

Environmental Biotechnology Research: Why it Matters now More Than Ever?

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Received date: June 06, 2015; Accepted date: June 06, 2015; Published date: June 13, 2015

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Ours is a world of looming challenges and increasingly limited resources. Sustainable development offers the best chance to adjust our course – is aptly said by Ban Ki-moon, Secretary-General of the United Nations. It is the responsibility of every individual and community on this earth to work towards environment protection and preservation. In this era of rapid globalization we tend to forget at times that often the short-sighted and hasty steps with regard to industrial development trigger harm towards the already dwindling natural resources. Contamination of drinking water by industrial effluents, soil contamination by industrial toxic waste, pesticides and heavy metals, oil spills, coral bleaching, carbon and methane emissions, carbon footprint, wildlife extinction, global warming and gradual rise in sea-level are just few examples of the pressing environmental issues that require our immediate action.

Earth is nearing an environmental tipping point [1]. All the catastrophic damages we are causing are somewhat irreversible and reshaping our environment in a drastic way for generations to come. The availability of clean drinking water is decreasing rapidly as a result of irresponsible human activities. One in nine people worldwide do not have access to clean drinking water. Around 2 million tons of sewage and other effluents are drained untreated into world's water bodies daily [2]. Looking at the list of the major polluted sites around the world, it's painful to see how the drinking water has been poisoned by our unjustified activities. Lead, uranium, mercury and pesticides have contaminated the drinking water which is affecting the poor in a big way and causing life-threatening diseases. For example: the level of lead and uranium in the ground water, 50% above the recommended WHO norms, has increased cancer prevalence among people of Northern India [3].

Environmental Biotechnology is one such field which promotes sustainable development with already a great amount of research going on in the world on various environmental issues. That said, plethora of innovative work is still required in order to check the toxic load we are passing onto the environment on a daily basis. There is no dearth of available technologies which can provide answers to some of the demanding environmental concerns. One such applicable technology is bioremediation (in situ or ex situ), which offers us some excellent and robust techniques to detoxify the industrial effluents and xenobiotic compounds. The process utilizes the 'waste-eating' microbes to clean-up contamination such as the harmful oil spills or metals or PCBs (polychlorinated biphenyls) or PAHs (polyaromatic hydrocarbons) contamination in the water and soil. These microbes consume oils, metals, grease, tar, sludge and toxic waste as their source of food and some of them also get stimulated to produce surface-active compounds called 'biosurfactants' which help these microbes to emulsify the stubborn contaminants.

Oil spills	Amount	Year
Amoco Cadiz, France	68.7 million gallons	1978
Ixtoc 1 Oil Well, Mexico	140 million gallons	1979
Atlantic Empress, West Indies	88.3 million gallons	1979
Castillo de Bellver, South Africa	78.5 million gallons	1983
Nowruz Oil Field, Persian Gulf	80 million gallons	1983
Odyssey Oil Spill, Canada	43 million gallons	1988
ABT Summer, Angola	80 million gallons	1991
Gulf war, Kuwait	240 to 336 million gallons	1991
Fergana Valley, Uzbekistan	87.7 million gallons	1992
Deepwater Horizon, Mexican Gulf	210 million gallons	2010

Table 1: Examples of some major oil spills (Source: www.telegraph.co.uk, [4]).

The disastrous oil spills (Table 1), contamination of rivers and estuaries, deterioration of aquatic habitats and forests, coastal pollution, discharge of urban run-off into coastal waters (Figure 1) point towards the ruinous destruction we are, intentionally or unintentionally, doing to the mother nature and the environment. Whilst this editorial is being conceptualized and put into words, another environmental nightmare happened on 19 May 2015 near Santa Barbara, Southern California. Due to the onshore oil spill caused by a ruptured pipeline estimated around 21,000 gallons of oil has reached the ocean [5]. It is difficult to assess the extent of the impact of such an oil spill on the wildlife. Spraying oil-eating microbes over these oil spills is a first step towards bioremediating such large scale disasters. More research, however, is required in the area of bioremediation and sister technologies such as biostimulation and bioaugmentation for prompt on-site results. The bioremediation solutions are economically justifiable as they require prudent capital investment, a low energy input, are self-sustaining, environmentally safe in the long run and do not generate harmful waste. The benefits of these technologies must be garnered and promoted to clean up heavily and increasingly polluted sites.

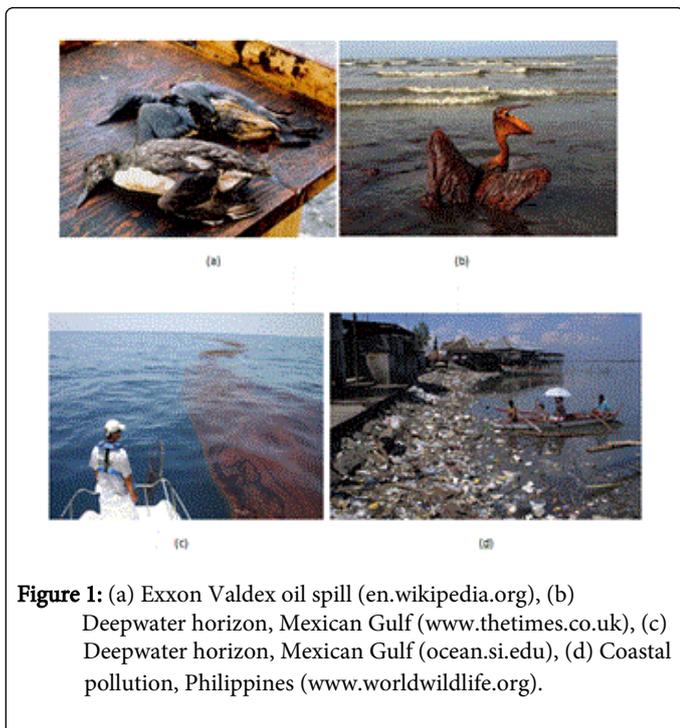


Figure 1: (a) Exxon Valdez oil spill (en.wikipedia.org), (b) Deepwater horizon, Mexican Gulf (www.thetimes.co.uk), (c) Deepwater horizon, Mexican Gulf (ocean.si.edu), (d) Coastal pollution, Philippines (www.worldwildlife.org).

It's high time we should turn our environment related concerns into actions to mitigate the influence of human activities on the environment. Stringent laws and regulations by the governments and stake holders need to be framed and implemented. Platforms like the forthcoming World Climate Summit in December 2015 in Paris, have a wider influence and impact in collaborating and framing global agreements to curb major environmental issues. Change in the mindset and carefree attitude, towards environment can alone bring a lot of improvement. Every individual, every household, every community can make a big difference! Every small step counts.

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This article was originally published in a special issue, entitled: "**Techniques of Environmental Engineering & Bioremediation**", Edited by Randhawa KKS, Department of Biotechnology, Chemistry and Environmental Engineering, Aalborg University, Denmark.