PEOPLE: International Journal of Social Sciences
ISSN 2454-5899

Kamal et al., 2015

Volume 1 Issue 1, pp.313-319

Year of Publication: 2015

DOI- https://dx.doi.org/10.20319/pijss.2015.s11.313319

This paper can be cited as: Kamal, M. Z., Md. Hashim, D., & Zin, M. S. (2015). The Effect of the Ammonium Concentration In The Groundwater. PEOPLE: International Journal of Social Sciences, 1(1), 313-319

THE EFFECT OF THE AMMONIUM CONCENTRATION IN THE GROUNDWATER

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Abstract

Groundwater has long been one of the major water resources for a variety of domestic, agricultural, and industrial uses, particular for the regions with limited surface water resources (Zektser, I.S., & Everett, L.G., 2000). This paper discuss to what extent the Ammonium concentration differences by making a comparison with the National Drinking Water Quality 1983 that states the permitted content of Ammonium is at 0.5 mg/l. The Ammonium content in Bachok district is quite a concern as from the data taken in 1990. 1999. and 2011, there's only *one observation well met the standard which is KB 51. KB 34 can be categorized as the most polluted, in 1990, the Ammonium concentration that has been recorded is at 11.2 mg/l. Anthropogenic activities such as urbanization is one of the major component that are causing the high NH_4content in the ground water.*

Keyword

Ground Water, Ammonium

1. Introduction

Groundwater has long been one of the major water resources for a variety of domestic, agricultural, and industrial uses, particular for the regions with limited surface water resources (Zektser et al., 2000). Sreenivasulu et al., (2015), over the decades, groundwater has been widely used for irrigation, industries and domestic purposes. The stress on water resources is increasing due to galloping population, haphazard industrialization and rapid urbanization. As groundwater depletion and pollution have become severe problems with the rapid economic growth and intensive resource (Wang et al., 2007).

2. Issues

Water is the most important resource on Earth, for humans and other living organisms alike. Despite this, nearly half of the world's population does not have access to drinking water of acceptable standard. Groundwater is usually a good source of drinking water since water is naturally purified when it is slowly percolating through soil. The use of groundwater as a source for drinking water has expanded much in modern times and today makes up 25 to 30% of the total water extraction of the world (Younger, 2007).

Nitrogen is found in groundwater as dissolved organic nitrogen (DON), NO_3, NO_2 or NH_4. The most common compound found in groundwater is NO3, but in strongly reducing environments NH_4 can be the dominant form. NH_4 is found in groundwater naturally as a result of anaerobic decomposition of organic material (Bohlke et al., 2006). It is also commonly found in groundwater due to anthropogenic activities, primarily due to leaching from fertilizes, organic waste disposal or leaking sewage systems (Johan Lindenbaum, 2012).

WHO (2008), the term ammonia includes the non-ionized (NH_3) and ionized (NH4) species. Ammonia in the environment originates from metabolic, agricultural and industrial processes and from disinfection with chloramines. Natural levels in groundwater and surface water are usually below 0.2 mg/liter. Anaerobic ground waters may contain up to 3mg/litre. Intensive rearing of farm animals can give rise to much higher levels in surface water. Ammonia contamination can also arise from cement mortar pipe linings. Ammonia in water is an indicator of possible bacterial, sewage and animal waste pollution.

The transport of dilute aqueous contaminants in groundwater is generally represented by the advection dispersion equation, which assumes that the contaminants neither decay nor interact with other aqueous species or mineral phases (Domenico et al., 1998).

3. Study Area and Methodology

The Bachok district is located in the northeast of Kelantan (Malaysia) that is adjacent to Kota Bharu in the West, the South China Sea (North and East) and Pasir Puteh (South). Highland area covers the entire colony with 26,420 hectares (264.1 sq km), which covers 1.8 percent of the area in the State. The study area includes the coastal areas along 32 Km.

There are two different locations seen in this study, namely Beris Kubur and Kg. Chap. Beris Kubur has five observation wells that are KB 31, KB 32, KB 33, KB 34 and KB 35, while Kg. Chap has only one observation wells, KB 58. We chose these two different locations are to differentiate the presence of Ammonium content in the ground water of the area.

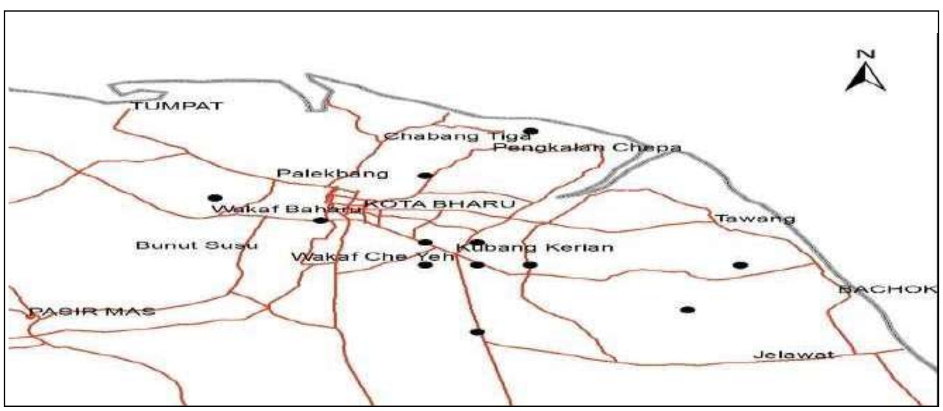

Figure 1: *Research Area*

Secondary data of the Ammonium content in ground water that were obtained from the Department of Mineral and Geosciences' Kelantan was used to view the content of Ammonium in the ground water of the research area, comparison method will be made. The Ammonium concentrations data will be compared with the National Drinking Water Quality Standards 1983. The value set by the Ministry of Health (1983) for the Ammonium content in drinking water should be at 0.5 mg/l. The ground water quality analysis will be carried out starting from 1990, 1999 and 2011 to see the ammonium content in the research area.

4. Results

The Ammonium content in Bachokis worrying, from the data taken in 1990, 1999 and 2011, there's only one observation well met the standard that is KB 51. In 2011, the wells in BerisKubur area (KB 31 and KB 32) met the standard set. KB 34 can be categorized as the most polluted, in 1990, the Ammonium concentration that has been recorded is at 11.2 mg/l, decreased to 2.0 mg/l in 1999 and 2011. It is worrying when the NH_4value increased to 2.6 mg/l making it the amount is at 4.6 mg/l. KB 33 also worrying when the increasing pattern in the year (Refer Figure 2). KB 31 and KB 35 are the most consistent when the value decreased in 1990, 1999 and 2011. Even though the value are decreased, both KB 35 and KB 31 are still met the standard. Anthropogenic activities such as urbanization are one of the major components that are causing the hight NH_4in the ground water. NH_4in aquifer is contaminated by the landfills and the waste disposal method (Baedecker& Back, 1979; LeBlanc, 1984; Cozzarelli et al., 2000; Heaton et al., 2005).

Table 1.1: *The Ammonium Content Value in the Ground Water*

No. Sample	NH_4 (mg/l) 1990	NH_4 (mg/l) 1999	NH_4 (mg/l) 2011
KB 31	1.12	0.6	0.49
KB 32	0.52	1.4	0.49
KB 33	0.8	0.9	0.9
KB 34	11.2	2.0	4.6
KB 35	8.5	4.1	2.4
KB 58	0.1	0.49	0.49

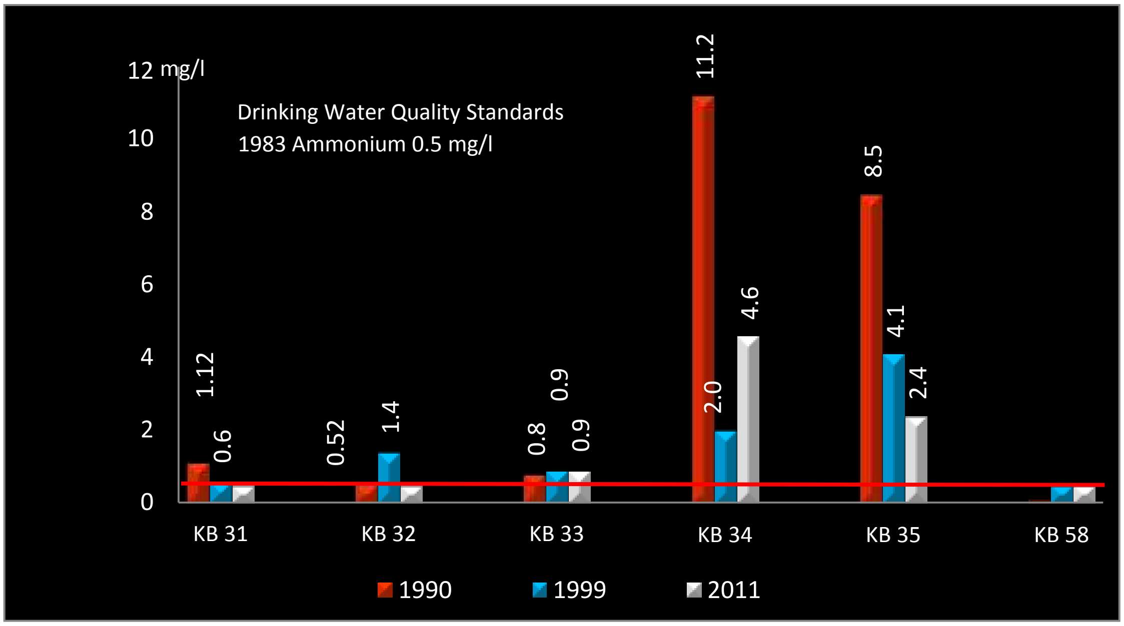

Figure 2:*Ammonium*

5. Discussion

Ammonia is toxic to organisms at concentrations exceeding 0.02 mg/L (U.S. EPA, 1977). Elevated levels of NH4 in municipal water can react with chlorine, used as a disinfectant, and lead to an increase in total coli form populations (U.S. EPA, 1999). Ammonium can also oxidize to NO_3, which can lead to decreased levels of dissolved oxygen and the eutrophication of costal ecosystems. Nitrates in drinking water may cause methemoglobinemia, an oxygen deficiency, which can be deadly to infants (WHO, 2008).Septic systems and agricultural practices also may result in locally elevated recharge rates of NH_4. NH_4 in aquifers can cause degradation of groundwater quality and usability, it can have substantial effects on water-rock interactions, and it can be a substantial source of N in surface waters receiving groundwater discharge. Despite the environmental importance of NH_4, there are few studies documenting NH_4 transport and reaction processes in aquifers.

Ammonium is typically present in landfill leachates, wastewater discharges and other industrial liquors, such as quench waters at coking plants and gasworks sites, at very high concentrations relative to relevant standards for drinking water or environmental quality. Under certain conditions it is also a relatively mobile contaminant. For these reasons, it is common to use NH_4 as a key contaminant species in risk assessments for landfills, effluent soak ways and NH_4 fate in wastewater and topsoils (USEPA 1993; Brady & Weil, 2002). Yu Umezawa et al., (2009), conversely NH_4 is removed from the subsurface system via uptake by plants, microbial transformation (e.g., anaerobic ammonium oxidation, nitrification), and physical reactions (e.g., sorption into minerals and ammonia volatilization).

6. Conclusion

Groundwater from wells in the study area contain high levels of ammonium. At current concentration, ammonium harmful to aquatic organisms and can have negative effects on human health. Groundwater abstraction has increased rapidly since the early 1900s and today the city is fully dependent on underground water.

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