IJSAR, 6(9), 2019; 22-24

International Journal of Sciences & Applied Research

www.ijsar.in

The Bacteriological profile of E-waste contaminated soil with reference to Microremediation

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Abstract

Electronic waste or E-waste is generally an unusual expansion to the regularly developing dangerous waste stream. E-waste incorporates an extensive variety of discarded electronics devices like, computers, office electronic equipments, entertainment device, mobile phones, television sets and circuit boards etc. These electronic goods are made of plenty of components which may contain toxic heavy metals as, Lead, Cadmium, and Arsenic etc. These heavy metal gets accumulated in the soil and leaches into the surrounding environment .The dumping of this substance into the environment cause many harmful effects to the living organism. In the present study bacteria was isolated from E-waste contaminated soil. The isolates were found to be Gram positive, Rods.

Keywords: Electronic waste, Bacteria, Heavy metal, Lead, Environment

Introduction

The constantly changing today's world of technologies has lead the serious problem of waste. The solid waste management is a difficult task and is becoming very complicated due to the invasion of Electronic waste (E-waste). E-waste describes discarded electrical or electronic devises includes mobile phone, television set, computer batteries, monitors and circuit board etc. These E-waste contain valuable metals (copper, platinum) as well as potential environmental contaminates, especially Lead, mercury, Nickel, Selenium and Cadmium etc. These components if not processed properly after their disposal leach in to soil and pollute the environment. These heavy metals are toxic even at low concentration. Lead and important component of different electronic goods can cause a wide range of adverse effect on biological systems. The effect includes problems in kidneys, gastrointestinal tract, joints, reproductive systems and chronic damages. To minimize the effect of heavy metal like Lead which is present in landfills of E- waste, different approaches has been followed like chemical oxidation, precipitation etc. An eco-friendly and cost-effective method is microremediation of toxic metals. In this method microorganism play a key role in the removal of metals from the environment. Microremediation is defined as the use of microorganism to

eliminate, contains, or transforms the contaminants to non hazardous foam in the environment through the metabolism of microbes. It has been reported that bacteria like bacillus species, pseudomonas species. are involved in the removal of Lead from soil and waste water.

Materials and methods

Sample collection: The E-waste contaminated soil sample were collected from e-waste dumping sites at Harda District (M.P) using clean, dry and sterile polythene bag along with sterile spatula. The sample was transferred to chemistry lab to check the presence of heavy metals in the soil sample.

Isolation of bacteria: For the isolation of bacteria from e-waste contaminated soil, Nutrient Agar Media was used as culture media .Under sterile conditions, 1gm of soil sample was added to 99 ml of sterile distilled water and was serially diluted up to 10-10 dilutions. The spread plate method was performed by APHA [1992] standard methods. All plates were incubated at 37ºC for 24-48 hours and final counts of bacterial colonies were noted.

Results and discussion

In the present study species of bacteria ware isolated from E-waste contaminated soil sample by standard microbiological methods as shown in the table 1. Among the species of bacteria obtained, the predominantly Bacillus species is predominant which is gram positive, rod-shaped and spore forming bacteria. Bacillus species were able to tolerate a variety of heavy metals at different concentrations. Bacillus species, which is found in E-waste contaminated soil sample was used to have better Lead adsorption capacity from the soil and aqueous solution. The present study focused on the isolation of bacteria resistant to Lead from the E-waste dumping site. The Bacillus species has a capability to absorb Lead which make a way to use this bacterial species as an agent to remove Lead from metal polluted areas. The bacillus species might uptake the metal ions and deposit them on the surface by a process referred to as Bioaccumulation, Bioadsorption which is a type of microremediation process has been reported for many metals including Lead. The Lead resistant bacteria employ different resistance mechanism like efflux mechanism, extracellular sequestration, Biosorption, precipitation, Bioleaching, alteration in cell morphology, enhanced siderophore production and intracellular Lead Bioaccumulation. The Bacillus species reduce toxic metal ions to non toxic state either by adsorbing and complex inside the cell.

Bacterial isolates from E-waste contaminated soil

Bacillus subtilis	+
Bacillus cereus	+
Bacillus megaterium	+
Staphylococcus aureus	+
Pseudomonas sp.	+

Conclusion

E-waste could be a troublesome problem for native as well as worldwide scales. The development of modernization leads to fast degeneration of the electronic gadgets, thus generation mammoth amount of E-waste. The present study reveals that the five types of bacterial species are isolated from E-waste contaminated soil sample. The most important bacterial species are Bacillus subtilis and Bacillus cereus reported in table, which are play a prominent role in the removal of heavy metal like Lead from the environment. The Bacillus sp. resist to heavy metal and adsorb by intercellular mechanism the process referred to as Microremediation. This study showed possibility for development of eco-friendly and effective technologies for the removal of

heavy metals from E-waste contaminated areas.

Acknowledgement

The author is thankful to Mr. Girish sinhal and Mrs.Abhilasha sinhal Directors of Harda Degree College Harda for providing necessary laboratory facility and thankful to Mr. R.K. Patil principal Harda Degree College Harda for giving necessary support for research work.

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