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EFFECTS OF INDUSTRIAL EFFLUENT ON SEED GERMINATION, GROWTH, CHLOROPHYLL, CARBOHYDRATES AND PROTEIN CONTENTS OF KIDNEY BEANS (*Phaseolus vulgaris*)

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Abstract

The effect of industrial effluent on the seed germination, seedling growth, stem length, leaf length, biomass, chlorophyll content and proximate analysis of kidney beans was investigated to determine the extent by which the effluent affects the growth parameters and performance of kidney beans. The experiment was carried out with 0%(control), 25%, 50%, 75% and 100% concentrations, each effluent concentration was mixed with 5kg of soil in a plastic pot and each treatment was carried out in three replicates. Germination of seeds begins 5th day after planting in control and treated seeds. Germination increased in 25% concentration and thrived better in 50% concentration than the control whereas there was a decrease in the growth of the plant as the effluent concentration increased to 75% and there was no germination in 100% concentration which was significantly different ($p<0.05$) from that of control, 25%, 50% and 75% concentration. This study demonstrated that the lower concentration of the industrial effluent caused a positive impact on seed germination, growth, chlorophyll content and on the proximate analysis of Phaseolus vulgaris L. However, at higher concentration of the effluent, the rate of germination decreased. This shows that high concentration of pollutant can adversely affect the growth and productivity of crops.

1.0 Introduction

Effluents are wastes produced from industries and they vary depending on the human activities that produce them. Production of these wastes is an integral part of industrial activities but unfortunately our inability to anticipate or predict the types and magnitude of undesired consequences of unbridled release of effluents in our environment, coupled with the growth of industrialization have resulted in massive and destructive operations in our ecosystems [23]. However, despite the treatment being employed by some industries, it is still impossible to remove all undesirable properties from effluents. Environmental pollution has been accepted as a worldwide problem because of its adverse effects on human health, plants and animals [23]. Rapid industrialization, deforestation, oil spillage,

exploitation of natural resources, unplanned construction of road and building, drains, sewage, solid wastes, use of chemicals, fertilizers and human population are the major key factors for environmental pollution in this universe [20]. The continuous increase in industries has become sources of pollution. These industries include chemicals, fertilizers, textile, food and beverages, breweries, pharmaceuticals, soap, petroleum and petrochemical, automobile, tannery, paper mill and cosmetics, tobacco and paint industries [20]. Biochemical, biophysical and cellular processes; morphological and genetic adaptations enable living things to survive. [22] stated that a useful distinction exists between wastes which pose a potentially high risk to human health and those with much less hazards. Many pollutants such as pesticides, hydrocarbons, heavy metals, thermal and radioactive pollutants can get into aquatic environments through direct or indirect release from industries, agriculture and households [8]. The dairy industry is one of a major source of waste water [5]. Environmental protection and rational use of natural resources and other industrial raw materials has become an important sphere of mankind's advancement in the 20th century. The widespread industrialization in urban areas has drastically reduced land area for waste disposal. Disposal of untreated industrial and domestic wastes into the environment affects both soil and ground water quality. Soil and streams have been used for multifarious purposes including waste disposal. The output of industries, agriculture and urban communities generally exceeds the biological capacities of aquatic systems, causing waters to become choked with an excess of organic substances. When the organic matter exceeds the capacity of those microorganisms in water that break it down and recycle it, the excess of nutrients in such matter encourages the excessive growth of algae leading to the depletion of dissolved oxygen and a series of events takes place and are called as eutrophication [7]. Most of the hazards coming to human and ecosystem are mostly due to ground water pollution. The untreated sewage, industrial effluents and agriculture wastes are often discharged into the water bodies. This contaminated water spread wide range of water borne diseases. The agricultural fields around these water bodies are affected [6]. According to [11] industrial organic wastes if used safely and effectively in proper concentrations can increase the fertility of soil. Though industrial effluents are used for irrigation, these may contain certain toxic substances besides the nutrients that promote the growth of the crop plants [18]. Certain industrial effluents such as those of distilleries, fertilizer factories, tanneries etc. have the potential of reutilization and may be harnessed for human welfare. The effluents produced from the distilleries are a rich source of organic matter as well as essential micro and macro nutrients [10,16, 17]. Wastewater is a rich source of plant food nutrients. The impact of wastewater irrigation on yield varies from crop to crop. If the crops are undersupplied with essential plant food nutrients, wastewater irrigation will act as a supplemental source of fertilizer thus increasing crop yields. This research has been designed to determine the effects of industrial effluents obtained from the Fan Milk Nigeria, PLC; to determine the protein content in the seeds of the plants and also the chlorophyll content of the leaf in each treatment in order to find out the extent at which the pollutant affects the protein and chlorophyll content of the crop.

2.0 Materials and methods

2.1 Materials

Materials used for this study include loamy soil, perforated plastic buckets, kidney beans seeds, industrial effluent.

2.2 Source of Industrial Effluent

The industrial effluent used in this study was obtained from Fanmilkplc Ibadan, Nigeria where

milk base products with trade names such as Fan vanilla, Super yogo and a lot more and; the main drain which is the main collection point where all the effluents meet and dilution is enhanced. Each of the effluent was analysed for colour, PH.

2.3Source of Plant Materials

The kidney beans seeds were obtained from the International Institute for Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria.

2.4 Soil Preparation and Germination Experiment

Kidney beans cultivation was done on loamy soil as it is known to thrive best in it. Fifteen plastic containers were perforated and labelled according to their effluent dosage.3kg of soil sample was weighed and put inside plastic buckets. The soil in each bucket was treated with 25%, 50%, 75%, and 100% concentrations of the effluent. Another plastic bucket containing soil did not receive any treatment with the effluent; this serves as control. Each treatment was then replicated three times. 5 seeds of kidney beans were sown into the soil in the plastic buckets. The soil in the plastic buckets was regularly watered to ensure that the soil was moist enough for plant germination.

2.5 Chlorophyll Content Determination

Newly formed, fully opened leaves from wastewater treated and control plants were collected for pigment estimation. Chlorophyll a, b and total chlorophyll were measured by extracting one gram of fresh fully expanded leaves in 80% acetone and measuring the color intensity of the extract at 645 and 663 nm wavelengths using a UV/VIS spectrophotometer. Chlorophyll contents were computed using the formula described by [4].

2.6 Determination of Proximate

2.7 Determination of Moisture Content

The sample (10 g) was weighed W_1into a known weight of an empty petri dish. The weight of the petri dish and the sample was taken and recorded as W_2. The Petri- dish was placed into a preset oven at 105 ^oC for 3 hours in order to reduce the moisture. After 3 hours, the petri dish was taken out and placed inside a desiccator for 30 minutes to cool. The sample was there weighed W_3 [2].

$$Percentage\ Moisture\ Content\ (\%) = \frac{W2-W3}{W1} X \frac{100}{1} \quad (4)$$

2.8 Determination of Fat Content

The crude fat content was determined using the method described by [3]. Using soxhlet apparatus. A considerable amount of the sample was put in a pre-weighed thimble, weighed, and dried in an oven. The thimble containing the sample was placed in the receiver of the soxhlet apparatus. Normal hexane BP 60-68^oC was used as solvent for the extraction; a 500 ml round bottom flask was filled to ¾ with the solvent. The flask was fitted to the soxhlet apparatus with a reflux condenser and placed in an electro mantle heater. The solvent was heated and refluxed several times and continued for 4hours until the condenser was detached. The thimble containing the defatted sample was removed and dried to a constant weight in an oven at 100 ^oC. The difference in weight before and after extraction was recorded and expressed as percentage crude fat extracted

$$Percentage\ Crude\ Fat\ Content\ (\%) = \frac{Weight\ of\ extracted\ fat}{weight\ of\ sample} X \frac{100}{1} .(1)$$

2.9 Determination of Total Ash Content

An amount of 1.0 g of the sample will be weighed in a clean pre-weighed W_1 crucible and the weight will be record as W_2. The crucible with the sample will be place in a muffle furnace and the temperature will be increase to 500 ^oC for 3hrs in order to allow the sample to burn. The ashing will continue until the sample become grey in appearance. After ashing, the crucible with the ash will cool in desiccator and then weigh as (W_3) as reported in [3].

$$\%\ Total\ Ash\ Content = \frac{(weight\ of\ crucible+ash)-(weight\ of\ crucible)}{Weight\ of\ sample\ before\ ashing} X \frac{100}{1}$$

$$\%\ Total\ Ash\ Content = \frac{W3-W1}{W2-W1} \quad (2)$$

Where:

W_1 is the weight of empty crucible

W_2 is the sample and crucible before ashing

W_3 is the crucible and the ashed sample.

2.9.1 Determination of Crude Fibre

Crude fibre is the portion of the plant material which is not ashed or dissolved in boiling solution of 1.25% H_2SO_4 or 1.25% NaOH. Each defatted sample was weighed and transferred into a 500 ml conical flask and 200 ml of 1.25% H_2SO_4 was added and boiled for 30mins using cooling fingers to maintain constant temperature. After boiling, the mixture was poured into filter cloth under gentle suction using a buchner funnel, rinsed well with hot distilled water. The material was then transferred into a conical flask containing 200ml of 1.25 % NaOH and boiled for another 30 mins while shaking gently to avoid spillage. The sample solution wa filtered, washed with hot distilled water and with 1% HCl respectively. The washing was repeated twice with ethanol and trice with petroleum ether to remove any remaining fat. The residue was then transferred into a clean, dried crucible, oven dried, cooled in the desiccator and weighed as (W_2). The crucible was placed in the muffle furnace at 450 °C for 2 hours, cooled in a desiccator and reweighed as (W_3).

$$\% \, Crude \, Fibre = \frac{Weight \, of \, crude \, fibre}{Weight \, of \, sample \, used} x \frac{100}{1}$$

$$\% \, Crude \, Fiber = \frac{W2 - W3}{W1} \quad (3)$$

Where: W_1 is the weight of the sample

W_2 is the weight of sample + crucible after oven drying. W_3 is the weight of the sample + crucible after ashing.

2.9.2 Determination of Crude Protein

This analysis was carried out in three stages;

2.9/3 Digestion Stage

This stage involves digestion of the sample. A known quantity (0.5 g) of the sample was digested with 10 ml H_2SO_4 with 0.5 g selenium as catalyst in a microkjeldahl digestion flask and the mixture was heated on an electro thermal heater until a clear solution was obtained. The flask was allowed to cool after which the digest was diluted with distilled water into a 100 ml standard flask. The sample was transferred into the Kjeldahl distillation unit.

2.9.4 Distillation Stage

It involved the steam distillation of the digest to which 10ml of 40% NaOH solution was added to release the ammonia. 3 drops of mixed indicator bromo cresol green and methyl red was then added to the receiving flask containing 10 ml of 2% boric acid solution to give a pink colour solution. The sample was distilled until about 50ml of the distillate was collected in the receiving flask. A colour change from red wine to green observed which indicate the presence of ammonia.

Equation: Sample + conc. $H_2SO_4 \rightarrow (NH_4)_2SO_4$

$(NH_4)_2SO_4 + 2NaOH \rightarrow 2NH_3 + Na_2SO_4 + 2H_2O$

The collected ammonia forms a complex with the boric acid as

$NH_3 + H_2BO_3 \rightarrow 2NH_4^+ + BO_3$

2.9.5 Titration Stage

It involves the titration of the resulting solution in the conical flask against 0.1 M HCl solution until a colour change from green to red wine was obtained indicating the end point. Equation: $NH_4^+ + HCl + H_3O^+ \rightarrow NH_4Cl + 2H_2O$

$$\% \, Nitrogen = \frac{Titre \, value \times Molarity \, of \, acid \, used \times 0.014 \times Dilution}{Weight \, of \, sample}$$

(4)

$$\% \, Crude \, Protein = \% \, gN \times 6.25 \quad (5)$$

2.9.5 Carbohydrate Determination

This is the summation of protein, fat, moisture content, ash, crude fibre minus 100

$$\% \, Carbohydrate = 100 - (Moisture \, content + Fat + Crude \, fibre + Ash + Protein)$$

2.9.6 Statistical Analysis

One way ANOVA was used to test for significant difference between the different effluents treatments on each of the growth parameters

studied. The significant difference (means) were separated using Duncan Multiple Range Technique (DMRT) at 1% probability level.

3.0 Results

Results showed that germination of seeds occured 10 days after planting in control and treated seeds except in 100% of treated seeds (Table 1). The percentage of seeds germination varies according to the concentration of the industrial effluent. On the 1st week of planting, germination were recorded in control (0%), 25%, 50%, 75% and 100% concentrations. Germination then increased till the 4th week in pot treated with 0%, 25%, 50% and 75% except in 100% concentration (Table 1). These values were recorded till the 6th week of planting. From these values, it was observed that the rate of germination was higher even than the control in 50% treated experiment while as the concentration of effluent increased further above this range, the percentage germination reduced and there was no germination at all in 100% treated experiment. Results are the means of three determinations ± standard error. Values with different same letters within the same column are significantly different at $P<0.05$.

3.1 Fresh and dry weight

Results of the effect of the industrial effluent on the fresh weight and dry weight of the seedlings sown in different concentrations of the pollutants and control are shown in Table 2. The 50% treated experiment has the greater value of fresh and dry weight of 18.50±0.01 and 4.80±0.93 respectively even than the control experiment which is significantly different from 100% concentration and the values reduced as the concentration of the effluent increased above 50% concentration.

Results are means of three determinations ±standard error .Values with different letters within the same column are significant at $P<0.05$, while means with the same superscript letter does not differ significantly at $P<0.0$

3.2 Growth Parameter

3.2.1 Leaf Length Characteristics

The result of the leaf length (cm^2) is shown in Table 3. This shows the effect of different concentrations of the effluents on the leaf length of experimental seedlings of kidney beans. Leaf length increased with time (in weeks) in each treatment concentration. The 50% concentration of the treated experiment has the largest leaf length than the control experiment and the leaf length reduced as the concentration increased beyond this value. The largest leaf length was observed at the sixth week in the 50% treated experiment with a leaf length of 7.60±0.01cm^2 compared with no leaf in the 100% treated experiment which was significantly different ($p<0.05$) from the control and other concentrations.

Table 1: Effect of Industrial Effluents on Seed Germination of kidney Beans Seeds (cm).

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Control	8.90±0.01^{a}	10.90±0.01^{d}	13.00±0.01^{d}	14.90±0.07^{d}	18.10±0.01^{c}	21.00±0.07^{c}
25%	7.50±0.01^{a}	9.00±0.01^{c}	12.00±0.00^{c}	12.80±0.00^{c}	14.00±0.01^{d}	14.70±0.00^{b}
50%	9.00±0.01^{d}	11.00±0.00^{c}	13.00±0.00^{d}	15.10±0.00^{c}	18.14±0.07^{c}	21.50±0.00^{d}
75%	5.50±0.01^{c}	6.70±0.01^{b}	8.40±0.00^{b}	10.00±0.00^{b}	11.00±0.01^{b}	12.50±0.00^{d}
100%	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.01^{a}	0.00±0.00^{a}

Table 2: Effect of Industrial Effluent on fresh and dry Weights of Kidney Bean Seeds (mg).

Treatment	Fresh weight	Dry weight
Control	13.25±0.01^{c}	3.50±0.39^{c}
25%	16.33±0.88^{d}	3.55±0.40^{c}
50%	18.50±0.01^{e}	4.80±0.93^{e}
75%	9.00±0.58^{a}	3.1±1.33^{b}
100%	0.00±0.00^{b}	0.00±0.00^{a}

Table 3: Effect of Industrial Effluent on Leaf length of Kidney Beans (cm)

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Control	6.10±0.01^{d}	6.20±0.01	6.40±0.01^{d}	6.90±0.00^{c}	7.00±0.01^{c}	7.40±0.00^{c}
25%	4.00±0.01^{c}	4.20±0.01^{c}	5.35±0.01^{b}	5.50±0.01^{b}	5.70±0.01^{b}	5.90±0.01^{b}
50%	0.00±0.00^{a}	6.40±0.00^{c}	6.90±0.00^{d}	7.00±0.01^{c}	7.40±0.00^{d}	7.60±0.00^{d}
75%	3.10±0.01^{b}	3.50±0.01^{b}	5.00±0.01^{b}	5.40±0.01^{b}	5.00±0.00^{b}	5.70±0.00^{b}
100%	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}

3.3 Number of Leaves of kidney Beans

The results of number of leaves of kidney beans in each treatment are shown in table 4. The number of leaves in each treatment increased with time (in weeks). The number of leaves increased progressively in 25% and 50% concentrations of the treated experiment than the control experiment in all the weeks, while the number of leaves reduced to the minimum value in 75% and 100% concentrations of the treated experiment. At the sixth week of the experiment, the numbers of leaves in 25% and 50% concentrations of the treated experiment were 30.00±0.01 and 32.00±0.09 respectively, which were greater than the control experiment (25.00±0.01)and the number in 100% concentration was zero. In all the weeks of the experiment, the maximum number of leaves was observed in 50% concentration of the treated experiment which was significantly different ($p<0.05$) from that of control, 75% and 100% concentrations of the treated experiment.

Table 4: Effect of effluent on No of leaves of kidney beans

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Control	2.00 ± 0.01^{b}	6.00 ± 0.01^{e}	16.00 ± 0.01^{d}	20.67 ± 0.34^{d}	22.00 ± 0.01^{c}	25.00 ± 0.01^{c}
25%	2.00 ± 0.01^{b}	4.00 ± 0.01^{c}	20.00 ± 0.01^{c}	25.00 ± 0.01^{e}	28.00 ± 0.01^{e}	30.00 ± 0.01^{d}
50%	3.00 ± 0.01^{c}	5.00 ± 0.01^{d}	13.00 ± 0.01^{c}	18.00 ± 0.01^{c}	23.00 ± 0.01^{d}	32.00 ± 0.09^{e}
75%	2.00 ± 0.01^{b}	3.00 ± 0.01^{b}	10.00 ± 0.01^{b}	12.00 ± 0.01^{b}	13.00 ± 0.01^{b}	15.00 ± 0.01^{b}
100%	0.00 ± 0.01^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}

3.4 Number of Seeds per Pod of the Kidney Bean Fruits

The effects of different concentrations of the effluents on the number of seeds per pod of the kidney bean fruits showed that the number of seeds per pods increased progressively with time (in weeks) in each treatment concentration, whereas it decreased as the concentration of the pollutant increased except for 50% concentration of the pollutant which has higher number of seeds per pod than the control (Table 5). At the sixth week of the experiment, 3.33±0.33 that was recorded in 50% concentration of the treated experiment was significantly different ($p<0.05$) from the control and other concentrations but there was no significant difference between the number of seeds per pod in 25% and 75% concentrations of the treated experiment.

Table 5: Effect of Industrial Effluent on Number of Seeds per Pod of the Kidney Beans

Treatment	Week 3	Week 4	Week 5	Week 6
Control	1.67 ± 0.33^{B}	2.67 ± 0.67^{BC}	3.67 ± 0.33^{C}	1.67 ± 0.33
25%	0.00 ± 0.00^{A}	1.00 ± 0.10^{AB}	1.67 ± 0.33^{B}	1.67 ± 0.33^{B}
50%	2.00 ± 0.00^{B}	3.67 ± 0.33^{C}	3.31 ± 3.33^{C}	3.33 ± 0.33
75%	0.00 ± 0.00^{A}	0.00 ± 0.00^{A}	1.00 ± 0.37^{AB}	1.33 ± 0.33^{B}
100%	0.00 ± 0.00^{A}	0.00 ± 0.00^{A}	0.00 ± 0.00^{A}	0.00 ± 0.00^{A}

Results are mean of three determinations ±standard error. Values with different letters within the same column are significantly different at $P<0.05$.

3.5 Biochemical Experiment

3.5.1 Chlorophyll Content of kidney Bean Leaves

The effect of the different concentrations of the effluents on the chlorophyll content of the freshly harvested leaves showed that chlorophyll a, chlorophyll b and total chlorophyll of the leaves in concentration of the effluent (Table 6). The leaves 50% concentration of the treated experiment was with 50% concentration has higher total chlorophyll content than the control, while the chlorophyll content reduced as the concentration of the effluent increased beyond 50% concentration.

found to be significantly different ($p<0.05$) from that of the control and other

Table 6: Effect of Industrial Effluent on Chlorophyll content of the Kidney Bean Leaves.

Treatment	Chlorophyll A	Chlorophyll B	Total
Control	18.04±0.01[d]	79.55±0.01[a]	97.55±0.01[a]
25%	131.55±0.01[d]	81.87±0.01[b]	213.63±0.01[d]
50%	318.02±0.01[e]	210.80±0.01[b]	526.75±0.01[e]
75%	126.62±0.01[c]	157.14±0.67[d]	182.99±0.01[c]
100%	0.00±0.00[a]	0.00±0.00[c]	0.00±0.00[b]

Results are mean of three determinations ±standard error. Values with different letters within the same column are significantly different at P<0.05.

3.5.2 Proximate Composition of the Bean Seeds

The effect of different concentrations of the effluent on the proximate composition of the bean leaves showed that 50% concentration of the treated experiment have higher composition of proximate with 83.82±0.01 of moisture, 11.29±0.01 of ash, 19.27±0.01 of fat, 12.50±0.01 of proteins, 25.30±0.01 of carbohydrates and 7.80±0.01 of crude fibre which was significantly different from the control and other concentrations (Table 7). Results are mean of three determinations ±standard error .Values with different letters within the same column are significantly different at P<0.05.

4.0 Discussion

Effect of industrial effluent was evaluated on germination pattern, leaf length, dry and fresh weight of the kidney bean leaves. The effect on chlorophyll content and the proximate composition of the kidney beans were also investigated. Germination was low in 75% concentration and there was no germination in 100% concentration of the effluent. The low rate of germination was probably due to toxicity resulting from pollutant contamination around the seeds.

The effect of industrial effluent on seed germination of kidney bean seed at higher concentration did not support the growth of the plant; this is in accordance with the findings of [9]who showed that the germination of seed is affected at higher concentration of textile effluents. [12]found that at higher concentration of industrial effluent, the seed germination efficiency decreases. The reduction in seed germination may be due to higher soluble salt in the polluted water. They revealed that this is due to the decrease in water uptake at higher level of salinity in view of toxicity of high osmotic pressure due to high soluble salts. At 50% concentration of the treated experiment, the percentage of seed germination was higher than the control experiment. This in accordance with the findings of [1] who showed that the effect of crude oil pollution on plants is dependent on the level of pollution and that small amount of mineral oils may actually be beneficial to plants. The result showed that increase in effluent percentage encouraged the decrease in the length of the leaf. [13] in their research reported that textile effluents were inhibitory at low concentration but with the increase in concentration, growth of seedling leaves was affected. Due to toxic effect of the pollutant, there was reduction in fresh and dry weight with increase in concentration of the effluent, except in seedlings treated with 25% and 50% concentrations which have increase in dry weight that significantly increased with industrial effluent concentration as compared to that of the control. At high concentration of the pollutants, there was low fresh and dry weight of the seedlings. This is in agreement with that of (16) who showed that there was a decrease in plant dry weight at high concentration of industrial effluent.

Number of leaves is an indicator of plant growth and there is a reduction in the number of leaves at higher concentration of the effluent which significantly reduces the yield of the plant. This is in agreement with the findings of [19] where a low concentration of Hudiara drain influences the growth of the leaves of

Eucalyptus camaldulensis while growth reduction was observed at higher concentration.

Table 7: Effect of different Concentrations of the Effluent on the Proximate Composition of the Bean Leaves

Treatment	Moisture	Ash	Fat	Protein	Carbohydrate	Crude Fibre
Control	73.68±0.01^{a}	5.13±0.01^{c}	11.00±0.01^{b}	12.43±0.01^{b}	8.60±0.01^{b}	6.25±0.01^{c}
25%	74.40±0.01	4.76±0.01^{a}	14.27±0.74^{b}	4.50±0.01^{a}	17.80±0.01^{c}	4.12±0.01^{c}
50%	83.82±0.01^{d}	11.29±0.01^{d}	19.27±0.74^{d}	12.50±0.01^{c}	25.30±0.01^{e}	7.80±0.01^{d}
75%	82.14±0.01^{d}	5.00±0.01^{c}	9.50±0.01^{a}	8.85±0.02^{b}	22.72±0.01^{d}	3.84±0.01^{c}
100%	00.00±0.00^{a}	00.00±0.00^{a}	00.00±0.00^{a}	00.00±0.00^{a}	00.00±0.00^{a}	00.00±0.0^{a}

The result of the effect of industrial effluent on the proximate composition of the kidney beans shows that higher concentration of the effluent greatly reduced the proximate composition of the kidney beans. Moderate concentration of the effluent at 25% and 50% concentrations produced higher percentage of protein, carbohydrate, ash, fiber, fat and moisture.

A level of significant reduction in chlorophyll a, b and total chlorophyll as the concentration of the effluent increased was observed except for 50% concentration which was higher than the control experiment. Chlorophyll contents serve as a key index of metabolic efficiency of plants for the utilization of absorbed nutrients [15].[21] observed an increase in pigment content in the lower concentrations of fertilizer factory effluent in gram. However, the results of this study showed that higher concentrations of effluents had a toxic effect on the chlorophyll of kidney beans. This decline in chlorophyll content beyond 50% concentration of treated experiment may be due to the inhibition of enzymes responsible for chlorophyll biosynthesis under the influence of higher concentrations of toxins present in the industrial effluents.

5.0 Conclusion

This study reveals that irrespective of nature, the industrial effluents could be well utilized for agricultural crops on proper dilution, so as to reduce the lethality of the pollutants. Higher concentration of industrial effluents creates serious hazards to plants and eventually to human health. In the countries where there is scarcity of water, reuse of effluents for irrigation of various crops is very effective method to meet demand for minerals in the soil and food supply generally or at a specific level/ concentration going by the results from this study. It may be further concluded that the higher concentration of industrial effluent causes many types of inhibitory effects on the germination speed, germination value, plant growth, crop yield accumulation of heavy metals in plants and poor human health. The proper treatment and dilution of the effluent is therefore needed before the disposal and usage of industrial effluent for irrigation purposes.

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