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RESEARCH ARTICLE

SEASONAL VARIATION OF NITRATE IN NATURALWATER OF BANGALORE NORTH

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Abstract

The water samples were collected from Bangalore North Taluk in pre monsoon season and post monsoon. The physico-chemical parameters such as pH, EC, total dissolved solids, hardness, chloride, sulphate, nitrates, sodium and potassium have been analyzed. Majority of the samples do not comply with BIS for most of the water quality parameters measured. The Nitrate concentration in the groundwater of these sites was recorded from 6 to 192 mg/L, nitrate generally increases as flow increases following intense precipitation. Main sources of nitrate in the studied waters might derive from agriculture, seepage from dumping of municipal waste, land use and land cover and farming. Overall water quality was found unsatisfactory for drinking purposes without any prior treatment in maximum samples.

Introduction

Nitrate contamination often affects aquatic systems worldwide. Nitrate concentrations in water may increase due to natural and/or anthropogenic sources, such as waste materials, intensive animal operations, with nitrate from over-application of manure, irrigated and row crop agriculture, with nitrate from fertilizer-induced mineralization, septic tank systems and landfills (Canter, 1997). Nitrate derived from atmospheric deposition is generally taken by plants, but where vegetation is scanty, and/or input is so high, nitrate behaves as a mobile anion (Drever, 1997).
Nitrate guidelines for drinking water established by the World Health Organization (WHO, 2006) are 50 mg/L for short-term exposure, and represent the reference values in the development of national standards. Indian standard recommends 45 mg/L nitrate concentrations in drinking water. Primary health concern regarding nitrate intake is the so-called "blue baby syndrome": nitrate is reduced to nitrite in the stomach of infants, and nitrite is able to oxidize hemoglobin to methemoglobin, which is unable to transport oxygen around the body (Greer and Shannon, 2005).

The aim of this study is to investigate the occurrence of nitrate in ground waters in Bangalore north Taluk. This region hosts intense agricultural activities and farming.

STUDY AREA

The study area located at the Latitude13°8', 13°12' and Longitude 77°33', 77°37' (Fig. 1). The study area is part of the Peninsular Gneissic Complex with intrusions of Amphibolites and Doloerites. The Double porosity Fracture setup exists in the study area indicating prevalent of fracture aquifer system.

In this study, a total of 47ground waters samples were collected. At selected sites, sampling of ground water was repeated under different seasonal conditions. Locations of water samples are shown in Figure 1.At the sampling site, water samples were filtered through 0.4 Fm pore-size filters into new polyethylene bottles, and taken refrigerated till analysis (storage time was usually <4 days). Water pH by glass electrode, TDS and conductivity were measured on

site. All other major cations and anions are measured by APHA methods (2005).The Nitrate was determined by UV-Visible spectrometer.

RESULTS

The studied waters show large variations in chemical parameters, chemical composition, of different seasons (premonson and post monsoon). Table 1 summarize nitrate concentrations in the study area, together with pH, conductivity values, major anions and cations. The mean nitrate in groundwater for premonson (54.6mg/L) and post monsoon (70.2mg/L) is significantly higher compared to BIS value (45 mg/L).

Nitrates are the most oxidized forms of nitrogen and the end product of the aerobic decomposition of organic nitrogenous matter. The groundwater contamination is due to the leaching of nitrate present on the surface with percolating water. Johnson and Reynolds (1977) found similar nitrate concentrations in stream water from (granite) and from metamorphic rocks. The Nitrate contamination is common in basic extrusive granite formation and also may be attributed to the percolation of large amount of organic wastes from effluent nitrate fertilizers and other wastes like sewage disposal which on decomposition by microorganism results in the production of nitrates. Figure 2shows that, the nitrate content of groundwater is well within the desirable limit of BIS (45 mg/l). While the nitrate content from granitic aquifers range between to be 6 and 190 mg/l.

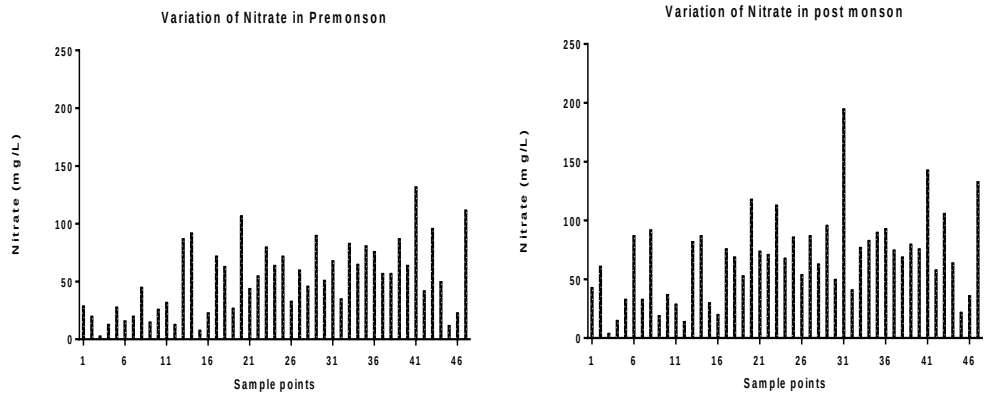

Figure 2. Plots showing variation of nitrate concentrations in different seasons

Positive correlations occur although large scattering is observed. The positive correlation between nitrate and potassium might indicate a common source from agricultural practices via the use of fertilizers and from farming. When a significant rainwater component was present; relatively high concentrations were measured in waters draining cultivated and farmed areas and were associated to relatively high potassium (K) contents. These observations suggest that nitrate flushing via rainwater allows nitrate transport in surface water, as well as potential infiltration in groundwater. Rainwater carry dissolved nitrate; mean values of 2 mg/L NO3- have been reported in Sardinian rain samples (Caboi et al., 1992).Figure 3, dissolved nitrate in the ground water samples does not show significant correlation with conductivity and potassium. The highest nitrate concentrations were observed in groundwater circulating in granite rocks, where water circulation occurs close to surface.

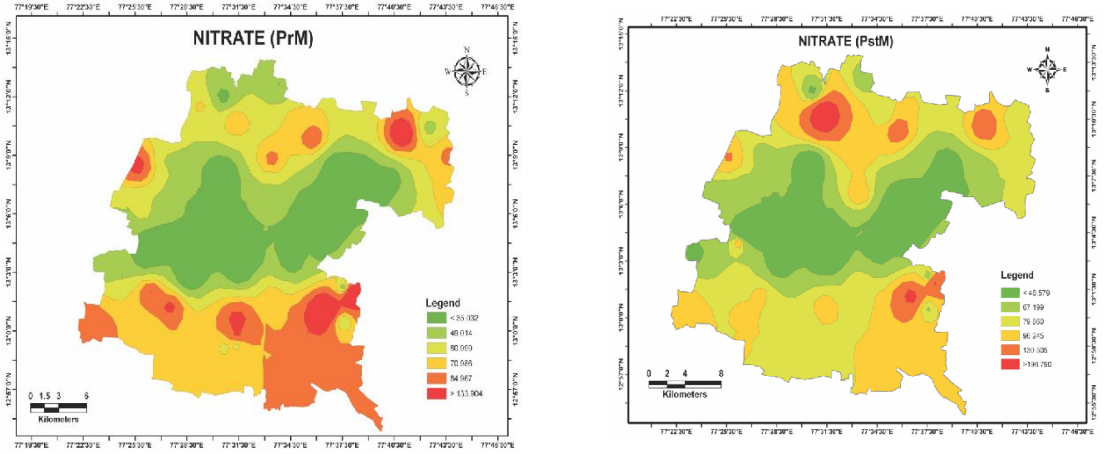

Fig: 3 Variation of Nitrate in ground water shown by GIS Maping

Among the investigated ground water, about 70% postmonson samples and 55% of premonson water samples showed concentrations of NO_3- >50 mg/L. Taking into account that many of these waters are used as drinking water, their regular consume may pose a health hazard, especially to infants.

CONCLUSIONS

The regular consumption of drinking water with high concentrations of nitrate may pose health hazards, especially to infants. In Bangalore north taluk, nitrate concentrations in natural waters vary from 0.1 to about 190 mg/L. Higher concentration of nitrate occur in waters draining cultivated and farming areas ;in these waters, nitrate is likely to derive mostly from agricultural and farming practices.

Appropriate management of livestock waste and rational use of fertilizers appear therefore necessary for controlling nitrate accumulation in the soil, which in turn will help reducing its transport by leaching. Any nitrate remaining in the soil profile after the end of growing season, which coincides with the beginning of the leaching season, is susceptible to leaching because of little opportunity for nitrate removal by plant uptake. Applying fertilizers based on soil testing and strictly according to the plant requirement, and evolving strategies that minimize the residence time of nitrate in soil can help mitigate the nitrate leaching problem (Hooda et al., 2000). Supply of Nitrogen may be restricted for agriculture activity where the high concentrated aquifer water is found.

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