Microbial assisted phytoremediation of chlorinated pesticides in a warming climate: Challenges and perspectives

*Abhilash, P.C**

Institute of Environment & Sustainable Development, Banaras Hindu University, Varanasi 221005, India

* pcabhilash@hotmail.com

Introduction

Organochlorine pesticides (OCPs; aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, hexachlorocyclohexane) are one of the priority groups of chemical pollutants found in all environmental media (Weber et al., 2008). They are potentially hazardous to living systems because of their high degree of chlorination, tendency to bio-accumulate in the lipid component of living organisms and their resistance to degradation (Walker et al., 1999; Weber et al., 2008). Most importantly, OCPs are included in Annex A of the Stockholm Convention on Persistent Organic Pollutants – global elimination is planned. There is an urgent need for the scientific community to develop innovative methods for the cleanup of OCP contaminated soils and water. Although a lot of chemical, physical and engineering based approaches have been widely pursued for the remediation and management of OCP contaminated soils, the microbial assisted phytoremediation is getting wider popularity because of its cost effectiveness and potential environmental sustainability. Furthermore, the phytoremediation with multipurpose species will provide other economic benefits such as biomass and biofuel production (Abhilash et al, 2012; 2013)

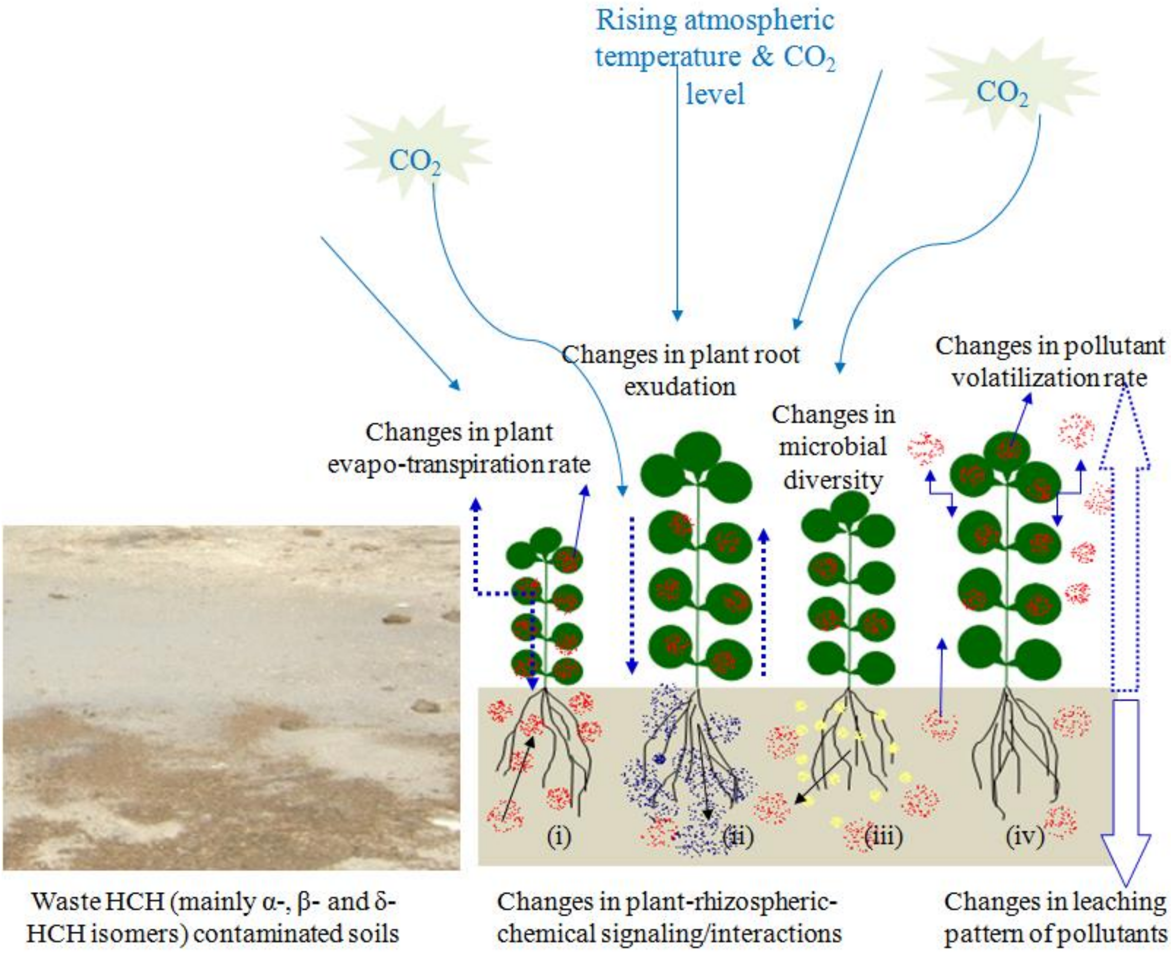

Figure 1. The schematic representation of the plausible impact of climate change on microbial assisted phytoremediation of pesticide contaminated soils.

However, in this time of global warming, the remediation and management of OCP contaminated soil is a difficult task because it has been postulated that the warming climate will significantly affect the fate and behaviour of OCPs in soil systems (**Fig. 1**). The increasing atmospheric temperature is likely to affect the solubility, biodegradability and biotransformation of OCPs. Furthermore, it is widely believed that the increasing CO_2 level and temperature will also affect the plant-microbe-pollutant interactions in the rhizospheric system, principally by altering the root exudation rate and microbial community structure (Walker et al., 2033; Miraglia et al., 2009; Abhilash et al., 2013)

Conclusion

In conclusion, climate change is likely to affect the phytoremediation of OCP contaminated soils and therefore site-specific studies are required to elucidate the real effect of climate change on plant-microbe interactions and bioremediation. Most importantly, strategic and applied research including simulation experiments, predictive ecosystem modelling and ecosystem biology-based approaches (Abhilash et al., 2013) are essential for a better understanding of the issues and processes.

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