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EFFECTS OF TEXTILE EFFLUENTS ON THE GROWTH OF TOMATO AND PEPPER PLANTS IN KANO METROPOLIS, NIGERIA.

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ABSTRACT
Various harmful substances emitted from Textile effluents had influence on lives, environment and plant growth. The aim of this work was to determine the influence of harmful Textile effluents on plants. Heavy metals content of the effluent was determined using Hach spectrophotometer. Analysis of the effluent for heavy metals indicates that metal content ranges from 0.01-3.12mg/l. For monitoring the effect of effluents on plant growth plants of tomato and pepper were sown on experimental plots. With each of the plots watered with different concentrations of the effluent. Highest growth of root, stem, and leaf for both tomatoes and pepper plants was observed in plants watered with 0% effluent. While no plant growth was observed in plots watered with 5-20% effluent concentrations. The textile effluents have greatly affected the growth of tomato and pepper vegetable in Kano Metropolis and the textile effluents cannot be used for irrigation purpose.

Key words: Heavy metals, Kano

Metropolis, Plant growth, **Textile** effluent

INTRODUCTION
A textile industry consumes large quantities of water and produces large volumes of wastewater from different steps in dyeing and finishing processes. Business and industry play a crucial role in the socio-economic development of a country. However, industrial development is the main cause of depletion of natural resources and degradation of the environment [1]. Industries generate wastes, which can be damaging to water, air, land resources and quality of life [2]. The issues of industrial pollution and control are gaining importance in Nigeria today. Kano as the second most industrialised city in Nigeria, is witnessing unprecedented levels of environmental degradation. Contaminated air, soil and water from industries are associated with heavy disease burden [3] and this could be part of the reasons for the current shorter life expectancy in the country [4], when compared to the developed nations. Some heavy metals contained in these effluents are known to be carcinogenic [5].

Plants are the most sensitive to pollution, more than other organisms. Toxic materials in water, soil and air (SO_2, NO_x, heavy metals etc) can harm fine structures of vital plant organs, leaves and root systems above all [6].

Plant effects caused by industrial pollutants depend on the distance of plants from the emitters. Wheat plants which were grown near the source of industrial pollution had decreased growth and crop yield, as well as disorder of biochemical

parameters in comparison with plants that are further away from emitters [7].

Uptake of metals by plants is affected by several factors including the type and age of plant, type of the soil, pH of the soil, organic matter content of the soil, redox potential, cation exchange capacity of the soil, surface area and texture of soil particles, the presence and concentration of foreign ions, growth rate and growth conditions [8].Plant species vary in their capacity to remove and accumulate heavy metals [9].

Differences also exist among plants as to whether the removed metals accumulated in the root or translocated to the shoot. Nevertheless, some metals have been observed to show characteristic physiological fates. For example, lead is accumulated more in the roots than in any other part of the plants, copper and zinc are accumulated in roots and shoots [8]. The aim of this work was to determine the influence of harmful Textile effluents on Tomato and Pepper vegetable plants in Kano Metropolis

MATERIAL AND METHOD

Study Area

Kano is over one thousand years old and became the largest city in Nigeria. Kano, at the height of her glory and prosperity around 1463 – 1499, was a great centre of commerce in Trans Saharan trade route specialising in textile, leather and iron works and thereafter became the foremost tannery centre in Nigeria and still holds that position till today.

About thirty factories were reported to be in Kano in the mid 1960s. By 1971, about forty one factories with about 9100 employees were reported with virtually all the factories situated in Bompai industrial area. The phenomenal growth of industries in the 1970s and early 1980s is reflected in Kano where there are over 350 industrial establishments today, comprising about 190 wet and 160 dry factories.

Determination of Heavy Metals

Heavy metals (Cr, Cu, Zn, Pb, and Cd) were determined by digesting a known volume of effluent sample with analytical grade HNO_3. The digested effluent was filtered into 20ml standard flask made up to the mark with distilled de-ionised water, and stored in a refrigerated nitric acid pre-washed polyethylene bottle prior to chemical analysis. The effluent extracts were analysed for metals with HACH Spectrophotometer. Each sample was analysed in triplicate and average of the results taken. General laboratory quality assurance measures were always observed to prevent sample contamination and instrumental errors. The water used throughout the experiment was doubly distilled in an all glass distiller before it was de-ionised. Wavelength setting of spectrophotometers used was done daily by standard instrumental procedure and other equipment used was always calibrated against reference standards.

Plant growth monitoring

For the monitoring of the plants growth, tomatoes and pepper were used as described by [10]. The seeds were sown in five different plots and each plot was watered as when necessary. The plants grown were watered with different effluent concentrations (0, 5, 10, 15 and 20%). The Borehole water was used as control. The experiment was terminated at 40 days after planting. At harvest the plants were carefully uprooted. The plants roots were gently teased to remove soil particles. The height of the stem and the lengths of the roots were measured.

RESULTS AND DISCUSSION

In 0 % (control) there was a highest growth of root, stem, and leaf for both tomatoes and pepper plants. In 5 – 20% effluents concentration there was no growth of tomatoes and pepper plants compared to 0 % (control).

The results of these study show that the presence of heavy metals in the effluent affected the plant growth. These are in accordance with literature results that heavy metals decrease seed germination and slow plant growth [11].

Heavy metals (Pb, Zn, Cd) are known to inhibit wheat growth and cause the decrease of crops [12].

The pH level also affected the growth of tomatoes and pepper in different effluent concentrations. According to [13] the soil factors that control the equilibrium are soil pH, ionic strength, and presence of ligands in soil solution that may affect sorption, soil organic matter and dissolved organic material.

In Getsi village where the industrial pollution is more pronounced, the industrial effluents have changed the texture of the soil and the colour becoming blackish.Crops under cultivation in the area include carrot, tomatoes, pepper, onion and grains such as maize, millet and sorghum.

Seeds did not germinate on land overflowed by rivers draining the industrial wastewater and productivity was reduced by as much as 80 to 100 %, with the crops usually losing their traditional colour. [14] reported that relative fresh mass of cowpea (*Vigna unguiculata*) was reduced by 10% at a Pb^{2+} activity of 0.2 µM for the shoots and at a Pb^{2+}activity of 0.06 µM for the roots.

The current situation is that even plants such as mango and guava trees all wither and die off in areas affected by the polluted water from the rivers.

The rural communities, now aware of this negative impact of industrial wastewater, no longer use it for irrigation except on weekend when the effluent was not released and this is grossly inadequate for dry season farming.

Markets no longer open regularly because the farm produce become unavailable and what was available could not compete with produce from outside affected environments.

There was a growing restlessness among the rural population affected by industrial effluent. This was as a result of dwindling earning capacity from land and occasional hunger and starvation caused by total or near total crops failure as a result of polluted Rivers overflowing their banks.

Farmers interviewed at Getsi village revealed that they can distinguish water toxicity levels by colour and can provide detailed description on temporal variations in water quality.

For example, according to one respondent, “there are three bad colours (of water) that came at different times- the oily red one and the green one which would kill the crops, and when we see these colours in the channel, we turn off our pumps immediately. The bluish water is corrosive and causes a red rash when it comes in contact with the skin. We always wash our hands after we come in contact with blue water”.

Many farmers were also able to make a connection between these poor quality waters and degradation of the soil. One cultivator pointed out that because of the poor water quality, the soil on his plot had developed a dark, blotchy stained look on the surface and the soil texture had become oily.

CONCLUSION

Considering the obtained results and great amount of literature on the subject, we can conclude that the textile effluents have

greatly affected the growth of tomato and pepper vegetable in Kano Metropolis and the textile effluents cannot be used for irrigation purpose.

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Table 1- Levels of pH and heavy metals of different effluent concentrations.

Effluent concentration	pH	Cu	Zn	Pb	Cd	Cr
0(%)	7.02	0	0.01	0	0	0
5(%)	8.95	0.5	1.1	0.05	0.02	0.01
10(%)	9.25	1.56	2.84	0.1	0.03	0.02
15(%)	9.83	2.1	3.0	0.13	0.03	0.02
20(%)	10.30	2.8	3.12	0.14	0.04	0.03

Table 2- Mean length of roots, stems and leaves of tomatoes and pepper watered with effluent.

Effluent concentration (%)	Tomatoes root length (cm)	Tomatoes stem length (cm)	Tomatoes leaf length (cm)	Pepper root length (cm)	Pepper stem length (cm)	Pepper leaf length (cm)
0	18	180	7	20	195	9
5	-	-	-	-	-	-

10	-	-	-	-	-	-
15	-	-	-	-	-	-
20	-	-	-	-	-	-