XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **208**

topic: **1**
Groundwater quality sustainability

1.4
Groundwater quality and agriculture

title: **Water quality assessment in North-East India**

author(s): **Mrinmoy Datta**
ICAR Research Complex for NEH Region, India, mdatta2@rediffmail.com

Prabir Kumar Ghosh
ICAR Research Complex for NEH Region, India, ghosh_pk@yahoo.com

Narendra Prakash Sin
ICAR Research Complex for NEH Region, India, jd_tripura@yahoo.com

S. V. Ngachan
ICAR Research Complex for NEH Region, India, director_icar@neh.co.in

Promode Kumar Singh
ICAR Research Complex for NEH Region, India, pksingh@rediffmail.com

Ashoke Kumar
ICAR Research Complex for NEH Region, India, akumar@rediffmail.com

Anup Das
ICAR Research Complex for NEH Region, India, adas@rediffmail.com

keywords: physico-chemical characteristics, microbial assay, pesticide residue analysis

INTRODUCTION

India's annual precipitation (snowfall and rain) is 4000 billion cubic metre (bcm). This translates into 1,869 bcm of water in rivers, of which, barely 690 bcm is used. Nearly 1,179 bcm of water flows into the sea. Considering 432 bcm of groundwater, the total water availability is around 1,122 bcm amounting only 1,122 cubic metres of water available per person per annum in the billion plus country (Singh, 2002). Moreover, the assessment of water quality (Das, Goswami, 2003) is of paramount importance to find out the suitability of water for various purposes viz., drinking, irrigation and other industrial/.household works particularly in the north east India where the pertinent research on water quality has not been carried out in a systematic manner.

MATERIALS AND METHODS

As such, water from sources like tubewells (shallow/deep aquifers) and surface streams (lakes/canals/ponds) in 3 places (Manipur/Meghalaya/Tripura) in north east India was collected and thereafter analysed to focus on the chemical, microbiological and pesticide residue analysis. The no. of samples collected/analysed were 19 (Manipur), 39 (Meghalaya) and 61 (Tripura) and moreover, seasonal variation of water characteristics was also brought under study.

PHYSICO-CHEMICAL CHARACTERISTICS

In Manipur, water samples were from Imphal (West District) and water pH was found to vary from 6.45 to 9.35 thus indicating the presence of acidic to alkaline nature. The comparatively high pH noted in ponds/dams could be due to erosion load of cationic constituents in the lower reaches of the hills (Manipur valley).

The seasonal variation of chemical analysis (WHO, 1993) in Umiam reservoir (Meghalaya) indicated that water pH varied from 7.12 to 9.11 being maximum during monsoon. Transparency was of the lowest value (upto 2.09 m) during monsoon thus indicating the rain induced erosion of mud or clay materials from the catchment areas. Calcium + magnesium content ranged from 0.06 to 0.15 (meq/100 ml) for pre-rain and 0.07 to 0.28 (meq/100 ml) for post rain samples in Meghalaya. The Fe content in pre- and post-rainy samples from West Khasi Hills ranged from 0.07–0.23 mg/l and 0.14–0.22 mg/l, respectively. The nitrate content among monsoonal samples ranged from 11.2 to 30.8 mg/l, mostly categorized under low and medium group. The chloride content of the monsoonal as well as post monsoonal samples were mostly categorized under increasing toxicity level which is quite safer for irrigation purposes. However, bicarbonate content was detected in almost all the samples and the values ranged from 2.3 to 6 meq/1000 ml for pre-rain and 3 to 5 meq/100 ml for post-rain samples. The carbonate content of the monsoonal and post monsoonal samples may be classified under none which is having no toxic effect for irrigation use.

The chemical characteristics of water as estimated for drinking/irrigation/pond water were evaluated in Tripura. In West Tripura, pH of water showed a variation from 6.11 to 7.68. But, pH of water samples collected from different places in South Tripura showed a variation from 5.37 to 7.48 Concentration of nitrate, phosphate, potassium and calcium in water samples of West Tripura varied from 1.0 to 7.2 mg/l, 0.04 to 1.43, 0.09 to 2.24 and 0.64 to 11.48 mg/l, respectively. On the other hand, concentration of nitrate, phosphate, potassium and calcium in South

Tripura varied from Trace to 4.2 mg/l, Trace to 0.25 mg/l, 0.05 to 2.34mg/l and Trace to 11.27 mg/l, respectively. It is indicated from the mean values that drinking water had more acidity compared to irrigation and pond water. Among the macroelements, drinking water contained high nitrate (2.35 mg/l) though it is much below the permissible limit (45 mg/l). Pond water was found to contain high amount of potassium (1.04 mg/l) and calcium (5.71 mg/l) compared to two other water sources. In West Tripura, contents of Zn, Cu, Mn and Fe varied from trace to 129, trace to 11, trace to 990 and trace to 4205 µg/l. In South Tripura, contents of Zn, Cu, Mn and Fe varied from Trace to 122 µg/l, Trace to 34 µg/l, Trace to 398 µg/l and Trace to 580 µg/l, respectively. So, pond water was also found to have more contamination in copper and manganese, but drinking water which contained iron lower than the permissible limit (300 µg/l), had comparatively high zinc contamination. Both irrigation and pond water contained iron contamination higher than the permissible limit.

MICROBIAL ASSAY

The assay of microbial load (Kistemann, 2001) is necessary to pinpoint water suitable both for drinking as well as irrigation. Some of the water sources from Meghalaya were analyzed for the *Colliform* and *Salmonella* and most probable number (MPN) to find out micro-organisms load in the water samples. The samples with higher MPN are unsafe to use. The water from Umshyrpi river had higher MPN value(>1000/100 ml). This water was also contaminated with *E coli* and Salmonella, hence not safe for drinking as well as irrigation. On the other hand, water present in Jalkund were containing less infection of colliform and salmonella as compared to river water.

PESTICIDE RESIDUE ANALYSIS

Presence of pesticides (Jaysree and Basudevan,2007) is a matter of great concern in water as well as various food materials due to their indiscriminate use for increasing the crop productivity in India. As such contamination or the presence of some pesticides, viz., monocrotophos, cyfluthrin, dimethoate, carbofuran, endosulfan (alfa and beta), chloropyriphos and cpermethrin were estimated in water samples collected from Manipur, Meghalaya and Tripura. Water in most of the rivers in Manipur and Meghalaya had alarmingly high contents of pesticide residue (> 1.0 µg/l) and such water is unsuitable for agricultural purposes. Water from Loktak lift irrigation in Manipur also contained 1.61 µg of beta endosulfan/l. But water from some of the village pond were found to contain pesticide less than 1.0 µg/l but higher than the admissible limit (0.1 µg/l) for drinking water. Water from tubewell in Manipur were found to be suitable for drinking purpose.

CONCLUSION

So, an accurate and reliable information on the water resource system can, therefore, be a vital aid to strategic management of this resources. for arriving at rational decisions that will result in the maximum amount of benefit to the people.

REFERENCES

Das P.J., Goswami D.C., 2003: *Long-term variability of rainfall over northeast India*. Indian Journal of Landscape Systems and Ecological Studies. 26(1): pp. 1–20.

Jayashree R., Vasudevan, 2007: *Organochlorine pesticide residues in ground water of Thiruvallur district, India*. Environmental Monitoring and Assessment, 128 : pp. 209–215.

Kistemann T., Danagendorf F., Exner M., 2001: *A geographical information system (GIS) as a tool for microbial risk assessment in catchment areas of drinking water reservoirs.* Int. J. Hyg. Environ. Health 203: pp. 225–233.

Singh A.K., 2002: *Water — The Key to Sustainability*. Indian Society of Soil Science Newsletter, no. 13:1–2.

World Health Organization, 1993: *Guidelines for drinking water quality, vol. 1. Recommendations, 2nd ed*. World Health Organization, Geneva, Switzerland.

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0