# Identification and Isolation of Toxigenic Algal Species from Urban Kano Water Supply

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**ABSTRACT:** A study of Toxigenic Algal species in Urban Kano Water Supply,Kano, Nigeria was carried out in the months of March 2013 to December 2014. Water sampling investigation procedures, field and laboratory investigations were carried out using the appropriate protocol. The study revealed that the water PH, temperature, nitrate, and phosphate values were 6.55-9.14, 11.1ºC- 29.8ºC, 0.00-14.30mg/l and 0.01-4.72mg/l respectively. Three classes of algae found included 33.92% Class Bacillariophyceae, 41.63% Class Chlorophyceae, and 24.45% Class Cyanophyceae. Result indicated the growth of algae in the river water was related to pH, Temperature, Nitrate and Phosphate. Statistical analysis of the result indicated a positive correlation and a significant difference at 5% level of confidence.

The occurrence of toxic algal species in the study sites poses public health concerns and a basis for water authority to take necessary actions.

**Keys words:** Algal species, Cyanophyceae, Identification, Isolation, Public Health,Toxigenic, Urban



## INTRODUCTION

Cyanobacteria (blue green algae) are natural components of most aquatic ecosystems. [1]; [2]. Toxic water blooms found in Municipal water supplies and many other water bodies throughout the world include the genera *Anabaena, Aphanizomenon,Nodularia, Oscillatoria,Microcystis* and *Lyngbya* species.[3]. They produce toxins called secondary metabolites comprising of Microcystins, Cylindrospermopsins, Nodularins and Saxitoxins. They are responsible for sporodic and repeated episodes of animal poisonings [4].

In the past 5 decades, public hazards and economic impacts of algal blooms and their metabolites appeared to have increased in frequency, intensity and geographical distribution and therefore needs to be taken into consideration when improving water treatment processes [5]. River water like any other flowing water has high degree of mixing and can be easily influenced by the local environment and therefore prone to contamination from various sources such as agricultural runoff, domestic wastes and industrial effluents[6];[7] .

Kano River is subjected to these forms of pollutions over the years, and at different points becomes suitable habitat for the growth and proliferation of aquatic species particularly algae and other submerged plant species[8]. Those algal species that produce substances which are toxic to animals including humans if consumed or

ingested, obviously attracts interest[9];[10];[11] Although the Kano urban water supply is being treated at Tamburawa plant to ensure that the water is safe for drinking and other domestic uses, it is also important to identify specific algal species in the area and screen compounds produced by them so as to establish a basis for taking necessary action.

## STUDY AREA AND SELECTED SAMPLING SITES


SATELLITE MAP OF THE STUDY AREA

The study area is the Urban Kano Water Supply demarcated by the coordinates 11° 50' 38.4" and 8° 30' 50.4" as described using the Global Position System (GPS, Model Garmin, USA).

## RESEARCH METHODOLOGY

### Collection of water sample and investigations

Water samples were collected monthly for twelve months (Mar 2013-Mar 2014). Water sampling procedures were carried out using the protocols of [12]; [13]

### Identification of toxic algae

Algal cells were viewed using a Hund Wetzer H 60D electronic microscope attached to an Amscope MD 900E camera, they were identified using standard Phycological keys, illustrations and morphological criteria as described by [1]; [14].

**Isolation and purification of algae**

Pure culture of algae was obtained by Capillary Pipette Isolation method as described by [15] A combination of antibiotics with Antifungus containing Chloramphenicol 25mg/l, Penicillin 10mg/l and Griscofulvin 50mg/l [16] were used.

**Construction of a Photobioreactor**

A 101 bubble column model photobioreactor was constructed to maximize biomass concentration from a 10ml flask.

**Culturing** BG 11 Medium for Blue Green Algae at a pH 7.1 was used in 100ml conical flasks at a temperature of 15-20˚c under 40 µmol $m^2s^{-1}$ intensity with 12:12 hours photoperiod for 14 days after which it was transferred in to a $^{1000ml}$ flask and finally to a 101 model photo bioreactor for obtaining large biomass of algae [17].

**Harvesting, preservation and storage of isolated algae**

The pure cultures of algae isolated were harvested after eight weeks in their stationary growth phase using the flocculation method as described by [18]. 50 ml of each algal culture was filtered through a pre weighed glass fiber filter (What man GF/C 47 mm diameter) and dried. The weight of the dry cells was recorded and stored frozen to maintain its viability and purity at 4˚C in a refrigerator as described by [19].



**PRESENTATION OF RESULT**

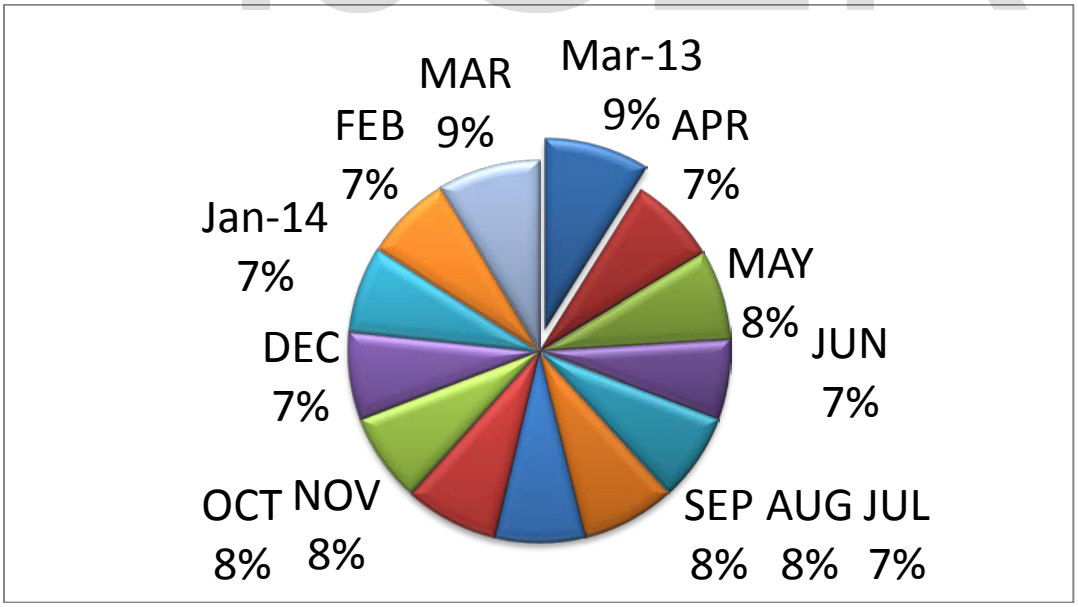


**FIG-1: MEAN MONTHLY PH OF THE STUDY SITES**

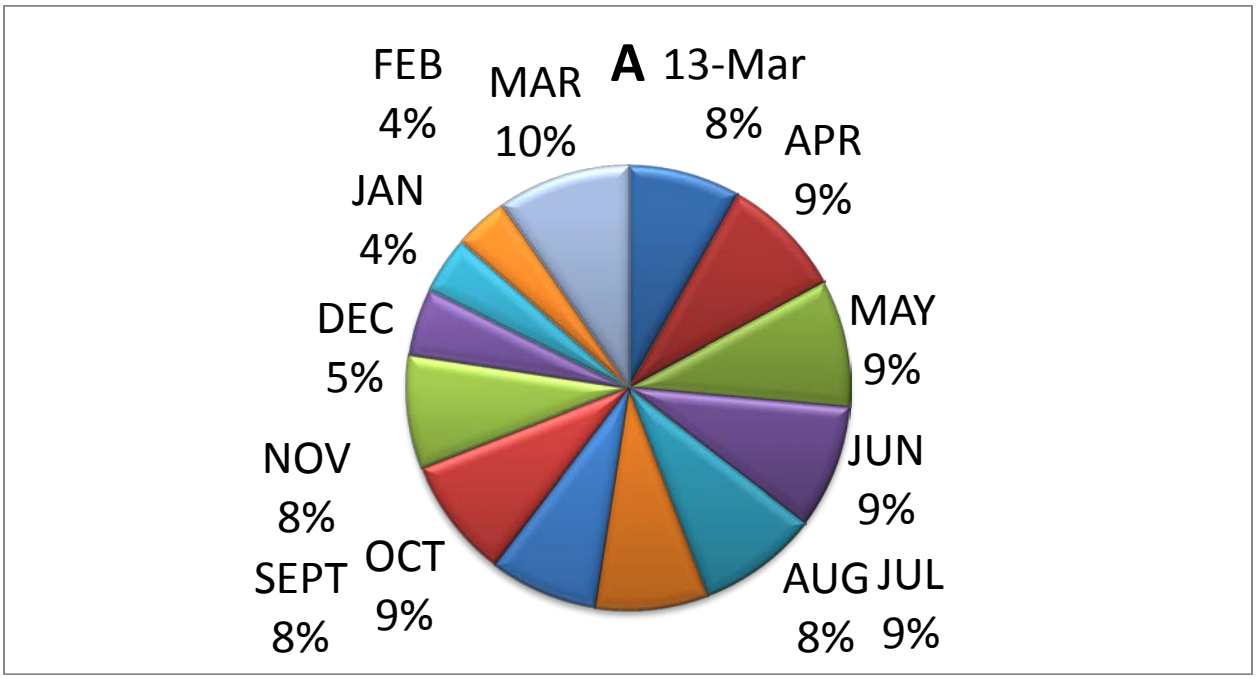


**FIG-2: MEAN MONTHLY TEMPERATURE FOR THE STUDY SITES**

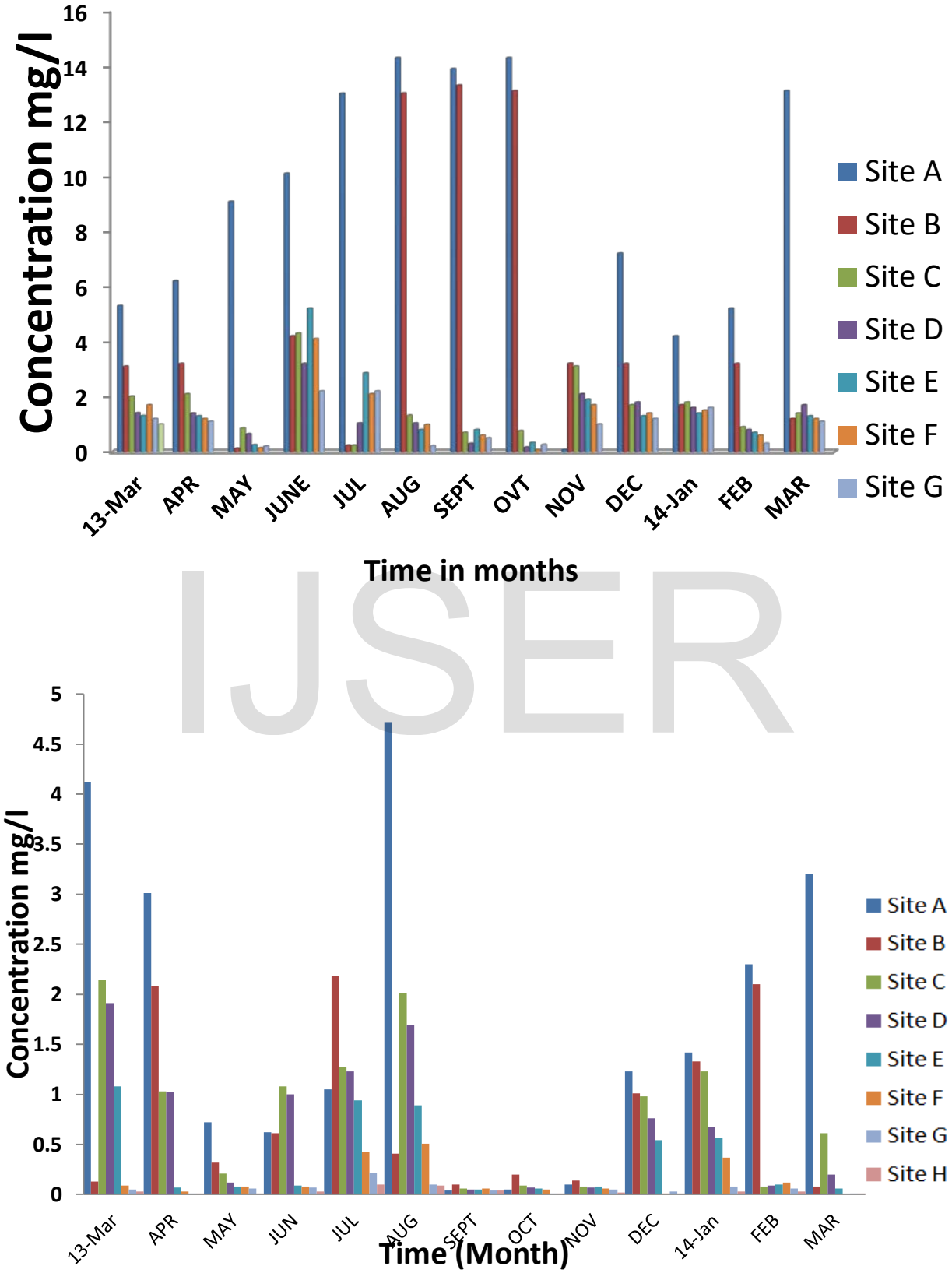


**Fig 4 : Mean Monthly Concentration of Phosphate mg/l**

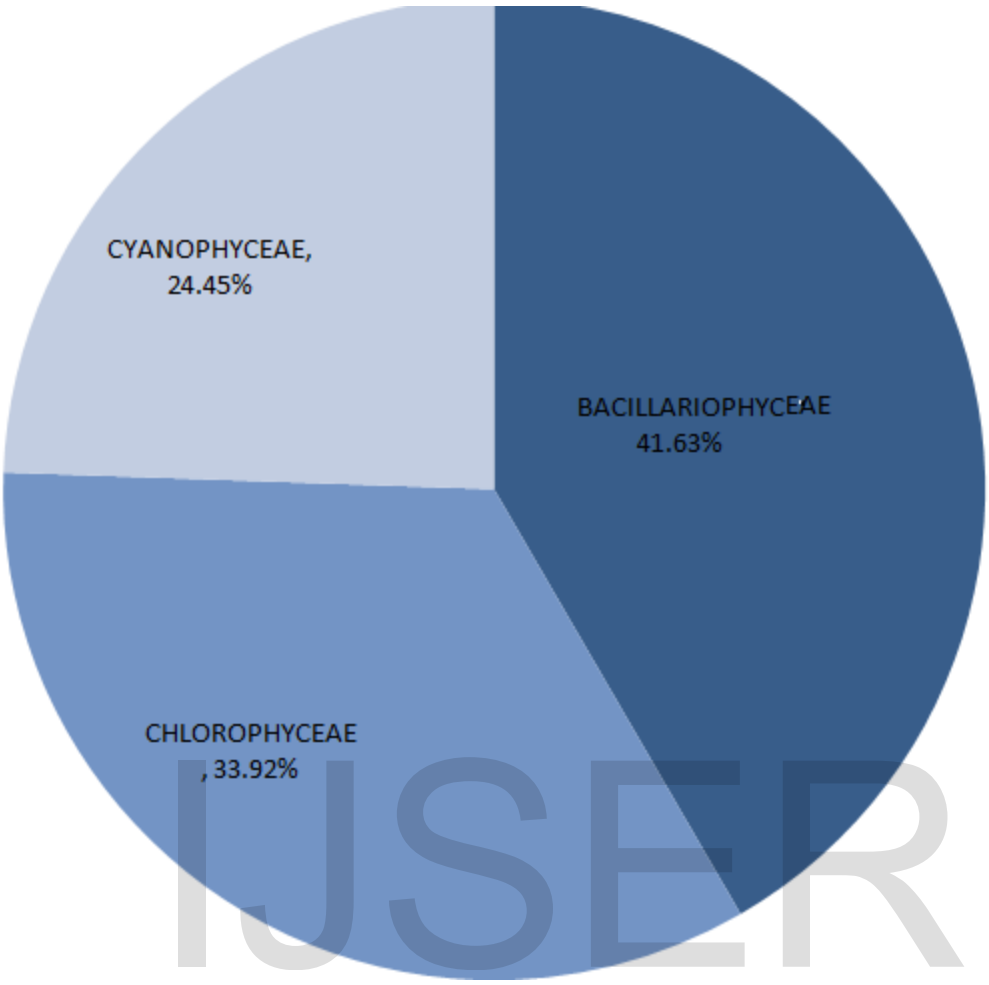




**Fig 5 :DISTRIBUTION OF ALGAL CLASSES IN THE STUDY SITES**

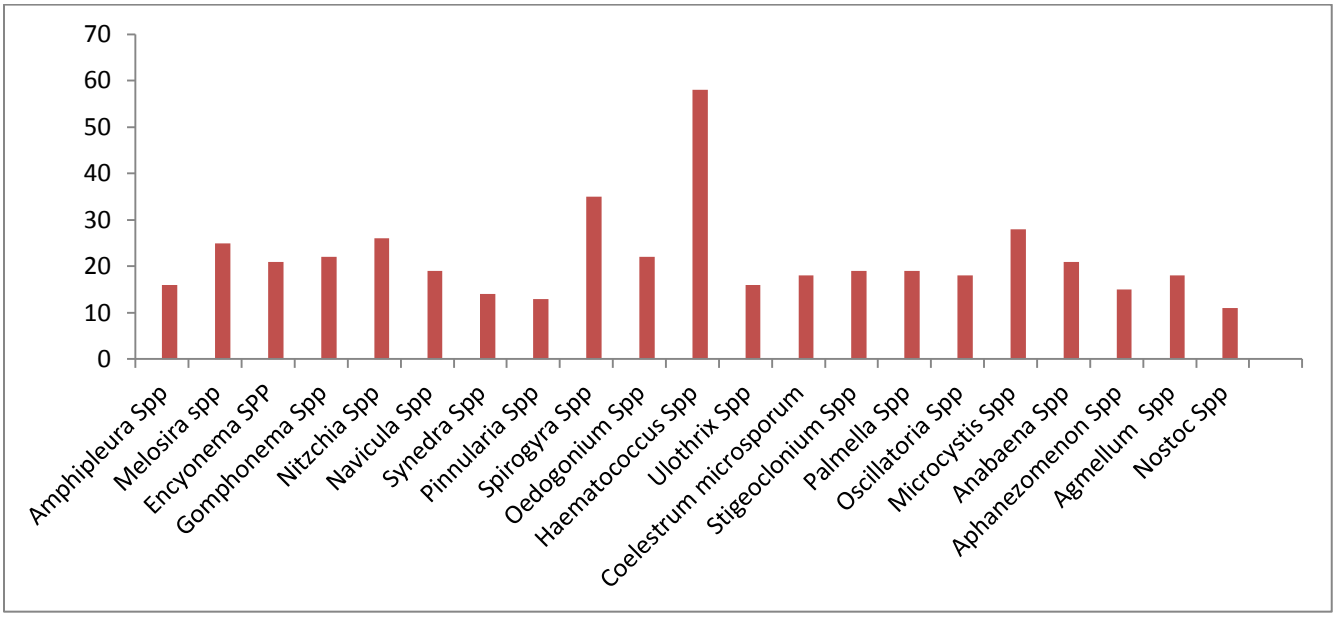


**Fig 6: Mean Monthly Algal Species found in the Study Sites**

## DISCUUSION OF RESULT

The pH of study sites as shown in figure 1 ranged from 6.55-9.14 in the months of June 2013 and March 2014. The high value from site A (raw water) could be as a result of anthropogenic activities taking place in the river which is within acceptable limit set by [20]. [21] reported a similar pattern in freshwater ecosystems and conforms with the work of [22] who remarked that surface water pH ranges from 6.6 to 9.3 and encourages proliferation of aquatic organisms. An analysis of variance at $p<0.05$, shows a significant difference among the study sites and a positive correlation between the pH and algal population.

The mean monthly temperature ranged from 11.11˚C to 29.8˚C. Highest and lowest mean temperature values were obtained in May 2013 and January 2014 respectively. The temperature is within the range in which aquatic organisms survives as reiterated by [23] where he studied the effect of temperature on aquatic organisms to be between 11˚C-31˚C. However, [24] maintained that most algal species thrive well in waters having a temperature range of 15˚C-25˚C. One way Analysis of Variance at $P<0.05$ shows no significant difference among the sites, but it has a positive correlation with algal proliferation.

Figure 3 represents the amount of Nitrate mg/l in the study sites. The values ranged from 0.00 to 14.30mg/l in the months of April and Aug 2013.The mean high concentration obtained in August 2013 may be due to water floods during the rainy season and as a result of rural and agricultural run offs which tends to wash waste and other substances in the water body [9]. The lower values could be due to utilization by biota as reiterated by [2]. An analysis of variance at 5% level of confidence shows a significant difference among the sites and also a positive correlation with algal growth. It is also within value set by [20] of up to 50mg/l in drinking water.

Mean Phosphate concentration mg/l in the study sites ranged ranged from 0.01 to 4.72mg/l which coincides with the rainy season as it brings along decomposed organic matter, livestock and human wastes, agricultural run offs from phosphate fertilizers in to the water body[5]. One way Analysis of Varience suggests a significant difference among the sites at 5 % level of confidence and positive correlation between algal population and phosphate (mg/l) but a negative correlation with the water at site H. Though nitrate and phosphate are limiting factors to biological activity, they are important factors to the growth of phytoplankton in the water under the right conditions of light, $_{P}$H and temperature. [25];[26]. The effect of which brings about eutrophication[6], deteriorating water quality due to low dissolved oxygen, unpleasant odour, contaminating drinking water and ultimately affecting human health [27]. This could be related to the vast distribution of algal population in the study sites as observed in figures 5 and 6. A total number of 454 algal species belonging to three classes were enumerated. Class Chlorophyceae had the highest number of species 41.63%, Bacillariophyceae 33.92% Class Cyanophyceae 24.45%. These species were also found in River Hadejia, River Challawa, river Wudil and most Nigerian Coastal waters rich in nutrients as re iterated by [28]; [5]. The presence of the members of the class Cyanophyceae may pose serious public health harzards to people consuming the raw and fairly treated water as maintained by [29]. Moreover, three species of toxic algae were isolated (Plates 5, 6 and 7) which included *Oscillatoria tenuis*, *Aphanizomenon flos-aquae* and *Microcystis aeruginosa.* These species of algae have been largely found to produce a wide range of Cyanotoxins [11] comprising of Microcystins, Cylindrospermopsins, saxitoxins and anatoxins.[3]; [30]. These are responsible for a number of human and animal morbidity and mortality which have been well documented, [10][4].Their presence in the water body may pose serious health implications[31]**.**

## CONCLUSION

Natural Water bodies especially Kano River supply which serves as the main water supply to the populace of urban Kano have been associated with high nutrients concentrations which play a major role in the growth and proliferation of algae.The presence of toxigenic algal species in the sampled water poses serious public health concern and for the relevant authority to establish a basis for taking necessary action.

## RECOMMENDATION

Since nutrients composition enhances algal growth, there is the need to ways in which nitrate and phosphate gets to the water body. There is also the need to reduce human activities like washing and bathing so as to cut the amount of soap and detergent which adversely increase nutrient concentrations and algal bloom production.



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