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Point for discussion this month **Administrative responsibilities in managing the wastes**

Eternal Words

It is imperative to maintain portions of the wilderness untouched so that a tree will rot where it falls, a waterfall will pour its curve without generating electricity, a trumpeter swan may float on uncontaminated water - and moderns may at least see what their ancesto rs knew in their nerves and blood.

~Bernand De Voto, *Fortune*, June 1947

Dear Readers,

The serene blue colour of the Himalayan rivers soothes your eyes where all modern engineering disciplines and sciences are dissolved in the purest of flows. The overwhelming beauty of the high mountains and the sound of river music just steal your soul and give you the utmost peace of life which cannot be given by any of the comforts of the world. Himalayan rivers are entirely different from rivers located elsewhere. They are always full of water. But due to some hydel projects you may see some dry stretches in Bhagirathi and Alaknanda rivers which join together at Devprayag to become Ganga.

It is only the wholesomeness of life there that charges you up; it cannot be calculated statistically or measured with any scale. It is only life and life. A living river is the lifeline of human development. Nobody pays attention to dead rivers like Mutha in Pune, Yamuna in Delhi, Mushi in Hyderabad, Waldhuni in Ulhasnagar and Kalyan, etc. The world's urban stretches of rivers are waiting to be revitalized so that they can refresh the populations on their banks with the aroma of liveliness.

This is an entirely different approach of melting materialistic development of human systems into naturalness of the ecosystems. What kind of yardsticks can be provided by modern sciences, statistics and engineering to measure this trans-generational healthiness of water bodies resulting in the healthy living of the human being? Let us try to understand where the real happiness is. Then, one would like to go to Bhutan where the happiness quotient is the highest amongst all the countries of the world.

The wastes, emissions and stinks in the urban sprawls bring back to the routine, the daily warfare of life. There is need to reduce the load of wastes by selecting appropriate methods to control them cost-effectively. One must not overlook ecological intelligence just for economic growth, market and profits. Healthi ness and social harmony must be taken into account for living successfully on Earth. Otherwise the day is not far away, when the human will join the "dinosaurs" in the list of extinct species.

Thank you,
Chief Editor

No Stats in Ecotech

- Sandeep Joshi

All the statistical and engineering tools have shaped up the innovations, comforts and performances into a measurable frame to define the contemporary "layer" of development. 'Development' is unidirectional and irreversible based on well-engineered plans supported by statistical evaluation of their outcomes. People fail to understand its impacts and reactions on the surroundings comprised of living and non-living components in un-defined indeterminate time and space. Rather, an attempt is always made to impress upon us that development is everlasting, stable, unfading and changeless. If the history of life on the earth is fathomed, it can be demonstrably noticed that the development of some biologically active molecules – DNA - RNA into unicellular and multi-cellular species is always a conundrum, a brain- teaser for the scholars of physical sciences, engineering, technology and calculus.

There is one school of thought that anything which is measurable in terms of dimensions, calculable in terms of formulae and expressible in terms of actions and performance is consummate science and engineering. This by itself can bring ultimate comfort to human life. However, reality is different. Everywhere, there is anarchy, created by the piles of 'used' or 'unused' in enormous quantities in the environment by the 300-years-old modern industrialization and subsequent development. It is reaching the uninhabited Polar Regions also. So, there is something beyond mere scientific and engineering scales. It is unreachable enigma. The payment of ecological services, which have direct bearing on healthy life of the human population, is not being paid proper attention to by those who have engaged themselves in ecological warfare of resources.

For example, the 'food security for growing population of the world' has led to various green revolutions and GM advancements. But its impacts on the next generation have made unimagined revelations of excessive use of chemical fertilizers resulting in exposure to radioactivity as concluded by scientists. Use of chemical fertilizers made a few generations in Punjab rich; but many more generations are posed with health risks due to radioactivity induced by modern agriculture. Now, all the Norman Borlaug s in the world will have to overwork to eliminate such health impacts in Punjab and make agriculture sustainable. Let statisticians delve into numbers – how many kilograms of fertilizers used, possibilities of leaching of wanted, unwanted elements, impacts on crop health, water use etc.

Toxic gas leakage from Bhopal's Union Carbide plant in 1984 is still having its shuddering impacts on the today's generations even after 26 years. All the concerned agencies, institutions and offenders lock themselves on statistics of deaths and injuries but they fail to understand the impact of those chemicals on environmental resources like ground water and ecosystems. The extent of trans-generational teratogenic and genomic effects are not even compiled or studied to understand the losses of population or living components of the ecosystem in the affected areas. Rehabilitation of population and ecosystem in such areas will involve the elimination of toxicity induced by the chemicals dumped by the said industry in its premises or elsewhere. The statistics of toxicity induced presently and in future by the emissions from the dumping sites of Union Carbide in Bhopal is difficult to estimate as the various environmental variables and feedback mechanisms are not understood properly by the present scientific procedures. One has to expand the horizons of understanding nature, ecological sciences, so that effective planning can be done for industrial development and population economy.

Economics, rather, tries to presume a known calculable set of parameters to show profitability in which complexity exerted by environmental dynamics is never considered. All the projects – whether infrastructural or industrial – calculate the economic feasibility of a project based on the statistics of earlier data available. But the effects on environmental processes are not considered as ecological accounts because the ecosystems are not valued by present accounting systems. That's why treating the waste from the point sources or non - point sources is considered by present economic and engineering establishments as externalities. Minimization of expenditure on waste management leads to calculated outcomes as per prescribed norms. Compliance with norms becomes the objective of treatment of wastewater overlooking the impact of treated water on the receiving water body and aquatic ecosystem. Many such discharge points up to several kilometres downstream are found to be lifeless as water contains minimal dissolved oxygen and some concentration of bactericidal chemicals like chlorine etc. in water. These chemicals mostly are broad spectrum bio-toxicity which keeps the river dead. Now "turning the tide" approach is needed to maintain the rivers and lakes alive with complex food webs which maintain the self-purification capacity of the water body. So, statistics has to enhance its horizon to understand ecotechnology and its curative effects on waste control and ecological cycling.

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Is Ecotechnology Complementing the Existing Conventional Technologies or Defying Them?

- Pradeep Thakur

Sustainability – this word has assumed tremendous importance today, in the context of "development". The advancement of human civilization in terms of technology, economics and life-style is turning out to be lop-sided. It is steadily being realized that the sheer amount of wastes generated by the present population, through its practices, is becoming more and more unmanageable with each passing day. Man's intelligence is, undoubtedly, succeeding in manipulating the forces of nature to fulfil his wants. But his enthusiasm in this direction needs to be coupled with an awareness of making his activities more "sustainable" in the long run.

Today, as global warming becomes a household word in the middle and higher rungs of society, the topic of effective disposal of wastes couldn't be more relevant. It is not that we have completely ignored the aspect of waste-disposal; application of modern science as well as common sense has resulted in the development of a variety of different technologies to treat waste-water, gaseous exhausts and solid wastes. The various techniques employed today can be broadly categorized into physical, chemical and biological techniques. As a representative example, let us consider the problem of wastewater-treatment. There are not less than 18 different physical techniques, apart from the chemical and biological ones, that can be or are applied at various stages of wastewater treatment – sedimentation, evaporation, floatation, centrifugation, filtration and reverse osmosis to name a few. Industrial units and government bodies all over the world have put various systems in place for the effective functioning of these technologies at the local level. Not only are these systems functioning well, but to some extent they are also proving to be successful. In most of the developed nations of the world as well as in many cities of the developing world, these conventional technologies are the crucial bearers of the load of waste-management.

In the previous paragraph, the word "successful" has been used with caution. Conventional technologies are necessary, but no longer sufficient. The staggering variety of wastes in today's sewage is rendering the existing sewage treatment plants (STP's) inadequate. Establishing such facilities is a capital-intensive as well as a time-consuming process. In the developing world, where more than half of the world-population resides, developing STP's and maintaining a particular

standard efficiency of their functioning is a monumental task. STP's require constant monitoring, and scarce or mismanaged resources, coupled with insufficient expertise create hurdles in the proper functioning of sewerage systems. Ineffective functioning of such systems is causing pollution on a 'grand' scale. This is particularly relevant in the Indian context.

There are about 233 Class-I cities in the 14 major river-basins of India, with a collective population of roughly 105 crores. These cities have been partially covered by their sewerage systems – 24% only. Therefore, around 76% of the untreated sewage from these cities reaches fresh-water bodies, mainly rivers and lakes. Class-II cities don't have sewerage systems at all. Natural drains in these cities are serving as sewer lines. Given these facts, it doesn't surprise us when we are told that even the holy Ganga, the national river of India, has ,at some places along its course, become nothing but a huge drain! Every lake in India is, today, receiving wastes from regions upstream, the amount and nature of which is making the water unfit for any kind of use, even unfit for supporting aquatic life.

At this juncture, it is worthwhile to consider the relevance of Ecotechnology. All sustainable engineering that can reduce damage to ecosystems, adapt ecology as a fundamental basis, and ensure an orientation of precaution in the implementation of the conservation of biodiversity and sustainable development may be considered as forms of ecotechnology. Various techniques like phytoremediation and bioremediation are being used to treat different types of wastes including toxic wastes like phenolics, hydrocarbons and fertilizers. Application of ecological engineering principles, environmental chemistry, microbiology as well as the mutual interaction of organisms is very useful in consuming organic and inorganic pollutants from waste-waters and biologically converting them into non-toxic forms, finally reintroducing chemical elements into their respective bio-geo-chemical cycles. Eco-transformations and degradation or bio-utilization of pollutants form parts of ecological cycles. In ecotechnology, an attempt is made to apply natural flora and fauna in a well-designed manner to develop sustainable technologies. Many pollutants cease to be polluting if they find their way back into the bio-geo-chemical cycles. This return of the elements to their natural cycles is facilitated by the methods of ecotechnology.

As an example of an ecotechnological method, let us consider the Green Bridge Technology developed by Sandeep Joshi of Shrishti Eco Research Institute (SERI), Pune. It is a low-cost horizontal filtration technique in which a small bund called the Green Bridge is built across the water channel or natural drain or stream. Cellulosic/fibrous material of biological origin, like coconut coir or dried water hyacinth or aquatic grasses, is compacted and woven to form a porous wall-like structure strengthened by stones and sand. As water passes through the bridge, all floatable and suspended solids are trapped in this biological bridge and the turbidity of flowing water is reduced. Growth of bacteria is facilitated on the stones inside the Green Bridge. These bacteria fix the pollutants and transform them into nutrients for plants. The green plants that grow on the bridge absorb these nutrients, which also include heavy metals. This technology requires zero electricity and negligible maintenance. Its economical nature may also be highlighted, with capital expenditure being just 5 to 10 % of the total for conventional mechanized aerobic and anaerobic treatment systems. Construction of Green bridges along the main course has been instrumental in reviving the health of the river Ahar in Udaipur, Rajasthan.

The obvious effectiveness of ecotechnological techniques is something of a challenge to the status quo! Their efficiencies are natural efficiencies because the processes utilized in ecotechnology are completely natural processes having natural biotic and abiotic components. Minimal use of electricity (if at all it is necessary) is an added advantage. Capital expenditure on ecotechnological systems is comparable with the annual operational cost for conventional bioremediation systems. So how is the Indian government supposed to spend the crores of rupees which it allocates to waste-management projects employing conventional technologies? The challenge posed by these technologies is constructive. It is not possible, at this stage of development of ecotech, to completely replace existing technologies and nor is there a need to do so. Ecotechnological systems can be developed and operated in combination with conventional systems to improve the performance of the latter. As such, they will only improve the efficiency of existing systems by sharing the load.

Never in the recent past has environmental sustainability of our activities been emphasized as much as it is today. This clearly indicates that ecotechnology is here to stay. Moreover, India, with its glorious history of human beings living in harmony with nature, can and should play a pioneering role.

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Announcement

2-day Ujjani Conference on ILBM will organised on 26/27 August in Pune. Please contact Mr. Pradeep Thakur for more details on seriecotech@yahoo.co.in

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