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Quality of Rain Water Harvested at Roof Level and in Some Ponds of Ajmer District, Rajasthan

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ABSTRACT

Rain water samples were collected at roof level at Pushkar and Budha Pushkar during July, 2007. Water samples were also collected from 2 ponds around in Ajmer district. Physico-chemical and bacteriological parameters were analysed. Roof water was found to be pure and free from bacteriological contamination. Pond water is turbid and has high iron content with objectionable bacteriological pollution load. collection of roof water for drinking purpose was found to be encouraging. Pond water needs treatment before use.

INTRODUCTION

All the settlements of human civilisation were along the rivers in ancient days. Dispersion of human settlement depends upon the availability of water resources. Major rivers were certainly exploited in the earlier phase of human civilisation. But there was also a complementary and more extensive pattern of settlement in the areas where rivers were few and where direct collection of rainfall was one of the few methods available for securing water supply. Rainfall was collected from house roofs and also sometimes directed into cisterns from paved country yards from hill and rock surfaces and even from specially surfaced areas slopping towards cistern inlets. Collection in artificially dug ponds was also in practice.

Modern technologies for obtaining and using water are concerned chiefly with the exploitation of river system and the development of groundwater by means of wells and boreholes. Groundwater is much favoured for drinking water supplies because of its freedom from contamination but in most arid parts of the world potable groundwater is not always available. Sometimes, it is found to be salty for human consumption or sometimes with high fluoride concentration. Groundwater can be found in the drier parts of the world but the yield will be inadequate to meet the demands (Stern 1982). Groundwater may also be very deep and, hence, costly to exploit and to pump. Not surprising, places where rain water collection has been fully applied are frequently in regions where other water resources are inadequate.

Rain water collection system can be attractive for the individual household who wants the convenience of its own supply under its own control, and for whole communities where the area lacks rivers or groundwater. In the pacific and Caribbean regions rain water is important source for drinking water supplies (Fujimura 1982, Layton 1984). Rain water collection is strongly emphasised in the parts of Nova Scotia (Canada), Jamaica, Java (Indonesia) and the Yucation Peninsula of Southern Mexico. The people of Khulna, Barisal and Patuakhali districts of Bangladesh mainly depend on water from artificially dug ponds, which are replenished by rain water in monsoon. In Australia, parts of India, the middle east, North Africa, Parts of East Africa, Mexico and Southwest United

States, the rain water collection practice is being in vogue not only for domestic supplies but for livestock, for runoff fanning and even sometimes for irrigation. Costwise rain water collection is cheaper because of high cost of alternatives. Rain water collection may fill the gap in existing water supply provision resulting from population explosion. Moreover the quality of water is advantageous for washing and drinking. In the eastern part of Sivagangai district, Tamil Nadu, a coastal area with sedimentary geological formation, which makes the exploitation of ground water costlier and devoid of river sources, roof water collection and rain water harvesting in artificially dug ponds (called Oorany in Tamil) have been in practice by tradition. Almost all the rural habitations have such rain water harvesting ponds for drinking purpose. These have been the sole source of water supply till early 1960s because of absence of technology for exploiting groundwater in the deep sedimentary formations. In addition, sandy aquifers in the most parts are saline and restrict the scope for creation of deep borewell.

People also prefer pond water for drinking than groundwater because of softness and accustomed taste (Mariappan et al. 1998). Roof water collection practice is being followed at household level. During rainy season, people collect rain water from roofs in specially prepared containers, and keep them for nonrainy periods. Increasing population coupled with increased demand per head solicits better management techniques and revival of traditional drinking water methods. The present study attempts to analyse the quality of rain water collected at roof level and in dug ponds for drinking purpose.

MATERIALS AND METHODS

The rain water samples were collected at Pushkar and Budha Pushkar on the event basis during July, 2007. For manual collection, plastic bucket was used according to internationally accepted specifications (WMO GAW No. 85). The bucket diameter was 30 cm with a height of 31 cm mounted over the roof of the house (height 4.5m) on a wooden stand. Immediately after collection, the rain water samples were transferred to 2-litre plastic bottles and transported to the laboratory for analysis. Samples for bacteriological analysis were collected in sterilised glass bottles. Water samples from different ponds located in and around Ajmer were also collected. As the water depth in the ponds was shallow, water samples were collected at surface and bottom to have a 2-litre mixed sample. Physico-chemical and bacteriological parameters were analysed as per standard methods (APHA 1989).

RESULTS AND DISCUSSION

Physico-chemical and bacteriological parameters of roof water collected at Pushkar and Buda Pushkar with mean values are presented in Table 1.

Mean value of total dissolved solids in the roof water is 10.5mg/L with other constituents present in very low concentration. Bacteriologically, it is also free from harmful microorganisms and is harmless. It can be stated that the roof water is almost analogous to distilled water. Mean values of physico-chemical and bacteriological characteristics of the pond water are given in Table 2. Average value of turbidity in pond water is 68.88 JTU against a permissible values of 10 JTU for drinking purpose (CPHEEO 1991) whereas the roof water is clean with 1 JTU. So the turbidity pick up from the soil by the rain water on the way to the pond is 58.88 JTU. Generally, surface water has always higher turbidity than the groundwater and subsurface water. Contrary to the roof water pond water is highly polluted by bacteriological parameters.

Table 1: Physico-chemical characteristics and Bacteriological parameters of roof water.

Parameters	Mean Values
Turbidity (JTU)	1
TDS	10.5
Electrical conductivity (μmho/cm)	30
pH	7.1
Alkalinity	10
Total hardness	10
Calcium	3
Magnesium	1
Iron	0
Manganese	0
Free NH_3	0
Nitrate	0
Chloride	3
Sulphate	0
Fluoride	0
Phosphate	0.5
Coliform	0
Faecal *Streptococcus*	0

All values are in mg/L except pH, otherwise stated.

Table 2: Mean values of physico-chemical and bacteriological parameters of pond water.

Parameters	Pond water
Turbidity (JTU)	58.8
TDS	117
Electrical conductivity (μmho/cm)	166
pH	7.02
Alkalinity	45.95
Total hardness	46.8
Calcium	11.64
Magnesium	3.84
Iron	1.32
Manganese	0
Nitrate	9.32
Chloride	17.09
Sulphate	0.288
Fluoride	1.409
Total coliform	8.7
Faecal *Streptococcus*	574.5

All values are in mg/L except pH, otherwise stated.

The pH is almost neutral in both the cases. Naturally, mineral acids resulting from oxidation of SO_2 and organic acids are also found to contribute acidity to the precipitation (Chan et al. 1987, Ayer 1990). Pure water is in equilibrium with global atmospheric CO_2 and yield the natural acidity to the rain water with pH 5.6. So, pH value of 5.6 is considered as the demarcation line for acidic precipitation. Moreover, in the absence of $CaCO_3$ the rain water pH would be expected to be around 5 due to natural sulphur compounds (Charlson & Rodhe 1992). Acid rains have been also reported in India (Chandramouzhi et al. 1997).

Rain water in Rourkela industrial area has been reported to contain 20.1 to 31.3 mg/L of sulphate and 10.8 to 40.0 mg/L of total solids. But the sulphate content is zero, and TDS 20.5mg/L in the industry free study area.

CONCLUSION

Roof water is found to be very soft and free from bacteriological pollution. Roof water collection system at household level for drinking purpose seems to be encouraging. Pond water is objectionable due to presence of TDS, turbidity and bacteriological pollution. For pond water sand filter may be used for clarifying the water. On the other hand, water from builtup area may be routed through a separate channel for household use.

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