Nitrate Pollution of Aya Watershed in Vandeikya Rural Area of Benue State Nigeria

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Abstract: *Nitrate levels in Aya watershed were examined .Water samples were collected from 10 sampling sites across the catchment Area of River Aya, for analyses. The analyses were done according to standard methods of water examination. The analyses showed 100% of samples with higher Nitrate concentration above the WHO standards for water quality. The Presence of Nitrate in these rivers may be traced to indiscriminate disposing of animal wastes, farming practices with the use of agro-chemicals. The presence of Nitrate in River Aya indicates pollution and offers threat to biodiversity. All land use activities capable of polluting water should be controlled.*

Keywords: Nitrate, Pollution, Watershed, Aya.

1. Introduction

Watershed is a natural unit, which collects water and drains, through a common point by a system of drains hence is comprised of a catchment area (Recharge zone), a command area (transition zone) and a Delta area (Discharge zone). Therefore a watershed is the area encompassing the catchment, command area and Delta area of a river. The topmost portion of the watershed is known as the "ridge" and the line joining the ridge portions along the boundary of the watershed is called a "ridge line"

Agricultural Chemicals in water must be assessed not only in terms of scientific findings, but also in the broader context of US Agricultural development, a growing conservation ethic and economics.

Concern about the potential harm of agricultural chemicals began slowly in the late 1950´s and early 1960´s and has been growing in both the public and agricultural community. In developing economics, farmers are not aware of the complex interrelationship between agricultural practices and environmental quality (U.S. Geological Survey, 1999). Watershed pollution occurs in two ways; point source and non-point source (Gillion, 1999).

2. Literature Survey/ Previous Work

An important National issue in the United State is the degradation of water quality from non-point source of pollution, including the prevalent use of fertilizers and herbicides on agricultural lands. The issue is of interest to many residents, water managers, across the nation because of the possible impacts on water uses, such as drinking irrigation, recreation and sustaining aquatic life and plants (U.S. Geological Survey, 1999).

Concern over the quality of surface water have received wide attention among researchers; Kakulu and Osibanjo, (1992) Olajire and Imepeopara (2001), Owuama and Uzoije (2005) and Ehinola and Coker, (2002), Consistent in their findings is that water from these rivers are polluted through human activities, and geochemistry of the surrounding environment.

Health Problems from Nitrates in water sources are becoming a serious problem everywhere in over 150 countries. Nitrates from fertilizers seeped into rivers and ground water (Maywald et al, 1988). Nitrate is one of the most commonly identified groundwater contaminants (BGS, 2003). Excessive levels can cause methaemoglobineamia (blue-baby syndrome). This is a situation whereby nitrate is reduced to nitrite in the stomach of infants thus inhibiting the transport of oxygen round the body. The consequence is shortness of breath (Cyanosis), blueness of Skin, and most times death (BGS 2003).

3. Problem Definition

In Nigeria, fertilizers and herbicides are similarly being over used; some farmers apply up to 290 tons per acre, more than twice amounts needed by plants.

In Vandeikya rural area of Benue State, the infertility of the soils, and high desire to achieve food security has led farmers to increased use of agricultural chemicals to boost production per unit area of land. The soils are so impoverished therefore the same form of fertilization and herbicide use is mandatory. One major problem with the use of these chemicals is that, it is often applied in excess of the plant needs or the whole year's supply is applied at once. The excess leached into water ways thereby unsuitable for human, aquatic, wildlife and plant use.

4. Methods/ Approach

In this research, we relied on the analyses of water samples collected from River Aya. 10 samples were collected from 4 sampling points each on River Be and Sambe, which are the major tributaries of River Aya.

To ensure quality assurance, adequate measures such as the use of sterilized containers in water sample collection, proper preservation and storage at temperature of 4^0 C

before Laboratory analyses. The analyses of the water samples collected were done according to standard methods of water examination using Colorimetric technique (APHA-AWWA-WPCF, 1985). The technique is based on the principles that the amount of energy absorbed is proportional to the concentration of nitrate iron present in the sample.

Nitrate concentration as it affects the quality of water is based on the WHO 2006 prescribed limit. The study area is Aya watershed, drained mainly by River Aya and its tributaries. River Aya traversed through Vandeikya; headquarters of Vandeikya Local Government Area. Vandeikya is located between longitude $8^0 3^1$ to $9^0 00$ East and latitude $6^0 30'$ to $7^0 00$ North. The population of Vandeikya is projected to be 256,308 people. NPC. (2009). The climate is tropical humid type with very high temperature between March and April. The Cool, dry harmattan weather is witnessed between December and February.

The wet season is witnessed between April and October, while Dry season is witnessed between the months of November and March. The terrain is undulating, low lying and is drained by rivers Aya, Sambe and Be. A forest reserve is found in the catchment Area of River Aya.

5. Results and Discussion

The results of analyses of Nitrate level in the study area are presented below for discussion.

Table1: Nitrate concentration of Aya Watershed in Vandeikya, Benue State-Nigeria.

S/no. of sampling sites	Location of sampling Sites	Nitrate Conc. Mg/L	WHO Maximum allowable limits. (Mg/L)
S1	River Aya	120	45.0
S2	Rivers Aya	150	45.0
S3	River Aya	148	45.0
S4	River Aya	157	45.0
S5	River Be	98	45.0
S6	River Be	106	45.0
S7	River Be	102	45.0
S8	River Sambe	86	45.0
S9	River Sambe	95	45.0
S10	River Sambe	103	45.0
	MEAN	116.5	45.0

From Table 1, all the ten (10) sampling sites have Nitrate concentration levels above WHO maximum allowable limit of 45mg/L, representing 100% of samples. The mean value of Nitrate was found to be 116.5mg/l.

Table 2: Descriptive statistics of Nitrate concentration in Aya Watershed

Sampling Point	Mean	Standard Error
Aya	143.75	5.896
Be	102.00	6.808
Sambe	94.667	6.808

Table 2 above, showed mean values of Nitrate concentrations for the various sample locations alongside

their standard errors. Despite the differences in mean Nitrate concentration observed in these rivers, Analyses of Variance, however, showed no significant difference in Nitrate concentration in these rivers, both at 5% and 10%(p=0.002). This may be attributed to the hydro-geochemistry of the environment, agricultural practices, indiscriminate disposal of human, animals and plant wastes and effects of seasons Calabresa, (1971),

Laftouhi et al, (2003), Kumar and Shah (2004), Foster et al, (1982) and chiroma et al,(2007). Mathes (1976), confirmed the use of Chemical fertilizers, improper disposal of human and animal wastes as main sources of nitrogen containing compound that are converted to nitrate in soil and water.

6. Conclusion

This study has been expository, revealing data that would have ordinarily been neglected or taken for granted. 100% of the samples taken have Nitrate concentration above the WHO maximum allowable limits of water quality. This implies that consumers of water from these rivers, especially children stand a very high risk of methaemoglobineamia. The source of Nitrate is majorly attributed to the use of chemical fertilizers and herbicides on farms, indiscriminate human, animal and plant wastes.

7. Future Scope

To reduce the rate of contamination, there should be proper control of all land use activities, capable of polluting these rivers. Water from these rivers should be used for other purposes other than drinking as is noticed with most residence in Vandeikya. These waters should be boiled for domestic uses.

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