3R TECHNOLOGY A PARADIGM SHIFT IN WATER RESOURCE MANAGEMENT

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ABSTRACT
The management of water is a global concern and particularly in India. In India millions do not have enough water, particularly during summer months, and women and girls have to walk long distances to fetch water. In the search for water, people are going deeper into the ground, lowering the groundwater table and leaving wells dry. The per capita availability of water for India in 2001 is expected to be half its 1947 level. Poor sanitation and unsafe drinking water account for a substantial part of the disease burden in India, contributing to diarrhoea, dysentery, typhoid, worms, jaundice and cholera. Each drought destroys the abilities of rural communities to cope. It makes them weaker and more disabled to deal with the vagaries of the monsoon. And in that way drought becomes permanent and long lasting and eats away at the very insides of the country. Challenges faced by more and more countries in their struggle for economic and social development are increasingly related to water. Water shortages, quality deterioration and flood impacts are among the problems which require greater attention and action. The world population has increased by a factor of about three during the 20th century whereas water withdrawals have increased by a factor of about seven. It is estimated that currently one third of the world’s population live in countries that experience medium to high water stress. This ratio is expected to grow to two thirds by 2025. The more time and effort spent on these problems today, the greater will be the reward for those who have the foresight, diligence and ability to see the challenge and meet it successfully. Every country has to mind its water business. But for a country like India, where it rains for roughly 100 hours of the year, the management of water becomes even more critical. It literally determines if the country remains poor or becomes rich; diseased or healthy. In other words, water is the determinant of its future. The issue of water is not about scarcity but about its careful use and about its equitable and distributed access. Water is the starting point for the removal of poverty in the country. It becomes the basis of food and livelihood security. But what is clear is that water management strategies will need to be carefully designed so that they lead to distributed wealth generation. This will require reworking the paradigm of water management, so that it is designed to harvest, augment and use local water resources so that it leads to local and distributed wealth generation. It is also clear that local and distributed water infrastructure, will require new forms of institutional management as water bureaucracies will find it difficult to management such vast and disparate systems. Under these contexts a technology that can be befitting for water management will be 3R technology. This paper analyses the prospects of 3R technology in water management.

KEY WORDS: Water resource Management, 3R technology, Reduce, Reuse and Recycle
Introduction

The growth of industries in the Indian context is highly phenomenal in different segments; one among them is the field of water management. According to Central Pollution Control Board, 90% of the watersupplied in India to the town and cities are polluted, out of which only 1.6% gets treated. Therefore, water quality management is fundamental for the human welfare (Gupta 1991). Globally water management has become a vital problem due to the depletion in the water sources, increase in population, pollution and global warming. It necessitates new strategies and technologies to face and solve the problem. Lots of techniques have come up in this field, needless to say that many were not able to sustain in the field due to various reasons. The present study is to analysethe scope, prospects and problems of 3R technology. This study is intended to provide insights into the prospects of establishing such a Technology.

The Main Challenges in Water Resource Management

Populations under Water Stress

The world population has increased by a factor of about three during the 20th century whereas water withdrawals have increased by a factor of about seven. It is estimated that currently one third of the world’s population live in countries that experience medium to high water stress. This ratio is expected to grow to two thirds by 2025.

The Impact of Pollution

Pollution of water is inherently connected with human activities. In addition to serving the basic requirement of biotic life and industrial processes, water also acts as a sink and transport mechanism for domestic, agricultural and industrial waste causing pollution. Deteriorating water quality caused by pollution influences water usability downstream, threatens human health and the functioning of aquatic ecosystems so reducing effective availability and increasing competition for water of adequate quality.

Securing Water for People

Although most countries give first priority to satisfaction of basic human needs for water, one fifth of the world’s population is without access to safe drinking water and half of the population is without access to adequate sanitation. These service deficiencies primarily affect the poorest segments of the population in developing countries. In these countries, water supply and sanitation for urban and rural areas represents one of the most serious challenges in the years ahead.

Securing Water for Food Production

Population projections indicate that over the next 25 years food will be required for another 2-3 billion people. Water is increasingly seen as a key constraint on food production, on a par with, if not more crucial than, land scarcity. Irrigated agriculture is already responsible for more than 70% of all water withdrawals (more than 90% of all consumptive use of water). Even with an estimated need for an additional 15-20% of irrigation water over the next 25 years - which is probably on the low side – serious conflicts are likely to arise between water for irrigated agriculture and water for other human and ecosystem uses. Difficulties will be exacerbated if individual water-short countries strive for food self-sufficiency rather than achieving food security through trade; by importing food countries can in effect import water from more generously endowed areas (the concept of “virtual water”) (Sunita Narain, 2006).
Main Challenges in Water Requirements
Although most countries give first priority to satisfaction of basic human needs for water, one fifth of the world’s population is without access to safe drinking water and half of the population is without access to adequate sanitation. These service deficiencies primarily affect the poorest segments of the population in developing countries. In these countries, water supply and sanitation for urban and rural areas represents one of the most serious challenges in the years ahead. Water is increasingly seen as a key constraint on food production, on a par with, if not more crucial than, land scarcity. All human activities need water and produce waste, but some of them need more water or produce more waste per job than others. This consideration has to be taken into account in economic development strategies, especially in regions with scarce water resources. Water has a value as an economic good. Many past failures in water resources management are attributable to the fact that water has been – and is still – viewed as a free good, or at least that the full value of water has not been recognized. In order to extract the maximum benefits from the available water resources there is a need to change perceptions about water values and to recognize the opportunity costs involved in current allocate patterns.

Management of Water Resources
In evaluating the range of available management tools, the role of and scope for technological advances should still be carefully considered as a factor that may help achieve sustainable water resources management. There is scope for substantial progress both in technology refinement within the water sector itself and in those other productive sectors which critically affect the supply of and demand for water services. Traditional technologies like rainwater harvesting can also play a key role.

3R TECHNOLOGY
3R stands for Reduce, Reuse and Recycle units and systems. In the competitive world, profits of industries come mainly from efficient use of raw materials and energy. That is optimum utilization of raw materials and energy with minimum waste or Zero Discharge through Reduces, Reuse and Recycles systems. This has been termed under Cleaner Technology of UN Resolution for sustainable business development. 3R Technology acknowledges the facts of Cleaner Technology and intends to offer suitable solutions and energy efficient systems for Reduce, Reuse and Recycle options.

Definition of the 3Rs
The principle of reducing waste, reusing and recycling resources and products is often called the "3Rs". Reducing means choosing to use things with care to reduce the amount of waste generated. Reusing involves the repeated use of items or parts of items which still have potential for use. Recycling means the use of waste itself as a resource. Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle" and finally "energy recovery". Things which cannot be used by any means have to be disposed of appropriately. The purpose of "reduce" is to save resources and to reduce waste, in other words, to reduce the amount of natural resources input into the production process and to reduce the amount of disposed waste.
Reduce can be achieved by the following measures.
- Reducing the amount of raw materials and energy used per product by changing the design of the product or changing the production process
- Reducing the quantity of production by extending the life of products or improving repair and maintenance technologies
- Reducing the amount of disposed waste by reducing the volume of waste or by selecting recyclable raw materials

Reuse can be achieved by the following measures.
- Repeatedly using products after washing or other proper measures
- Reusing parts derived from dismantled used products

Recycle is to use all or a part of a used product as a raw material in the same or other products by shredding, recovery of valuable metals or other proper measures. PET to PET recycling and recycled paper are typical examples of "recycle". Wastes which cannot be materially recycled are incinerated for volume reduction, stabilization and detoxification in Japan. In the incineration process, much thermal energy is generated and can be utilized for electric power generation or heating public and other facilities near incineration plants. Incineration ash is also used as a raw material for cement production and as a soil conditioner.

Categories of 3Rs technologies and techniques
Technologies related to a wide range of activities from simple waste segregation to complicated reuse and recycle of automobiles are considered to be "3R technologies." "3R technologies" can be categorized into five divisions, mainly reduce, reuse and recycle technologies, and additionally appropriate disposal technologies and common fundamental technologies.

Application of 3Rs technologies
3R technologies are essential tools to promote a sound material-cycle society. The basic concept is to reduce the amount of raw material input, the final disposal of waste and the energy consumed in the production and transportation systems of products. "Reduce" should be considered as the first priority as it has the most direct effect on the reduction of wastes. It can directly reduce the scale of production process, energy consumption and the amount of waste produced by reducing the amount of input in the production process. "Reuse" is regarded as the second priority. "Recycle" is also important, however, it cannot be denied that environmental burdens such as energy conservation are brought about by the intermediate treatment and manufacturing processes of recycled products. In the case that 3R technologies are applied, this priority setting should be emphasized.

Benefits of Reduce, Reuse and Recycle Systems and Best Available Technologies
- Zero Discharge or minimum waste
- Recovery of chemicals and metals
- Low operating cost
- Low capital cost
- Return on investment within 2 to 3 years
- Ease of operation and maintenance
- Compliance to meet pollution control board requirements on discharges
BAT (Best Available Technologies) Technologies and Products from 3R Technology

- Counter current rinsing – reduces water consumption during rinsing up to 90%.
- Effluent Evaporators for concentrating process solutions, rinse waters, membrane rejects, heat sensitive liquids, recovery of solvents, waste heat recovery, industrial wastewaters etc.
- 3R Technology offers Modular units of MF, UF, NF and RO for reducing the volume of the wastewater and other process liquids for recovery of water or chemicals in the concentrate.

Figure:1
- Advanced oxidation using UV, Ozone, Hydrogen Peroxide, and photo catalyst for complete reaction with high molecular organic contaminants.
- Zero Discharge Systems and Package ETP and STP units integrated with above technologies.
- Effluent Treatment Plant with emphasis on Cotton Dye Waste Water
- Sewage Treatment Plant
- Membrane Based Desalination Plant for Treatment of Brackish Water and Sea Water
- Demineralization Plant (Ministry of the Environment, 2005)

Technical advantages of this System are:
- Smaller Foot Print Area
- Modular & Easily Scalability
- Low Chemical Consumption
- Low Sludge Generation
- Consistent & Superior Quality of Permeate
- Colourless Pure Brine for Reuse

Zero Liquid Discharge

Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle" and finally "energy recovery". Things which cannot be used by any means have to be disposed of appropriately.

Suggestions

The demand for water and water treatment is a never ending phenomenon in human life owing to the growth in population, technological and industrial development, depletion in natural water resources etc. In this context knowledge about water, understanding the importance of water treatment and developing an attitude towards water treatment are of utmost importance. In this direction the industrial growth and development towards water treatment is the present scenario of industrial sector. We observe ‘World Water Day 22nd March’in order to remind the people the importance of water in human life. But still people are not aware of and they lack sufficient knowledge about water. The general public are to be educated in the directions of significance of water, knowledge about water treatment and various technologies behind water treatment particularly technology behind water treatment and its worthiness. More over the industries involved in using water extensively are to be informed then and then about various modern technologies involved in water treatment. Accordingly they will implement the newer technologies so that it would help in saving water and the effective and economic way of using water. At this juncture it is imperative to think about a viable water resource management and obviously the 3R technology could certainly be a befitting technology in the water resource management in the present day contest.
References

Figure: 1