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RETHINKING WASTEWATER MANAGEMENT IN INDIA

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ABSTRACT:

Under the burden of high population and the extreme stress on water resources, India is missing a great opportunity of utilizing vital water resources by the inappropriate use of wastewaters. Global warming and climate change related effects on the water resources making India vulnerable where more than 50% agriculture is still rain fed. Moreover, the country's ambitious projects such as Smart City Project and Make in India campaign need to be reviewed from water resource lens also. Currently India reuses wastewater without treating it on all types of uses. This is a serious situation because this waste water contains agent's pathogens that can trigger disease.

KEYWORDS: *Water Resource, Wastewater, REU (Reuse of Wastewater).*

INTRODUCTION

India has almost 4 % of world's fresh water resources to carry on over 17 % of world's human as well as animal populations. From a per capita annual average of 5,177 cubic meters in 1951, fresh water availability in India dropped to 1,820 cubic meters in 2001. It is estimated that by 2025, annual average fresh water availability will be 1,340 cubic meter /per capita, while less than less than 1700m3 is considered as 'stress' level beyond which water availability gets classified as scarcity level. In this scenario reuse of wastewater is ultimate demand of the time. In itself, the reuse is a good idea as it conserves an increasingly scarce resource and provides the crops with some of the fertilizers they need. A lot of countries have practiced this reuse for a long time. However, it should carry out in good conditions as the waste water must be treated according to precise standards. How to determine these standards and what is the cost of their application?

Currently, India has the capacity to treat approximately 37% of its wastewater, or 22,963 million litres per day (MLD), against a daily sewage generation of approximately 61,754 MLD according to the 2015 report of the Central Pollution Control Board. India accounts for 4% of the world's water resources. Strong geographic and chronological irregularities in the distribution of water resources further aggravate the situation. Some regions are already using to unconventional methods of exploiting water resources such as desalination of seawater in Chennai.

Groundwater is often overexploited in the southern regions. In this tense context, the Reuse of Purified Wastewater would make it possible to exploit a significant additional resource. The REU does not will not solve all the problems of lack of water that will appear within the 20 next few years, but it is an option to be developed before resorting to more expensive methods such as seawater desalination or transfer of water between regions. Sanitation programs in large cities attempt already to integrate into their master plan, a possible use of wastewater purified for agricultural purposes.

There has been a long history of reusing raw wastewater in India, particularly in proximity to the imperial cities due to the large population concentrated around these cities and significant needs in basic agricultural products. This reuse is done in an anarchic manner without taking into account health constraints and environmental hazards leading to health risks for local populations and risks of groundwater pollution and soil degradation. This ancient practice is certainly based on good intentions, among other conservation water and use of fertilizers, but is dangerous and must make way for new practices based on the treatment of wastewater according to standards strict.

Irrigation with treated wastewater is very useful in areas where the rainfall is less than 500 mm and more particularly in developing countries development where it also considerably reduces the use imported fertilizers. However, certain health problems remain to be resolved in order to prevent the spread of pathogenic organisms through irrigation water that has suffered faecal contamination.

Currently, many countries reuse, on a small or large scale, water used in agriculture after having treated them: England, Israel, Tunisia, Germany, South Africa, Russia, Australia, Mexico, Persian Gulf Countries.

In the United States, 34 states have regulations or recommendations - often very demanding - on the agricultural use of wastewater (EPA & USAID, 1992 quoted by Faby, 1997). In some arid and semi-arid countries, this reuse is one of the most used methods to exploit water resources.

OBJECTIVES AND METHODOLOGY

Reuse of wastewater is challenging task but is need of the hour. The present research work examines the concept of Reuse of wastewater in India. Content analysis method is adopted for critically exploring the subject. Content analysis is an observational research method that is used to systematically evaluate the content of all forms of recorded communication. The method adopted in this research is Qualitative. Cities are classified into two categories –

- continental cities where the REU will be done by gravity;
- coastal towns where the REU will require pumping to reach a site storage and reuse.
- In the category of continental cities, we distinguish the cities where the REU:
- Already exists ;
- is not practiced, but the waste water flows produced are significant; and
- is not practiced and the flow rates involved are low.

The World Water Council sets the threshold between low flow and high flow at 250,000 m3 of wastewater per year in 2015.Here are the first three categories selected as priorities:

I. continental cities where the REU is existing,
II. continental cities where the REU is non-existent and whose speeds are important;

The report funded by USAID as part of the project "Sustainability of Water Resources of India -PREM", aims to provide the SEE with the elements necessary for the establishment of national regulations on the reuse of wastewater in agriculture. This basic document characterizes the domestic wastewater as well as treatment and disposal processes reuse, presents the Indian situation and compares the regulatory contexts in India and other countries.

INDIAN SITUATION: IDENTIFICATION OF WASTEWATER REUSE AREA

The reuse of raw wastewater for crop irrigation is a practice current and ancient in India. We notice the predominance of market gardening. The CSE estimates that there will be 900 million m3 of wastewater in 2020, i.e. approximately 5% of the volume of water that can be mobilized. Even if this does not represent a major issue on a national scale in terms of the quantity of water resources, REU can be vital in some regions where water resources are limited.

A survey carried out within the framework of the National Water Policy identified 70 areas of reuse of wastewater distributed throughout the territory. According to the authors of this survey, this number seems underestimated, given the climatic and social context of the country suggesting that wherever water is available in quantity significant and continuous, it is used for agricultural purposes. This list is not probably not exhaustive and reuse is probably more widespread than it does not appear in the list in Table 2 for two reasons:

- if the reuse is not perceptible immediately downstream of the water discharge worn, it is sometimes practiced further away in an indirect way that is not inventoried,
- given the informal and illegal nature of this practice, it can be assumed that all of users did not respond to the survey.

It is currently difficult to identify precisely the state of wastewater reuse in India. The REU is practiced throughout the country on all types of crops (fodder, arboriculture, market gardening, field crops, etc. without any health precautions.

Farmer surveys and interviews indicate that they have acquired, locally, a good agronomic experience of irrigation with wastewater.

They know, for example, that an input of organic matter through wastewater compensates for the salinity of the waters or they practice only one or two irrigation with raw water to avoid an excess of fertilizers which would, for example, example, grain lodging. On the other hand, the health consequences of reuse of raw wastewater are often overlooked by farmers.

There are several reasons for using wastewater:
- recovery of organic matter and fertilizing elements;
- energy saving ; and

- insufficient ground or surface water resources

The definition of regional or local priorities was based on the considerations following :

– existing REU;

– Volume of wastewater involved;

– Scarcity of water resources at the scale of the basin where the REU represents a miss to win ;

– Complementary role of environmental protection (aquifers, reservoirs, of water,...) and consequently, protection of public health or the interests economic; and

– Pumping constraint.

REU is considered a priority where it is currently practiced for economic and social reasons. This practice generates for farmers concerned with added values comparable to, or even greater than, those of the irrigated perimeters.

REU is vital when water resources are globally limited. of the basin. This saves drinkable water requiring little or no prior treatment. We proceed in a way to an exchange of resources.

Finally, the REU can also be considered as a priority when it has a role protection of the environment in general and water resources in particular. Following precautions to be taken when reusing water worn out.

There are then two categories of cities:

• Continental cities where the REU will be done by gravity;

• Coastal towns where the REU will require pumping to reach a site storage and reuse.

In the category of continental cities, we distinguish the cities where the REU:

• Already exists;

• is not practiced, but the waste water flows produced are significant; and

• is not practiced and the flow rates involved are low.

Here are the first three categories selected as priorities:

I. continental cities where the REU is existing,

II. Continental cities where the REU is non-existent and whose speeds are important;

III. Coastal towns requiring pumping to use sites and whose flow rates are significant;

REGULATORY ASPECTS OF WASTEWATER REUSE

The reuse of water for irrigation is only possible if the wastewater is processed according to certain quality standards. The definition of standards and specific regulations are essential for any implementation policy of sustainable reuse. These standards should specify the physico-chemical quality and microbiological aspects of treated water in order to guarantee the protection of health human and the preservation of the environment.

There are two approaches to defining REU sanitary standards in agriculture: the “zero risk” approach and the epidemiological approach.

The "zero risk" concept was developed in the United States just after the Second World War He considers that the presence of a pathogenic organism in the environment poses a serious risk to public health. This approach, chosen by many states, is the basis of the standard of 2.2 CT/100 ml for waste water intended to irrigate vegetables eaten raw. This standard, too severe for developing countries (DC), could not be applied there for technical and above all financial reasons. In these countries, the growing demand in foodstuffs and the absence of suitable standards have led to a reuse of raw wastewater that harms public health.

The 1989 guidelines recommend:

-the complete (or almost) elimination of intestinal Helminths, with an average < 1 egg per liter of water; and

- significant elimination of pathogenic bacteria, with an average value< 1000 C.F. /100 ml.

These two measures are strictly applicable for unrestricted irrigation, while that for restrictive irrigation only the elimination of Helminths is stressed.

Several arguments make it possible to justify the sufficiency of the value of 1,000 C.F. /100 ml for irrigation of all crops:

- there is a natural death of pathogens;
- U.V. rays give rise to a certain inactivation of pathogens;
- the combined effects of desiccation and predators decrease pathogens very strongly in just a few days;
- even if a used effluent used for irrigation contains 1000 C.F./100 ml, this is low compared to the concentrations encountered in the environment (a study by the WHO and the United Nations showed that 45% rivers studied had concentrations > 1000 C.F. /100 ml).

Moreover, these standards can be compared to those applied to water bathing: for the WHO: < 1000 C.F./100 ml and for the EEC < 2000 C.F. /100 ml; and

- the major risks are by far greater for Helminths.

For the first time, guidelines take into consideration diseases parasitic. Many countries consider these guidelines as a solid basis implementation of REU regulations.

The epidemiological approach and the “zero risk” approach differ in the level of risk that we agree to assume, taking into account the economic level and the social situation of the country. The epidemiological approach results in a level of less extensive treatment and therefore lower investments than approach “zero risk”.

STANDARDS USED ABROAD:

Many countries have developed wastewater reuse regulations treated in agriculture. Generally, the countries wealthier have adopted the principle of "zero risk".

These regulations are not final and regular and progressive revisions can be applied to take into account the improvement of the average level of hygiene. Countries such as Israel or Cyprus have reviewed their regulations for the make it more strict. This is also the general trend; WHO is currently reviewing its directive and the constraint of 1000 CF/100 ml will probably be revised downwards. PREM project: Reuse of wastewater in irrigation 17

The situation of most countries in the Mediterranean area has been analyzed in the framework of the European Avicenna project (1997). In February 2000, a group of scientists gathered in Barcelona, at the invitation of the AGBAR Association, have developed a proposal for Mediterranean guidelines for the reuse of wastewater purified in agriculture. It appeared that the drafting of this directive should be part of a broader reflection on resource management global water.

The working group accompanies the proposed guidelines of some considerations:

- interest other international institutions (WHO, EU, etc.) in the discussion,
- establish guidelines specific to the Mediterranean environment rather than European;

- the proposals must take into account the sanitary level of the countries
- Draw up an inventory of the laws currently used country by country;
- establish local committees to study the application of the regulations
- consider the reuse-environment relationship;
- choose the type of treatment plant and size it taking into account the local conditions;
- study the impacts on the environment and public health, the working conditions control and sampling, restrictions on use, recharging of tablecloth and
- improve public information.

The suggestions are minimum recommendations that each country could adapt to its socio-economic conditions. They should, in a later stage, be presented to the national authorities of all the countries.

From a qualitative point of view, a typology of urban wastewater in India has been carried out on behalf of. The results of this study provide a precise idea of the quality of wastewater in India, the evolution of the ratios and the refund rates, depending on the size of the center,.

The larger the city, the higher the concentration of pollution (BOD5, COD, MES) concentration decreases; indeed the big cities use a greater quantity

of water used hence a higher dilution. The restitution rate increases according to the size of the center and is globally lower than the rate of restitution used within the framework .There are no analogous data for microbiological parameters. As indicative, we can retain for domestic wastewater, the areas of concentration from trace elements, organic compounds, pathogens, etc. The suitability of the waters used for irrigation is mainly linked to its effects on the soil, crops, the environment and human health. The composition of wastewater requires a particular attention and constant control in order to guarantee a healthy use in irrigation. In order to achieve this goal, certain practices must be adopted.

They include wastewater treatment, minimization of human exposure, and the application of hygiene conditions defined within the framework of a system of integrate control.

Irrigation with wastewater is a special practice and the greatest concern is environmental and health. All techniques and possible means used must contribute to reduce the potential risk. For control the health risk related to REU, we must control the microbiological quality some water. However, the cost to achieve complete pathogen elimination may be so high that it is necessary to take other measures (choice of the cultivation, choice of irrigation system, protection measures) in order to reduce the risk at an acceptable level. However, these measures may not be sufficient, for example, when transporting water to the plot, accidental use, etc

The creation of the WHO guideline made it possible to provide a basis on which to develop the REU in good sanitary conditions. However, many other factors that cannot be transposed into a quality standard affect health risks. These factors, gathered in the form of rules to be follow will constitute a code of good practice which should be followed with the same rigor than laws or directives. The code of good practice, like the quality standards, must be developed and adapted to each country, taking into account local conditions.

Two questions should be asked for any irrigation system using the waste:

- Which crops can be irrigated (choose certain crops and rule out others)?

- How to irrigate these crops (recommendation of the irrigation method appropriate and the necessary precautions)?

In addition, excess nitrogen in relation to crop needs can lead to groundwater pollution if adequate corrective measures are not applied.

How to improve wastewater management in India

The Council on Energy, Environment & Water (CEEW) in association with the 2030 Water Resources Group completed an in-depth study on finding viable pathways for improved wastewater management in India. This study highlights a framework of essential factors for decision-making. This study involved critical literature review, comparative analysis of wastewater treatment technologies, in-depth study of 17 global case studies and expert interviews with wastewater treatment plant operators, academicians/researchers, urban planners/architects and technical and financial experts.

To improve the wastewater management in India, several factors are needs to be considered. Following are the most critical factors -

- Public awareness and initiating wastewater management,
- Government Policies and regulations,
- Access to Technology and Funding,
- Level of Involvement,
- Management policy and Logistic support,
- Public perception,
- Phases of deployment, and
- A framework for participatory approach.

Wastewater reuse requires wastewater quality standards treated for irrigation. These standards must specify the physic-chemical quality and microbiological aspects of treated water in order to guarantee the protection of human health and the preservation of the environment.

Faecal coliforms and helminthes eggs are the two parameters main microbiological tests to be followed when the original treated wastewater domestic are intended for irrigation. For this type of water, the physicochemical parameters are generally at lower concentrations than the values of the international standards.

CONCLUSION

Wastewater treatment is the main control measure allowing partial or total elimination of pathogenic microorganisms. There is also other barriers to the spread of contamination; professional measures, crop restrictions, medical treatments and choice of irrigation system.

An archetype swing from "use and throw – *linear*" to a "use, treat, and reuse – *circular*" strategy is required to deal with wastewater. However, venture in wastewater treatment has coupled risks, therefore it is key to recognize the causal soci-political, technical, and monetary factors that will drive, assist, and maintain wastewater management strategy in India.

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