COMPARATIVE ANALYSIS OF GROUND WATER AND RO WASTE WATER

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Abstract

Across globe fresh water sources are depleting at a faster rate. In some regions where ground water is the only source of fresh water, water table is going down and is a major concern. Efforts to consume treated water sometimes result in the loss of more water as waste than what is obtained as clean. Reverse osmosis (RO) gives only 5-15% of input as clean water and the rest is discarded as waste water. This study revealed that RO waste water has physicochemical parameters like TDS, pH, Conductivity and hardness well within ISI permissible limits and should not be discarded as waste.

Keywords: *Reverse Osmosis; ground water; RO waste water; physicochemical parameters*

Introduction

Water is the most abundant compound found on earth. It is the only compound which exists in all the three states of matter viz., solid, liquid and gaseous state at temperatures normally found on earth. Nearly 70% of the earth's surface is covered by water but only 2.5% of this water is fresh water which is present in the form of freshwater lakes, glaciers, streams and ground water. Most of the living organisms depend on fresh water for the sustenance of their life. However, this water is available to a limited world population and majority face fresh water scarcity. Fresh water bodies are either getting depleted due to climatic changes (Frederick et al., 1997; Loáiciga, 2003) or getting polluted/contaminated due to pollution by human activities *viz.*, industrialization, urbanization, population explosion, increase in living standard (Datta, 2005) and some climatic factors like global warming, deforestation and drought. Potable water in the form of ground water is also affected due to seepage of effluent water from domestic households, commercial buildings and other manufacturing units (Adekunle, 2009). Direct consumption of water from these sources pose various health problems especially in children like amoebic dysentery, cholera and other epidemic diseases. Need of the hour was to treat this water before consumption which includes, boiling, filtration, ozonolysis, chlorination, reverse osmosis, etc. (Barcicki, 1980; David, 2006; Christiane, 2009; Nemerow, 2009). However, some treatment processes are out of bounds for

common masses due to high costs. Some treatment processes like RO (Reverse Osmosis) generate more waste water as compared to pure water. It is found that in RO only 5-15% of the input is received as clean water and the rest is discharged as waste water along with contaminants and also with some healthy minerals from the water. Thus, a RO unit which delivers 5 gallons of treated water per day may discharge 20-90 gallons of waste water at the same time. In some cities which have no fresh water source other than ground water, it is imperative to lessen its consumption (Tarique, 2001). The much hyped use of reverse osmosis not only results in more wastage (Morrison *et al.*, 2009) than what it purifies but also robs water of essential minerals thus ripping off consumer`s health and money. Hence, it is necessary to look for alternative water treatment processes to reduce the wastage of water or reuse the waste water.

Herein, we have focused our study on the waste water generated through Reverse Osmosis (R.O.) of ground water. This study was carried to assess and reveal the effectiveness of RO waste water as an alternative to ground water for irrigation purposes which is otherwise discarded as waste.

Experimental

Materials and Methods

The entire chemicals used in this study are laboratory grade and study is carried out at room temperatures. The physiochemical parameters like pH, TDS, conductivity were measured using Water Analysis Kit 1160 (Environment and Scientific Instruments) while other parameters such as Total hardness and DO were estimated in the Laboratory by using Standard Methods.

Collection of samples and its description:

The samples were collected in neat and clean plastic bottles and stored at room temperature.

Water Quality Analysis

Water samples which were collected from different sampling sites were characterized for pH (Himmel *et al.*, 2010), Total Hardness (Trivedy and Goel, 1986), Total Dissolved Solids (TDS) (Shrinivasa and Venkateswaralu, 2000), Dissolved Oxygen (D.O) and Conductivity (Dahiya *et al.*, 1999). The analysis were carried as per the standard procedures of Indian Standard Specifications and compared with desirable and permissible limits.

Results and Discussion

Several studies were carried out on RO waste water to determine different parameters viz.

hardness, dissolved oxygen, pH, total dissolved solids and conductivity. The results of these studies are summarized in table 1 and figures 1-5.

Table 1: Comparison of different parameters of ground and RO waste water

S. No.	Parameters	Ground water	RO Waste water	Permissible limit	Desirable limit
1.	Hardness (ppm)	286	345	600	300
2.	Dissolved oxygen (ppm)	8.65	8.0	6	6
3.	Total dissolved solids (ppm)	550	635	2000	500
4.	pH	7.35	7.7	8.5	6.5
5.	Conductivity (µs/cm)	1030	1280	3000	3000

Hardness

The hardness of ground water was found to be 286ppm. However, the hardness of RO waste water was found to be 345ppm which is higher than the ISI desirable limit of 300ppm but lesser than the ISI permissible limits of 600ppm (Figure 1). Thus, we can infer that the hardness of RO waste water is well within ISI permissible limits and should not be discarded.

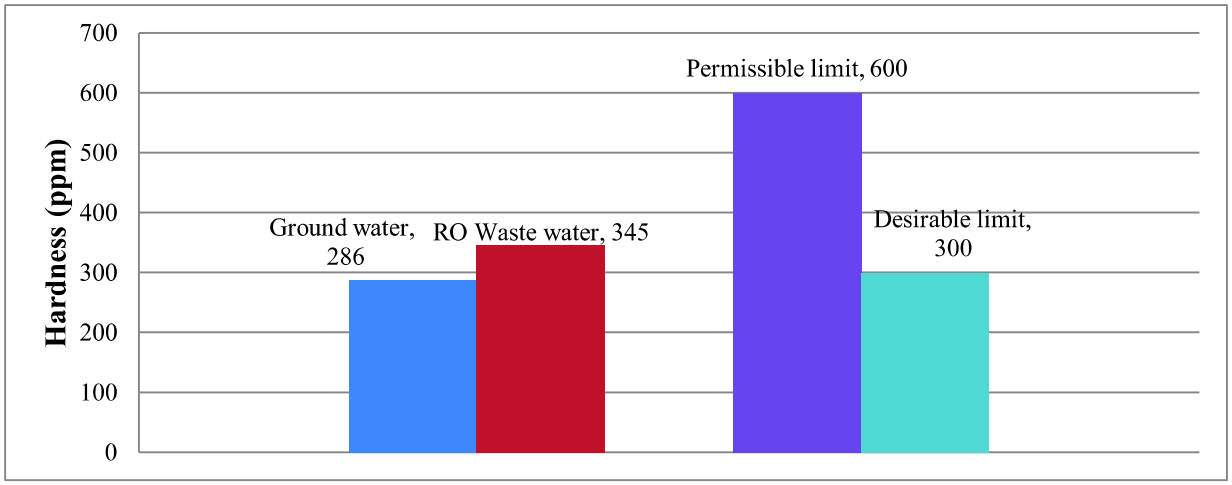

Fig. 1: Representation of comparative study of hardness of ground water and RO waste water

Dissolved Oxygen

ISI desirable limit for dissolved oxygen in drinking water is 6ppm and above. DO in ground water was found to be 8.65ppm. The DO in RO wastewater was found to be 8ppm (Figure 2). Hence, it was found that dissolved oxygen in RO waste water is above ISI desirable limits which imparts good taste to water.

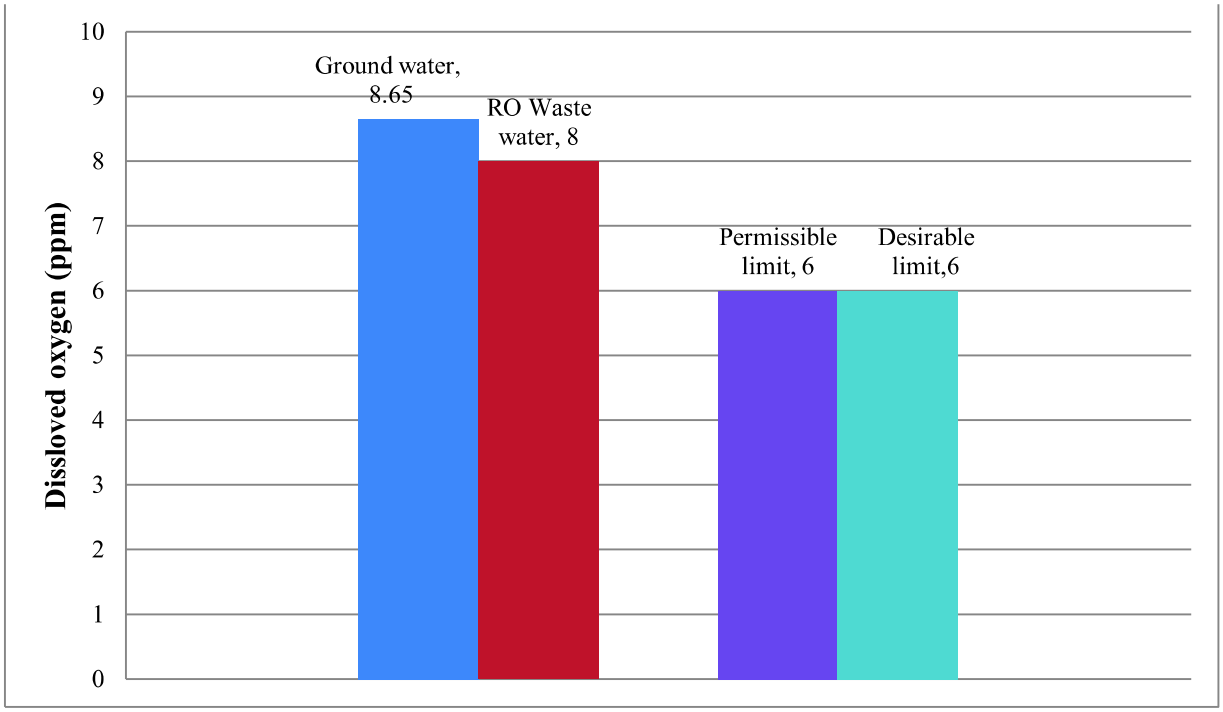

Fig. 2: Representation of comparative study of dissolved oxygen present in ground and RO waste water.

Total dissolved solids

From figure 3 it was clear that total dissolved solids (TDS) in ground water sample were found to be 550ppm. It was found that the Total dissolved solids of RO waste water is 635ppm. From this we can infer that TDS of RO waste water is well below the ISI permissible limits of 2000ppm. Thus, instead of discarding the water as waste it can be used for irrigation purposes.

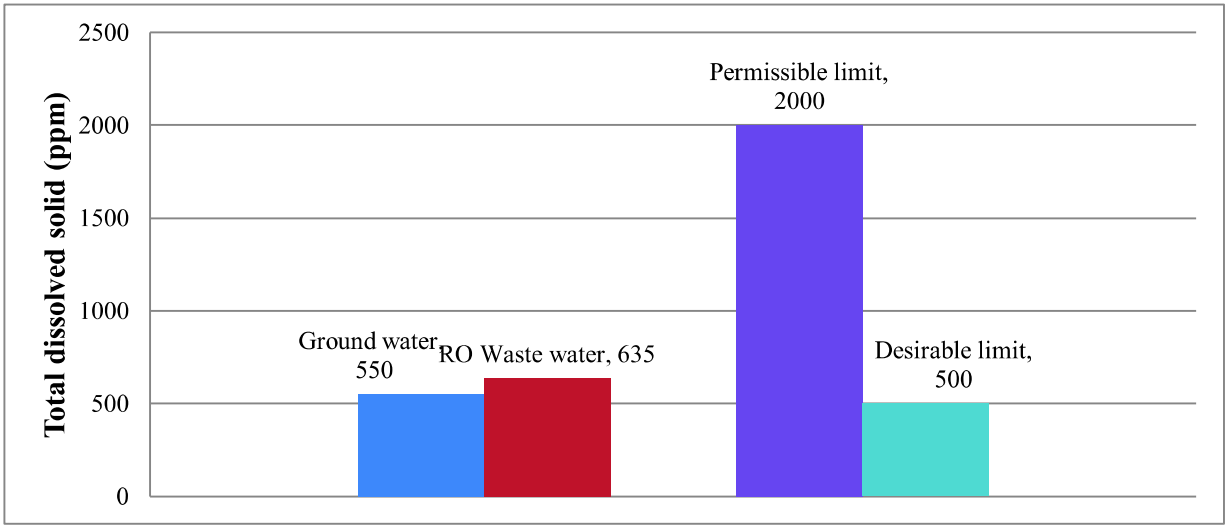

Fig. 3: comparative study of dissolved solids in ground and RO waste water and their ISI standard limits.

pH

Studies show that in the sample of ground water pH was 7.35. In the sample of RO waste water pH was found to be 7.70 which is below the ISI permissible limits of 8.5 (Figure 4).

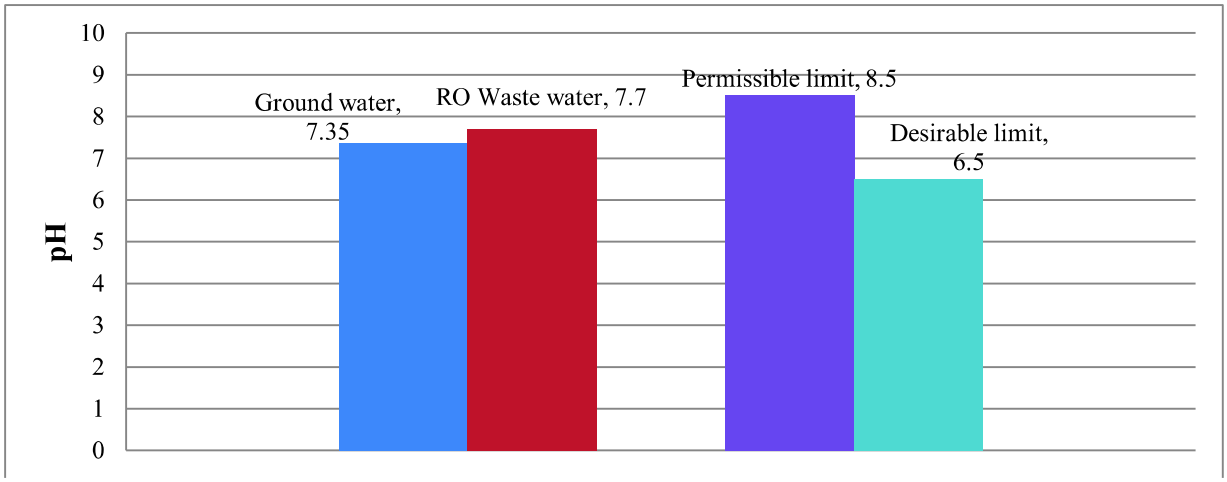

Fig. 4: Representation of comparative study of pH in ground and RO waste water.

Conductivity

From figure 5, it was found that conductivity of ground water sample was 1030µS/cm and conductivity of RO waste water sample was 1280µS/cm which is well within ISI permissible limits of 3000 µS/cm.

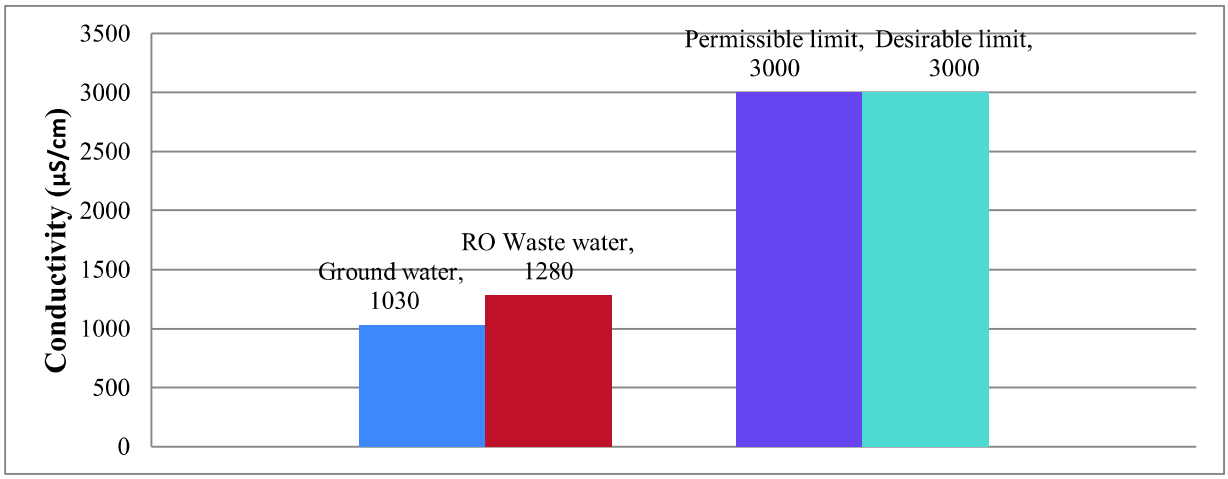

Fig. 5: Comparison of conductivity in ground and RO waste water with ISI standard limits.

Conclusion

In these studies it was found that most of the physico-chemical characteristics of RO waste water are well within ISI permissible limits. The major concern for carrying out this study was to check and create a caution among the users of RO systems that more water is drained

out as waste in the name of filtration which is almost 3 times the clean water. Instead of installing RO systems conventional methods of water treatment should be employed which can help in reducing the losses. Installation of RO systems costs heavily to fresh water supply because it drains much more as waste than what it gives as treated water. If there will not be an immediate check or some alternative to the use of RO system of water purification; water table in places where ground water acts as only source of fresh water will go further down. The study reveals that physico-chemical parameters of RO waste water in the sample was below ISI permissible limits and its use as an alternative for irrigation, washing and other house hold cleaning purposes can help us to save lot of fresh water. This way we can follow the principle of Reduce, Recycle and Reuse.

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