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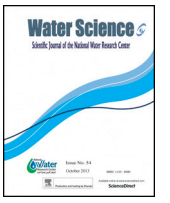

Research Article

Studies on high iron content in water resources of Moradabad district (UP), India

Vipin Kumar [a], Pawan Kumar Bharti [a], Meenu Talwar [a,*], Ajay K. Tyagi [a], Pamposh Kumar [b]

[a] *Shriram Institute for Industrial Research, New Delhi 110007, India*
[b] *NCSTC, Department of Science and Technology, Technology Bhavan, New Mehrauli Road, New Delhi 110016, India*

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Abstract

In India, the district of Moradabad lies between 28°21′ to 28°16′ north latitude and 78°4′ to 79° east longitude in western Uttar Pradesh. The city is known for its export of brass handicrafts to various countries across the world including North America and Europe and is also known as Peetal Nagri (Brass City). A field survey was conducted in district Moradabad along with a public interaction program on water related problems. A total of 108 representative villages covering all eight blocks of Moradabad district were visited and interactions were held with the local population to find out the status of drinking water quality and associated problems. The previous studies on surface and groundwater quality assessment of Moradabad district did not cover the entire area or present the water quality awareness amongst the local population despite of the repeatedly complains about the yellow colour of water.

Water quality of surface and groundwater has been assessed with respect to metal concentration using ICP-OES technique. Out of the 64 water samples collected, copper, arsenic, lead and chromium concentrations were always within the permissible limits. While iron concentration, more than 50% of the samples were beyond permissible limit. Maximum iron level in groundwater sample was 3820 ppb and that in surface water sample was 6294 ppb whereas the permissible limit is 300 ppb.

The overload of iron may cause severe health problems such as liver cancer, diabetes, cirrhosis of liver, diseases related to heart and central nervous system, infertility etc. The presence of high concentration of iron leads to adverse changes in colour, odour and taste of water and it also stains clothes and utensils. However, the local health authority's records are not available.

Keywords: Water quality; Iron content; Field survey; ICP-OES technique

* Corresponding author at: Shriram Institute for Industrial Research, 9-University Road, New Delhi 110007, India.
E-mail addresses: environment.vip14@gmail.com (V. Kumar), gurupawanbharti@gmail.com (P.K. Bharti), meenu@shriraminstitute.org (M. Talwar), aktyagi@shriraminstitute.org (A.K. Tyagi).

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1. Introduction

District Moradabad situated in western Uttar Pradesh region of India is famous for the manufacturing of brass handicrafts. Moradabad district occupies 3493 km^2 area and had the population of about 4.8 million according to census 2011. Majority of population utilizes groundwater for domestic, agriculture and industrial purposes. Some villages near the bank of Ramganga and Gangan river utilize river water for agricultural practices. Fast population growth, urbanization and industrialization have imposed pressure on the natural resources. The disposal of industrial effluent into the water bodies without adequate treatment is the major cause of the environmental pollution (McLaughlin et al., 1999). Apart from the metal handicraft manufacturing industries, electronic waste recycling and metal waste recycling is being carried out on the banks of Ramganga River in Moradabad. The waste is being dumped into the ground and in the drains without any treatment. Considering the non-judicious disposal of wastes, the environmental monitoring of this region becomes very necessary.

Both quality and quantity of water limits its usage. Polluted water can be a serious threat to human health (Rawat and Arora, 1986). Urbanization and conventional landfills leads to deterioration of the groundwater quality and poor drainage system impairs the surface water quality. Sinha and Kumar (2006) have carried out trace metal monitoring in Gangan river water at Moradabad. The river water was found to be excessively contaminated with copper, lead and iron. Gangwar et al. (2012) have reported that the water quality of river Ramganga in Bareilly, Uttar Pradesh is unfit for drinking purposes as a result of the discharging of domestic and industrial wastewater into the river and also other anthropogenic activities around the river.

Iron is the fourth most abundant element making up 5.6% of earth's crust. Iron contamination of water can either be geogenic or via industrial effluents and domestic waste. Iron containing water after reacting with tea and coffee appears inky black (Colter and Mahler, 2006). Iron is an essential element for haemoglobin, myoglobin and a number of enzymes and its deficiency lead to anaemia and loss of well-being. However, its overload causes severe health problems in human beings such as liver cancer, diabetes, cirrhosis of liver, heart diseases and infertility etc. The presence of higher concentrations of iron changes colour, taste, odour of water, leaving stains on clothes and corrodes water pipe lines (Behera et al., 2012).

In the present study, the water quality has been assessed with respect to iron contamination by real time profiling and also by interaction with local population. Moradabad district comprises of 8 blocks as shown in Fig. 1. Before starting the water sample collection for real time profiling and interaction with local population, the location of industries, drainage system and river bodies were thoroughly studied.

The objective behind carrying out both the quantitative estimation of water in the laboratory and qualitative assessment of water quality through interaction with local population is to have data from two sources which complement each other in highlighting the same problem of poor water quality with respect to iron contamination.

2. Materials and methods

2.1. Interaction with local people

Field survey was carried out covering all eight blocks and 108 villages to get the public feedback on water quality. Survey was carried out by interaction with local community and filling up of a detailed questionnaire related to water related issues. The questionnaire used for gathering information from the local population where about 159 questionnaires were filled after interacting with 549 people locally (Fig. 2).

2.2. Near/real time profiling

A total of 64 surface water and groundwater samples were collected in pre-cleaned high density polyethylene (HDPE) bottles as per the standard methods. Samples were preserved using nitric acid and maintained at $10 \pm 2\,^{\circ}C$ temperature (BIS 3025 part 1(2003) and APHA (2012) 21st edition). Water samples were analyzed in the laboratory for iron concentration using Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) within three days of sample collection.

The quantitative estimation was carried out in the instrument laboratory in the institute. It is important to mention here that the institute is ISO 9001 and NABL certified. The estimation of water quality is being carried out regularly

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