"Chemical Sciences vis-a-vis Environmental Engineering with Specific Reference to Controlling Environmental Pollution: Issues, Challenges and R&D Directions"

Dipteek Parmar
Associate Professor & Head
Department of Civil Engineering, Harcourt Butler Technological Institute, Kanpur
E mail: d_parmar@rediffmail.com

The quantity and quality of freshwater resources has been going down day by day because of anthropogenic reasons, thereby leading to water pollution. Various types of pollution and their remediation strategies techniques have been developed over the last two three decades, but their results are far from satisfactory. This can be attributed to: a) lack in understanding of pollution processes, b) characterization of pollutants, c) lack of technical know-how amongst engineers and scientists d) limited implementation of developed technology to real life field applications. Conventionally, the first two of these are in the domain of a Chemical Scientist whereas the third one is in the domain of an Environmental Engineer. The last one is purely in the domain of policy maker. The crux of the problem is- lack of interdisciplinary approach wherein neither the chemical scientist nor the environmental engineer understands the complete understanding of the pollution control. Today, the environmental engineer understands the pollution control aspect but lacks the understanding of environmental chemistry involved in the pollution process. The chemical scientist on the other hand understands the chemistry of pollution process but has limited knowledge of the mathematics involved therein. What could be done in such a situation? Can we, the engineers and scientists do something fruitful to ensure that environmental pollution is controlled to fullest possible extent for the benefit of mankind? We, the Chemical Scientists, Environmental Engineers, technocrats, policy makers and above all the Academia have a herculean task at hand-Can we do it? If yes-then how? That's the premise of this paper. The paper is aimed at presenting the overview of this challenging issue and the impediments that hamper the realization/implementation of interdisciplinary approach especially in the context of environmental engineer and chemical scientist.

The paper begins with an overview of the problem. Various types of environmental pollution along with the science of processes involved therein are discussed. These includes: water contamination by Fluoride, arsenic, nitrate, chromium, eutrophication, point and non point sources, root zone uptake of heavy metals, leaching of heavy metals, atmospheric air pollution in terms of-acid rain, ozone layer depletion, characterization of suspended, particulate matter and RSPM. This is followed by a brief introduction of various basic processes involved such as: sorption, adsorption, absorption, diffusion, dispersion, advection, decay and constituent changes. Thereafter various pollution abatement techniques are discussed. To ensure availability of technical manpower with high research and engineering acumen, few research directions are enumerated. These include: chrome recovery from tannery effluent, understanding the biogeochemical processes involved in bioremediation, understanding the cause and effect

relationship of water pollution with specific reference to heavy metals, root zone uptake, eutrophication, acid rain, ozone layer depletion and RSPM tec.

Lastly, it is emphasized that there has to be a coordinated effort involving the policy makers, scientists, engineers and the academia. Lastly, as a member of academic fraternity, it is strongly suggested that the academia (both, chemical scientist and environmental engineer) should provide the knowledge and tools to ensure that the pollution control is carried out efficiently on a sustainable footing. This would require capacity building of technical manpower with societal viewpoint. It is opined that incorporating the solutions and R&D initiatives discussed in this paper will pave the way towards making development of realistic pollution control management plans for the benefit of mankind.