

Phytoremediation, a Biotechnology with Important Applications

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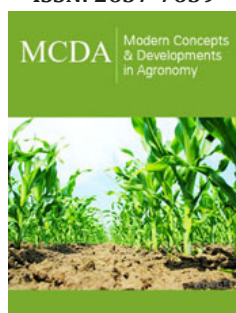
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ISSN: 2637-7659



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Submission:  April 10, 2019

Published:  April 17, 2019

Volume 4 - Issue 1

How to cite this article: Vanesa P C, Martín E. Phytoremediation, a Biotechnology with Important Applications. Mod Concep Dev Agrono.4(1). MCDA.000578.2019.
DOI: [10.31031/MCDA.2019.04.000578](https://doi.org/10.31031/MCDA.2019.04.000578)

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Introduction

The pollutants found in the environment, of natural origin and as a result of human activity, generate a negative impact on ecosystems. The resolution of this type of problems through the application of environmentally friendly technologies are of extreme necessity, one of these technologies is phytoremediation. Pollution with different types of substances has become a phenomenon of great importance because it affects air, water and soil, also disturbing all the ecosystems that develop in them, including humans. Although some contaminants are of natural origin, through the degradation of materials of the earth's crust, but human activities greatly increase the occurrence of certain other contaminants [1,2]. Water pollution is especially important because this pollution often affects freshwater sources, many of which are used for human and animal food. The contamination of water by arsenic (As), fluorine (F), boron (B), vanadium (V), cadmium (Cd), heavy metals, nutrients and organic constituents is of particular concern [3]. In addition to the direct impact of water consumption with excesses of different toxic elements in public health, it must be considered the transfer of the toxic elements from water to crops and from crops to livestock, generated in this way their subsequent incorporation into the human food chain through cereals, vegetables, milk and meats [4,5].

Water treatment plants include water removal systems of different elements especially toxic for humans, however, in many cases the treatments for removal of toxic elements are extremely expensive, which means that people from undeveloped countries, rural areas or towns with few inhabitants cannot access to them, being exposed to severe health problems [6,7]. In response to this need, alternative techniques for the elimination of contaminants from water become increasingly important, with special attention paid those that involve the use of plants [6,8-12]. These techniques, called phytoremediation, are a method of removal of various pollutants used successfully since several years ago in the world [13].

Phytoremediation is applied to eliminate, or diminish, harmful components through the use of plants that have specific capacities to absorb contaminants. The term phytoremediation, used for the first time in 1991 [14], is a technique that uses plants to degrade, contain, extract or immobilize soil or water pollutants, widely studied due to its good cost-effectiveness ratio and absence of adverse implications for the environment [15,16]. Phytoremediation is still in research and development phase, with many technical issues needing to be addressed [1], for example most of the experiments have taken place on a laboratory scale, with plants grown in hydroponic settings fed heavy metal diets, so in this sense agronomic management practices and plant genetic abilities need to be optimized to develop commercially useful practice [1]. Although in recent years there have been more investigations that provide innovative data in the application of these technologies [17,18]. The most important factor for the phytoremediation process to be successful is a suitable plant species which can be used to uptake the contaminants [18]. However, phytoremediation has some technical limitations, and in this way information is needed to consolidate phytoextraction into a cost-effective

method [19]. When the remedial plants manage to establish themselves in large areas, they help to return utilitarian and/or economic potential to the environment, in addition to modifying the aesthetics of the landscape of the contaminated sites [19].

Conclusion

It is essential optimize phytoremediation to ensure water quality in order to begin to reduce the negative impact of some of the contaminants present in the food chain. Generating information on water phytoremediation will be extremely useful for professionals who practice preventive medicine, for agronomic irrigation projects, as well as for the relevant authorities related to the management of water resources, given their responsibility in the delivery and distribution of drinking water to the most affected sectors.

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