Dehalococcoides-assisted reductive dechlorination of xenobiotics and recalcitrant compounds

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Xenobiotics are synthetic chemicals used for domestic, agricultural and industrial purposes which are not intrinsically part of the metabolic process of an organism. Chlorinated xenobiotics are highly dangerous and harmful to human and the environment, hence, their removal from any system is of utmost importance and the need of the hour. Bioremediation, a buzzword for this century, reduces the time and money spent on the removal of hazardous compounds. Bioremediation involving biostimulation and bioaugmentation has emerged as the most advantageous, economically and environmentally viable soil and water decontamination and detoxification techniques. Several bacteria are reported to transform or altogether remove chlorinated xenobiotics from the sites of contamination. Most prominent among them is *Dehalococcoides*, which selectively dehalogenates the chlorinated compounds and converts them into less lethal substances like ethene. This review gives a detailed description of bioremediation strategies for reductive dechlorination of xenobiotics and recalcitrants by the application of *Dehalococcoides*, with a major emphasis on environmental biotechnology research that requires immediate attention to avoid widespread groundwater contamination due to halogenated organic compounds.

Keywords: Agriculture, bioremediation, dechlorination, *Dehalococcoides*, groundwater, persistent chlorinated pollutants.

pollutants. These chemicals include dichlorodiphenyltrichloroethane (DDT), tetrachloroethene (PCE), trichloroethenes (TCE), polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB) and chlorofluorocarbons (CFCs). Widespread usage in a variety of industrial processes such as the manufacturing of plastic, cleaning solutions, propellants, anti-knocking agents in gasoline, as well as their role in being intermediary in the production of essential chemicals makes them prevalent in almost all regions of the earth[2]. Besides, they are also used as herbicides, pesticides and weedicides. Among the chlorinated aliphatics, PCE and TCE are widespread groundwater pollutants[3]. Chlorinated ethenes which include monochloroethene/vinyl chloride (VC), isomers of dichloroethene (DCE), TCE and PCE are toxic and also carcinogenic[4,5]. In the United States, TCE and PCE are most commonly detected in contaminated groundwater systems. They find their way into these systems through point and non-point sources[4]. As they are carcinogenic, the authorities concerned have set maximal admissible concentrations in drinking water[6]. Autoimmune disease in mice is also reported to be caused by these chemicals[7]. TCE and PCE are sparingly soluble, which leads to the improper disposal of these solvents, causing groundwater contamination. The rectification of groundwater contaminated with chlorinated ethenes is a herculean task[8]. Techniques used to alleviate the effects of these pollutants include reduction using zero-valent iron[9]; ad-