling, seeds of Vigna radiata were used. Types of samples under the study were the same as in the water determination. Root growth pattern of seedlings germinated were examined, beyond the root growth same seeds were made mixed with the raw materials during the sample preparation. Growth patterns of these seeds without potting mixture were also observed. Using the same types of four samples as in previous case biodegradability was examined. Biodegradability was observed under soil conditions for ten days.

Discussion:

Among the six samples prepared only five samples found to be successful, the first combination ie, sawdust plus PMS binder solution, was a failure. After one month, it was observed that plant growth is supported by the five sample polybags used. And these polybags not undergone any deformation in terms of structural appearance, but the fifth sample exhibits more flexibility in the same period. The more flexible one can be devoted for fast growing plants. In the case of water retention of samples, the S2 sample exhibited the highest water retention. The S4 and S6 samples showed the least water retention and an intermediate value between the highest and lowest in the case of sample S3. Within one week Vigna radiata exhibited outward root growth beyond the container wall and this could be attributed to increased porosity and air permeability than in the case of plastic nursery polybags. Biodegradability test on the samples showed the degradation of polybags, except the coconut fibre part make used. The ability of degraded polybags to act as a source of manure with the action of small earthworms was also noticed.

Conclusion:

The present work investigated the possibility of utilizing industrial lignocellulosic waste materials as replacement of plastics for making plant nursery polybags. Apart from the environmental concerns regarding the plastic polybags the biodegradable polybags prepared during this work can address various plant related concerns too. In addition to the preparation of plant polybags, it is possible to develop biodegradable self manuring polybags for eliminating the problem of root coiling. The utilization of the industrial lignocellulosic waste materials is a reliable sense of approach in industrial waste management and to eliminate various issues evolved from the use of conventional plastic nursery polybags.

References:

Bilck A, Olivato J, Yamashita F & Souza J(2014) Biodegradable bags for the production of plant seedlings.Polimeros,24(5),547-553.https://doi.org/10.1590/01041428.1589

Jalil M A, Mian M N, & Rahman M K (2013)Using plastic bags and its damaging impact on environment and agriculture: an alternative proposal. International Journal of Learning and Development, 3(4), 1- 16.

Kharazipour A, Ludwig, K, Chaisaena, W, Polle A & Kues U (2007) Wood and other plant fibres in the production of peat substitutes and pot plant containers. Molecular Wood Biotechnology And Forest Botany And Tree Physiology Institute Of Forest Botany, Georg-August-University Gottingen, 609- 635.

Muriuki J., Kuria WA., Muthuri C, & Mukuralinda A (2013) Testing biodegradable seedling containers as an alternative for polythene tubes in tropical small – scale nurseries. Small-scale Forestry. https://doi.org/10.1007/s11842-013-9245-3

Nandakumar U (1996) Evaluation of alternative materials for use as containers for raising forest planting stock. Kerala Forest Research Institute Peechi, Thrissur.

Ouya D (2013) Biodegradable seedling bags could grow stronger trees, but can they replace polythene? Agroforestry World. Agroforestry World. https://blog .world agro forestry. org/ index. php/2013/08/20/biodegradable-seedling-bags-could-grow-stronger-trees-but-can-they-replace-polythene/.

Soni P, Singh R, & Naithani S (2013) Scope of natural and synthetic biodegradable materials in development of ecofriendly substitutes for nursery polybags- A review. Ejournal of Applied Forest Ecology (Ejafe), 1(1), 35- 44.

Sreenivasan E (2020) Solid waste management and its role in mitigating environmental degradation with special reference to recycling of wood wastes. In: Environmental Degradation: Causes and Remediation Strategies, Volume1, Eds. Kumar, V., Singh, J. and Kumar, P. 166- 182. https://doi.org/10.26832/aesa-2020-edcrs-012r.