

Nitrate concentration in groundwater: a cross-sectional study in three villages near paddy fields in Bachok district, Kelantan during the harvest season

ABSTRACT

Nitrate fertilizer is extensively used to produce healthy crops on a wide scale, and paddy planting is no exception. Nitrate that is not used by plants is able to penetrate the soil and end up in groundwater. This, if not checked, can give rise to health problems including infant methemoglobinaemia, a disease where hemoglobin in erythrocytes are changed into methemoglobin by nitrite which, in turn, makes it unable to transport oxygen to body cells. Nitrite is formed from ingested nitrate that is altered by bacteria present in the infant's stomach. This cross-sectional study was conducted in February 2019 for 2 weeks' observation during the paddy pre-planting season, and a total of 149 wells across three villages were sampled for nitrate. Readings were compared to the Drinking Water Quality Standard stated by the Ministry of Health, Malaysia. The maximum acceptable value for nitrate in drinking water is 45 mg/L nitrate (NO₃⁻). The three villages, namely Keting, Kuchelong and Telaga Ara, were chosen as they are located near paddy fields and water from wells were used for drinking and cooking without filtration. It was found that only one (0.67%) of the wells had nitrate above the maximum acceptable value (56.85 mg/L NO₃⁻). This highest value was found in Telaga Ara village and the location of the well was 50m from the nearest paddy fields. In Kuchelong village, the mean nitrate level was 5.10 +0.85 mg/L with a range of 0.73 to 27.10 mg/L. While in Telaga Ara village, the mean nitrate levels was 10.52 +1. 24 mg/L with a range of 1.67 to 56.85 mg/L. Mean nitrate level in Keting village was 5.34 + 4.94 mg/L with a range of 0.40 -23.65 mg/L. In general, nitrate levels were found to be below the maximum acceptable value in the villages concerned and therefore did not pose any health risks to users. Periodic assessment of nitrate in groundwater is still important as to ensure the levels remain below the acceptable value, and in turn, safeguard the health of its users.

Keyword: Nitrate; Groundwater; Paddy; Bachok