Evaluation of Physiochemical Properties of Eggshell for Wastewater Treatment

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Abstract:
Wastewater and other low-quality waters are significant in overall water resources management. The aim of this study was to assess the physiochemical properties of textile wastewater before and after treatment, analysis of ground-well and tap water were also carried out in order to make comparison between them and treated textile wastewater. The results of the study showed physical and chemical properties of the different types of tested water which analyzed that: pH, Turbidity, Moisture content, Ash content, Odor and colour. The tests for major and minor element were also carried out on the different types of water (Ca, Mg, Na, K, P, Cr, Cu, Fe, Zn, Pb, NI, Mn and Cd). The obtained results encouraged with respect to reuse treated water for processing and agriculture in compared with tap and ground-well water

Keywords*: Activate; Eggshell; Moisture content; Tap water; Turbidity*.

1. INTRODUCTION

Water is the basic and most fundamental resource for humans, animals and plants; all are dependent on it. The water uses are increasing with enormous rapidity; whereas the supply is static [1].

Wastewater and other low-quality waters are significant in overall water resources management. By releasing fresh resources for domestic supply and other, priority uses, reuse makes a contribution to water and energy conservation and improves quality of life [1]. Wastewater can have positive agronomic results. Moreover, wastewater schemes when properly planned and managed, can have positive environmental and health impact, besides providing increased agricultural yields [2].

Wastewater also present problems because of their variable composition and possible high concentration of suspended solids [2].

Pollution of water by industrial and urban development's increasing in scope and must be faced realistically though government aid to prevent community pollution. State and federal control regulation agencies indicate that a desire attack is to be made on this problem [3]. Pollution control and treatment of polluted waters can return large quantities into useful channels [3].

Textile wastewater is nowadays a major source of surface water contaminations, where different technologies have been applied for treatment of these carcinogenic effluents. Among these technologies, adsorption is one of the most promising ones [4]. In the light of the above the main objectives of this research work, were to study the chemical composition of textile wastewater, to compared the treated textile wastewater with tap water (pure), ground-well water and untreated textile wastewater and to evaluate the suitability of treated wastewater for reuse in agricultural production and for livestock.

2. EXPERIMENTAL PROCEDURE

2.1 Materials and Method.

A total of three samples including untreated natural waters (Tap water, Ground-well water) and Textile wastewater were sourced from different locations which are Federal Institute of industrial research, oshodi, Lagos; Ogijo area of Ikorodu, Lagos; and Atlantic Textile Manufacturing company Ltd, ilupeju industrial estate, Mushin, Lagos, respectively. The textile wastewater sample is then treated with the activated eggshell in comparison with the natural water samples (tap water and ground-well water).

The eggshell samples for this study were washed with the deionized water to remove the impurities from the sample and then dried in electric oven (Model Memmert, Western Germany, more than heat, 0-240oC) at $100^{O}C$ for 24 hours, grounded with a ball milling machine (Model 87002 Limoges-France, A50……….43)., and further vetted through vibro sieve machine at 200µm mesh Bs410 standard sieves (Endecott's Limited, London). The sieved sample of the eggshells was calcinated at a temperature of 500oC, activated using NaOH in 5:1 and then soaked for 2 hours; which was then passed through distilled water for washing off the reagent. Notwithstanding, a digital weighing balance (02250Kg/02551.11bs) was used to measured 10g of the calcinated eggshell that was added into 250ml of textile wastewater sample solution for purification.

3. MATERIALS TESTING

3.1 Chemical analysis:

Representative sample of the eggshells were analyzed to determine the chemical compositions using UNICAM 929 London Atomic Absorption Spectrometer for the chemical analysis. Various trace elements (Fe, Cu, Zn, Pb, Mn, Cr, Ni and Cd) and major mineral elements Na, Mg, K, P and Ca) in the wastewater before and after treated, ground-well water and tap water.

3.2 Determination of the specimen's properties

Some properties of the specimens were tested for proper examination of their suitability in compliance with National and International procedures of ASTM standards which includes ASTM D4448 – 01 (2019) [4], ASTM D8010 – 18 (2019) [4] and ASTM D5630 – 13 (2019) [4].

3.3 Colour

The colour was measured by the visual comparison method (Nonstandard laboratory methods) according to the standard methods for the examination of water and wastewater (Anon, 1978) [4].

3.4 Odor

The method used was organoleptic. A panel of laboratory staff (3 peoples) was asked to evaluate odor of wastewater samples and to report whether the water samples showed any odor [4].

3.5 Total dissolved solids (TDS)

Dissolve total solid was desiccated at 105 + 3oC, the evaporating dish was washed, cleaned and then put in air oven for 30 min (at 105 + 3oC). Then it was taken out and cooled with a dryer for 30 min and was weighed by analytical balance and desiccated again, weighed to constant weight. After that 100ml of sample was added and also 1ml of Sodium Hydroxide solution was added to evaporating dish and mixed uniformly.

The evaporating dish was put on water-bath and then was dried then the evaporating dish was removed to air oven at 105oC for 1 hour then was put into dryer for cooling down for about 30 min,

The weighed evaporating dish was put into air oven at 105oC for 30 min and cooled in dryer for 30 min again till a constant weight was obtained [5].

$$C = (W2 - W1) \times 1000 \times 1000/V \quad (5)$$

Where: C= Dissolved total solids in water sample, mg/l; W1= Weight of empty evaporating dish, g; W2= The total weight of evaporating dish and dissolvable solids, g; V= Volume of water sample, ml.

3.6 pH value: pH was read direct from pH meter [5].

3.7 Turbidity: Turbidity was read directly from 2100 turbidimeter 46500.00.

3.8 Biochemical oxygen demand (BOD)

300ml of wastewater sample were taken with graduated cylinder and were put in a BOD bottles then soda (KOH) was added. After that a BOD bottles were incubated for 5 days at 20oC, lastly the initial and final dissolved oxygen were determined [5].

$$BOD, mg/l = D1 - D2/P \quad (2)$$

Where: D1= Dissolved oxygen of diluted sample immediately after preparation; D2= Dissolved oxygen of diluted sample after 5 days incubation at 20oC, mg/l; P= Demand volumetric fraction of sample used.

3.9 Chemical oxygen demand (COD)

Three ml of potassium dichromate 1/120ml was taken into beaker (100ml). Then 1.2ml of wastewater sample was added and the volume was completed to 10ml by adding 8.8 of distilled water. Then 17ml of silver sulfate reagent (AgSO4) was added for heating and recycling of 15 min. After cooling 33ml of distilled water and 7ml ferric ammonium solution (Fe2SO4)3 were added. Then the mixture was cooled to ambient temperature for test. Ten ml of distilled water were taken to make blank test in the same way [5].

$$COD, mg/l = (A-B) \times N \times 8{,}000m \quad (3)$$

Where: A = volume Fe2SO4 used for blank, ml; B = volume Fe2SO4 used for sample, ml; N = normality of Fe2SO4.

Volatile hydroxyl Benzene compound (Phenol)

Two hundred and fifty ml of sample were transferred into a 500ml glass vaporizer, also 2.5ml of methyl orange indicator was added, adjusted with phosphorus acid solution to pH = 4 (solution indicated orange). Five ml of copper sulfate solution was also added. After that a condenser was connected and heated for distillation till 225ml distillate was produced, the heating was stopped and cooled down, 25ml distilled water without hydroxyl benzene was added into a distillation flask. Then distillation was continued till 250ml distillate was produced.

Fifty ml distillate was taken into a 50ml colour comparison tube, 0.5ml buffer solution with pH = 10.7 was added and shake up, when pH was about 10.0 + 0.2, 1.0ml of 2% 4 – amino antipyrine solution, 1.0ml of 8% potassium ferricyanide was added shaked up and was settled for 10 minutes. After that the absorbency of the solution was tested at wave length of 510mm, with 20mm cell, blank reagent which was taken as reference. At the same time, 250ml distilled water without hydroxyl benzene was taken with the simple test steps for blank test. Volatile hydroxyl benzene content [5].

$$(mg/l) = M \times 1000/V \quad (4)$$

Where: M = Quality of volatile hydroxyl benzene in mg, decided by standard curve of absorbency to corresponding hydroxyl benzene content; V = Sample volume, in ml.

3.10 Ammonia nitrogen (Narch colorimetry method)

Two hundred ml of wastewater sample was taken and added to 150ml of distilled water and put into distilled bottle then pH was controlled to be in the range of 6 – 7 by using sodium hydroxide or hydrochloric acid (HCl) due to the condition of the solution in alkaline conditions acid was added and in acidic conditions alkaline was added. Then magnesium oxide (MgO) and anti-pumping ball were added, and the distillation bottle was heated to distillate. Four beakers were used as collecting vessel to receive distillation with 200ml boric acid solution concentration (20%), (boric acid was added used as absorption solution). Till 200ml for all samples were collected them titration was made and the colour was changed to violet [6].

$$CN = (V2 – V3) \times C \times 14.01 \times 1000/V1 \quad (5)$$

Where: CN = ammonia – nitrogen concentration, mg/l; V1 = sample volume, ml; V2 = volume of consumed, HCl, ml; V3 = HCl volume for blank, ml; C = HCl concentration ©, mol.

3.11 Determination of sulfide.

Ten ml of 10% zinc acetate solution and 5ml of M/L sodium hydroxide solution were poured into a sample – taking bottle of 250ml. 250ml of wastewater sample was taken into this bottle to determine sulfide of wastewater sample. Middle-speed filter paper and vacuum pump were used to filter white settling, and the sediment was washed with distilled water. Settling and filter paper, was put into an iodine flask of 250ml. 50ml distilled water was added and agitated then 5.0ml of sulfuric acid solution was added as ground-well as 10.0ml of 0.05mol/L iodine water and covered with a bottle block sealed with distilled water and settled in a dark place for 5 minutes. Then titrated with 0.05mol/L sodium hyposulfite. Drops of starch indicator were added and titrating was continued till colour disappears completely. Consumption V2 (ml) of sodium hyposulfite was recorded. Sulfide content in mg 1 liter can be calculated as follows [6].

$$S2\text{-}(mg/l) = (V1\text{-}V2) \times C \times 16 \times 1000/V \quad (6)$$

Where: V1 = volume of sodium hyposulfite standard solution for blank test, ml; V2 = Volume of sodium hyposulfite titrating water sample, ml; V = Volume of water sample, ml, 16 = Mole number of S2.

3.12 Determination of total phosphorus content

Two hundred and fifty ml of wastewater sample was taken filtered through middle speed filter paper I 500ml beaker. 10ml was taken from filtrate into another conical flask (100ml). Then 5ml of ammonium desulphate and 1ml of sulfuric acid solution were added, also 25ml water was added into conical flask. After that the mixture was put on adjustable electric store to boil for 15 minutes till the solution was dried off. After that it was taken out and cooled with water to ambient temperature and transferred into a 50ml volumetric flask. Then 2.0ml of ammonium molybdate solution and 3ml deposited at ambient temperature for 10 minutes. Absorption cell thickness of 1cm was used at 710mm of spectrophotometer [6].

The total phosphorus content X5 (in PO4-3) of the sample in mg/L is

$$5= M3/V3\text{-}7 \quad (7)$$

Where: M3 = The quality of PO4-3 checked from work curve, mg; V3 = The volume of transferred test solution, ml.

3.13 Ash content

Two grams of dry sample were weighed in clean dry crucible and placed in muffle furnace at 550oC. The contents of the crucible were cooled and 10ml of 2NH were added and placed in hot sand bath for about (10 – 15) mins the content was filtered and the volume diluted to 100ml flask with distilled water [6].

4. RESULTS AND DISCUSSION

4.1 Materials chemical compositions

The results of the physical, chemical and bacteriological analysis of the eggshell is shown in table 2 below.

Table 2: Chemical Composition of Chicken Eggshell

S/No.	Elements	Chicken Eggshell (mg/l)
1	Calcium	2300.3 + 3.81
2	Magnesium	848.00 + 1.26
3	Sodium	32.82 + 0.73
4	Potassium	18.05 + 1.05
5	Iron	1.5 + 0.02
6	Zinc	0.99 + 0.03
Proximate composition of chicken Eggshell		
1	Moisture	0.94 + 0.08

2	Ash	46.22 + 0.05
3	Crude protein	1.50 + 0.21
4	Lipid	0.34 + 0.7
5	Crude fibre	4.35 + 0.31
6	Carbohydrate	46.64 + 0.31
7	Total Calorific (cal/g)	806 + 12.64
8	pH	6.59
9	Electrical conductance (mS)	0.1
10	Specific gravity	0.846
11	Bulk density g/cm3	0.8024
12	Particle density g/cm3	1.075
13	Porosity	(%) 25.4
14	BET Surface area	(m2/g) 21.2
15	Particle size (mm)	150

The chemical composition of the chicken eggshells in Table 2 above, indicated that among the compositions in the eggshell that proportions of Zn and Fe has the lowest values of 0.99 + 0.03. and 1.5 + 0.02 respectively, while that of Ca have the highest value with 2300.31 + 3.81. This has proved that eggshell have high percentage of calcium with low percentage of other elements which can be referred as impurity. However, the result has showed that from eggshell, high percentage of $CaCO_3$ can be processed after calcinations for the application of wastewater treatment, food supplement and pharmaceutical usage. Prior to approximate composition the eggshell ash content and carbohydrate has a significant value of 46.22 + 0.21 while others showed a very low value as indicated in the table above.

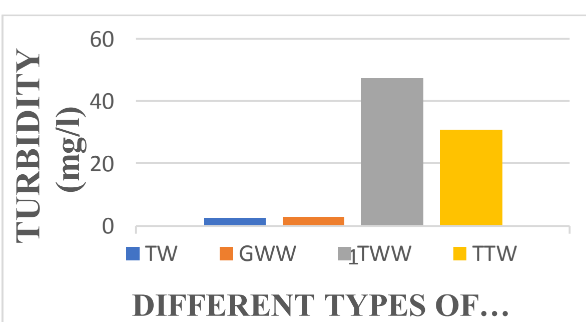
4.2 Colour.

The colour of the textile wastewater before treatment was black. The black color of the textile wastewater was as a result of the formation of ferrous and sulfides, which were resulted from the reduction of aerobic biological reaction occurring in the sewer, thus, this agrees with the results obtained [7]. But after treatment wastewater sample was greenish in colour. The tap and ground-well are colourless.

4.3 Odour

The odour of textile wastewater before treatment was ammonical but during a point had the odour of phenol and this was indicator of the lack of aeration decomposition of the organic matter. Then after treatment wastewater, ground-well water and tap water were odourless and clean.

4.4 Total dissolved solids (TDS) and Turbidity.



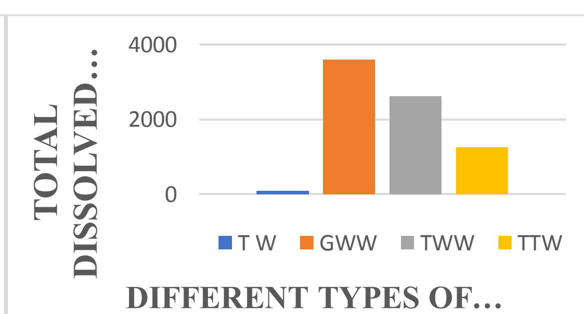
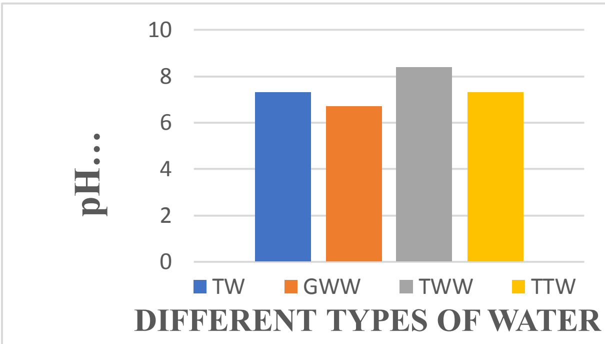


Fig.1 Turbidity in different types of water **Fig.2** Total dissolve solids in different types of water
Note: TW: Tap water, TWW: Textile waste water, TTW: Treated waste water, GWW: Ground well water.

As show in **Fig 1** the textile wastewater has the highest value of turbidity. However, the treated wastewater significantly higher than ground-well water and tap water. The result of textile wastewater was 47.34 while that of treated was 30.87, and they are higher than 5 NTU of WHO guidelines. The result of ground-well water and tap water are 3.00 and 2.59 respectively, which are in line with WHO guide line. High levels of turbidity can protect microorganisms from disinfection and can promote bacterial growth

As shown in **Fig. 2** the value of total dissolved solids in mg/l were found to be 2623.93mg/l for textile wastewater before treatment and decreased significantly to 253.3mg/l after treatment. The values obtained before treatment were considered to be high as described [7]. After treatment there were reduction in the values of total dissolved solids and were considered to be slight to moderate for irrigation as described [7]. The T.D.S. content for treated wastewater, ground-well water and tap water, which were 1253.3, 3600 and 90mg/l respectively, with highly significantly difference between treated wastewater and other types of water.

4.5 pH and Biochemical oxygen demand (BOD)



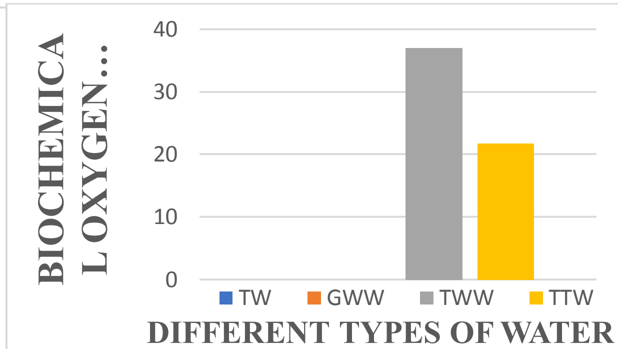
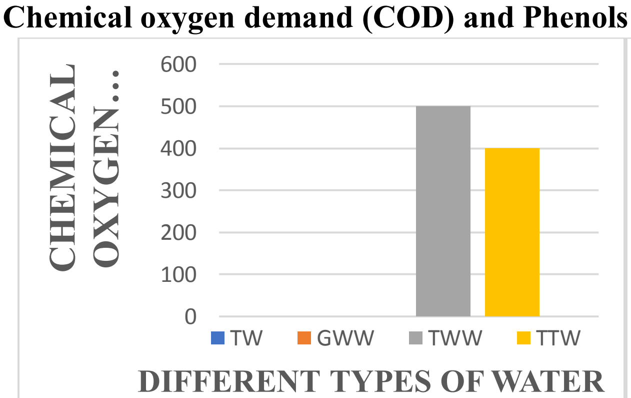


Fig. 3 Biochemical oxygen demand in different types of water. **Fig. 4** shows the values of hydrogen ion concentration different waters.

Fig. 3 shown the values of pH were found to be 8.4 for wastewater before treatment and 7.3 after treatment with significant difference; after treatment value of pH are within the range determined [7]. The pH of ground-well water and tap water were 6.7 and 7.3 respectively, with little significant difference. While treated wastewater and tap water has the same values. Also, all these values were fund to be within permissible level, which was determined according to the recommendations [7], which stated that pH for drinking water is 6.5 – 8.

Fig 4 proved in accordance with [5], the biochemical oxygen demand should be less than 20 parts in a million parts by weight of water (20 ppm). The values recorded before treatment was 37.0mg/l while after treatment the value was decreased to 21.77mg/l. While tap water and ground-well water are 0.00mg/l values respectively.

4.6 Chemical oxygen demand (COD) and Phenols



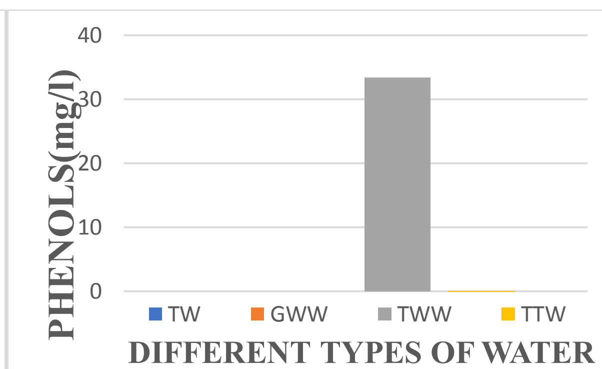
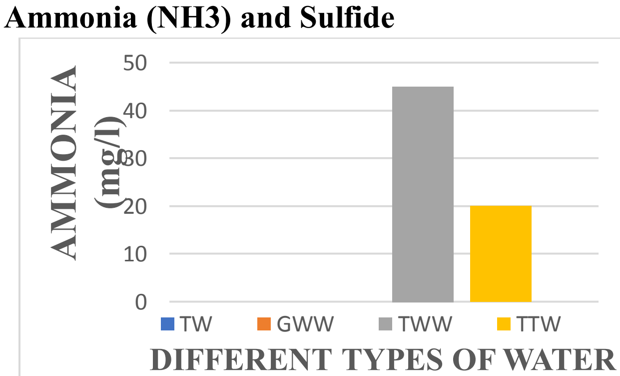


Fig 5 Chemical oxygen demand of different types of water **Fig. 6** Phenols of different types of waters

As shown in **Fig 5** the values of COD before and after textile wastewater treatment were 500 and 400 respectively which were highly significant. The values of COD before treatment were exceeding the typical values [7,8] the typical value of COD for wastewater is 500mg/l. On the other hand, the value of COD after textile wastewater treatment was decreased to significantly level, which has 0.00mg/l in the tap and ground-well water.

Fig. 6 illustrated that the average values of phenols before and after textile treated wastewater were 33.30 and 0.1mg/l, respectively. The average value of phenol before treatment was greater that the discharge standards limits [8] . After treatment the average value was significantly lower than the untreated one and found to be within the discharge standards limits [8]. The value of phenol in treated wastewater was 0.100mg/l with insignificant difference with other types of water which have value of 0.00mg/l

4.7 Ammonia (NH3) and Sulfide



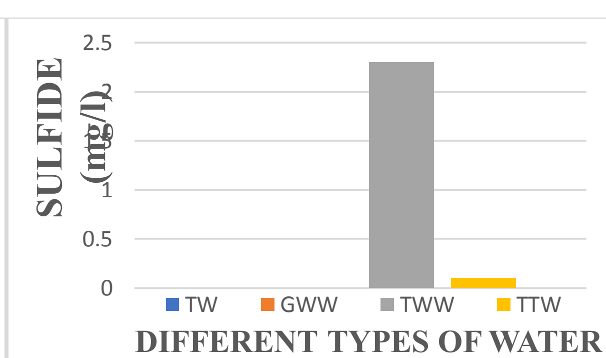
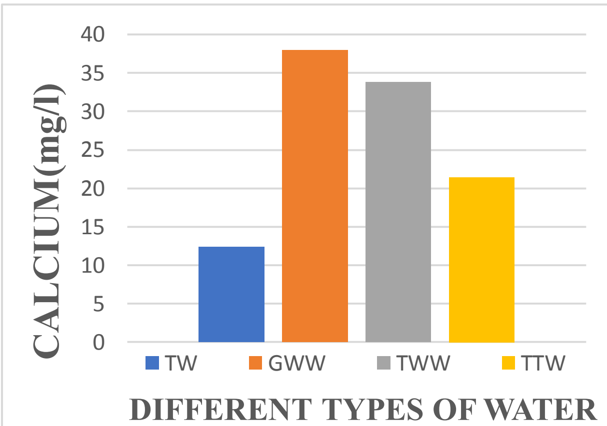


Fig. 7 Ammonia in different types of water **Fig. 8** Sulfide in different types of water

As shown in **Fig 7** there is a high significant difference of ammonia between textile wastewater before and after treatment with the values of 45.00 and 20.00mg/l respectively. There is a reduction in ammonia (0.5) mg/l for wastewater and also was acceptable for discharge standards. While the ground-well and tap water has 0.00mg/l ammonia value.

Fig.8 shows the average values of sulfide in mg/l of the different water. It was found to be 2.3 and 0.1mg/l before and after treatment respectively with significant difference, these results agree with that obtained [8], which showed that sulfide and sulphrous materials should not be allowed in any public sewer with a concentration greater than 10mg/l in contribution waste. Also, these two results were less than the standard values specified (<1) mg [8]. As shown in Fig. 8 there was no significant difference between other types of water in sulfide content with the value of 0.00mg/l.

4.8 Calcium (Ca) and Magnesium (Mg)



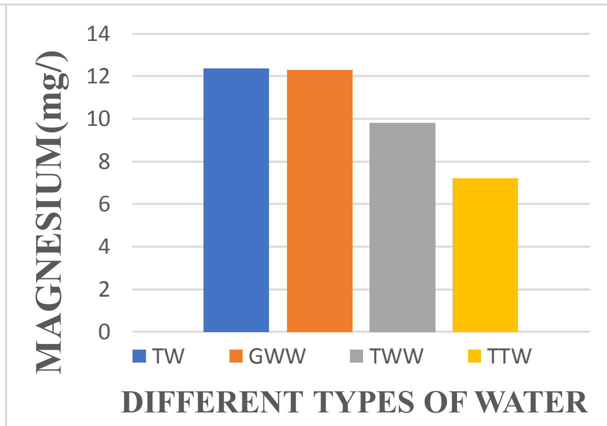
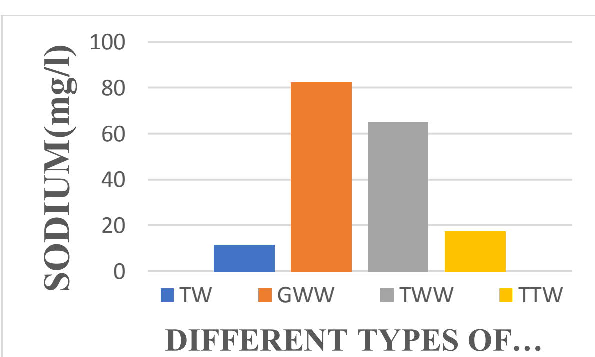


Fig. 9 Calcium in different types of water **Fig 10** Magnesium in different types of water

The values of Ca content are shown in Fig. 9, in which the average value of Ca was 33.80 and 21.40mg/l for before and after treatment wastewater, however, the tap and ground-well water have an average value of 12.36 and 37.99mg/l respectively. On the other hand, these were high significant difference from tap water average Ca 12.36mg/l. Calcium contents of all water samples were below the permissible level which ranges between 75-100mg/l (WHO).

The results in Fig. 10 illustrated Mg content, in which the average Mg value of treated textile wastewater was 7.20mg/l which is lower than textile wastewater 9.80mg/l, ground-well water 12.30mg/l and tap water were12.36mg/l, there is little significant difference observed between the tap and ground-well water. These results were below the permissible level for tap and ground-well water, which ranges between (30-150mg/l) [9].

4.9 Sodium (Na) and Potassium (K)



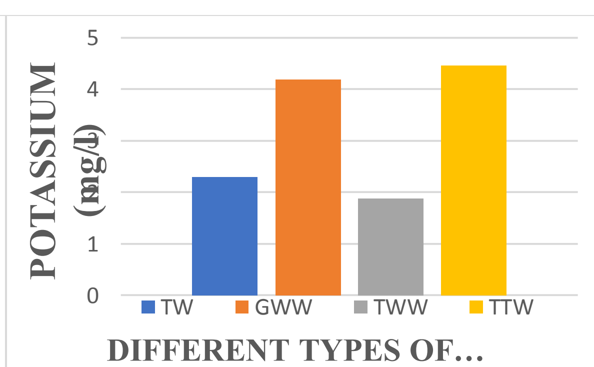


Fig 11 Sodium in different types of water **Fig. 12** Potassium in different types of water

As shown in Fig. 11 the average Na value for treated textile wastewater was 17.58mg/l, which was significantly lower than textile wastewater and ground-well water that were 64.85 and 82.33mg/l, respectively. However, a high significant difference was shown between treated textile wastewater and ground-well water were within the recommended levels, but treated textile wastewater and tap water were lower than recommended level [9].

As shown in fig 12 the treated textile wastewater exhibited the lowest K value 1.87mg/l, which significantly lower than textile wastewater (4.46mg/l), ground-well water (4.18mg/l) and tap water (2.30mg/l). Little significant difference observed between treated textile wastewater and tap water. Al sample tested were lower than permissible levels [9], who stated that the maximum permissible levels for pure water range between 10 – 12mg/l.

4.10 Phosphorus (P) and Chromium (Cr)

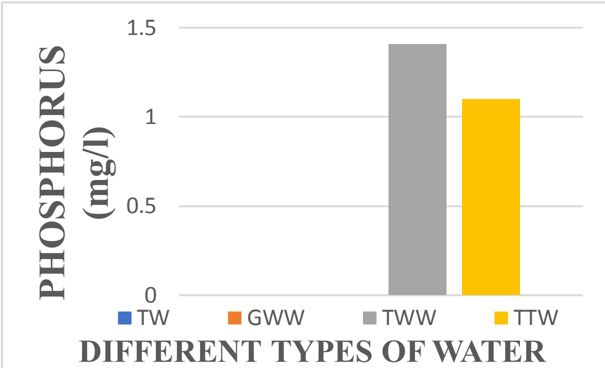


Fig. 12 Potassium in different types of water

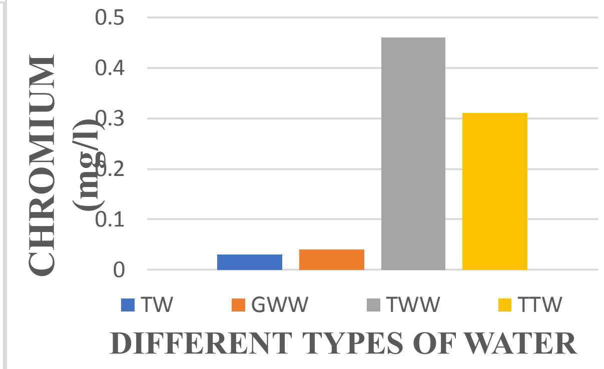


Fig. 14 Chromium in different types of water

As shown in **Fig. 13** the average values of phosphorus in the wastewater before treatment was 1.41mg/l, which s significantly higher than the treated textile wastewater which is 1.1mg/l. There is no significant difference between the tap and ground-well water in phosphorus content with value of 0.00mg/l. The average value after treatment was less than the recommended value for wastewater, which is 8ml/L as stated [10]. As recorded in **Fig. 14** the average value of chromium of treated textile wastewater was 0.31mg/l which was of lower significant difference ($P < 0.05$) than untreated textile wastewater that have the average value of chromium 0.46mg/l in acceptable concentrations even without the treatment. These values are considered appropriate compared with the values [10] as standards for discharge. Also, there is no significant difference when comparing the values of ground-well and tap water. The average Cr content for ground-well and tap water were 0.04 and 0.03mg/l, respectively. These values are in line with the standard values as defined, for reuse which is 0.10mg/l. However, these results were lower than the maximum contaminant levels of chromium for pure water, which is 0.05mg/l and for pure water, which is 1.0mg/l [10].

4.11 Copper (Cu) and Iron (Fe)

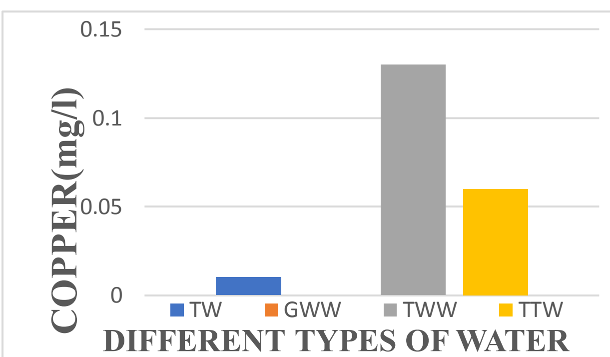


Fig. 15 Copper in different types of water

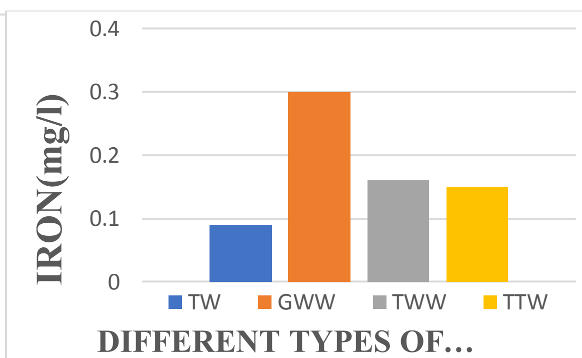


Fig. 16 Iron in different types of water

As shown in **Fig. 15** the average values of copper in textile wastewater and treated textile wastewater were 0.13mg/l and 0.06mg/l respectively with little significant difference. The two values before and after the treatment were in acceptable concentration [10,11] discharge standards. The tap water had Cu content of 0.01mg/l; which was significantly higher than the ground-well water with the value of 0.00mg/l. Also, the values of all the types of water are less than the recommended levels for drinking water which ranges between (0.5 – 1.0mg/l) [9] and also lower than upper limit in pure water, which is 0.5mg/l [11]. The treated textile wastewater has a 0.15mg/l with no significant difference between treated and untreated wastewater. This level of iron is considered appropriate as recommended [11] standards for discharge.

Fig. 16 illustrated that there was little significant difference between all types of water with tap and ground-well water having values of 0.09 and 0.3mg/l respectively. These vales can be regarded as acceptable concentration even without treatment [11] standards levels for pure water, which were (0.1 – 0.3mg/l).

4.12 Zinc (Zn) and Lead (Pb)

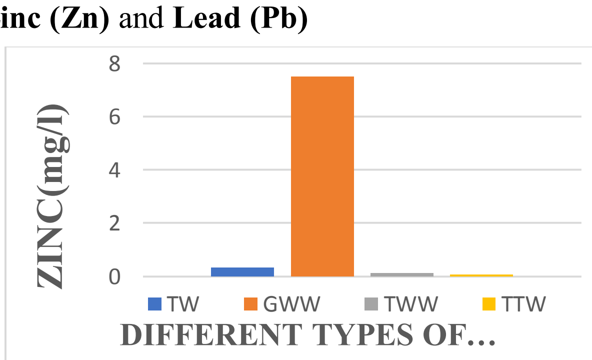


Fig. 17 Zinc in different types of water

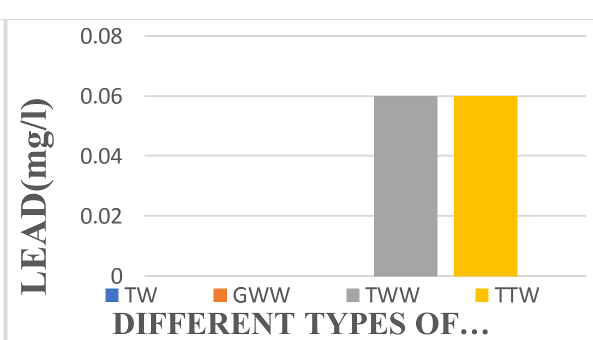


Fig. 18 Lead in different types of water

As shown in **Fig. 17** zinc contents of wastewater samples before and after textile wastewater treatment were 0.12 and 0.08mg/l respectively with little significant difference. These values in concentration lower than the maximum permissible level allowed [12] , which was 2.0mg/l. There is a high significant difference between tap and ground-well water which were 0.34 and 7.51mg/l, respectively. The average value of treated wastewater of zinc content was significantly lower for tap water, which have the average value of zinc in the textile wastewater, treated textile wastewater and tap water is lower than the desirable and permissible level [12], which were 1.5 and 5 respectively, only the ground-well water is higher than the level The average value of Zn in textile wastewater before and after treatment is also lower than the upper permissible limit of zinc in pure water, which is (24mg/l), [12].The values of lead for textile wastewater before and after treatment was 0.06mg/l as shown in **Fig. 18**. These values relate to the recommended maximum concentration of lead for reuses of [9], which was 5mg/l. The tap and ground-well water were recorded with 0.00mg/l lead content. These values are lower, which is 0.1mg/l for pure water [12,13].

4.13 **Nickel (Ni)** and **Manganese (Mn)**

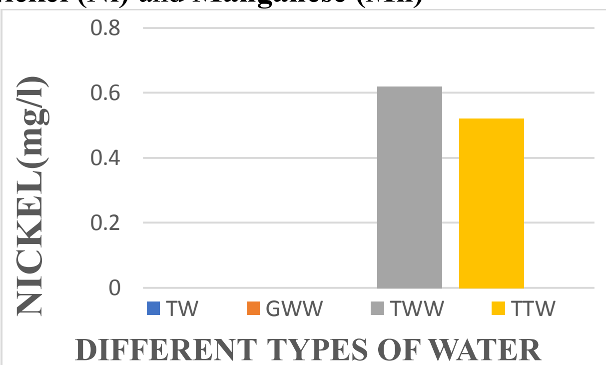


Fig. 19 Nickel in different types of water

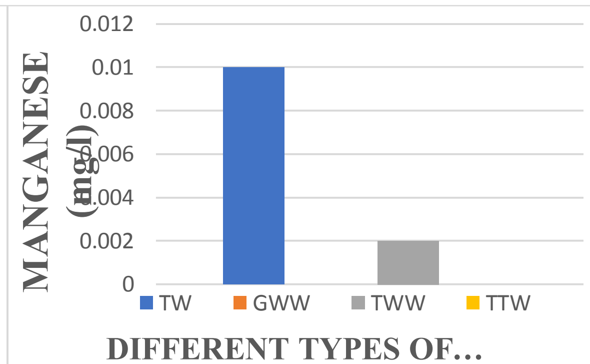


Fig. 20 Manganese in different types of water

As shown in **Fig. 19** the textile wastewater recorded the highest Ni value 0.62mg/l, which is significantly higher than textile treated water of the average value of Ni was 0.52mg/l. However, the tap and ground-well water have a 0.00mg/l Ni content

Trace amount of Mn was found in different samples of tested water as illustrated in **Fig. 20**. Little significant difference was found between treated textile wastewater and textile wastewater, ground-well water and tap water which have values of 0.00, 0.002, 0.01 and 0.00 respectively. All results of Mn value were considered lower than the upper limit in pure water [13].

4.14 **Cadmium (Cd)** and **Moisture content**

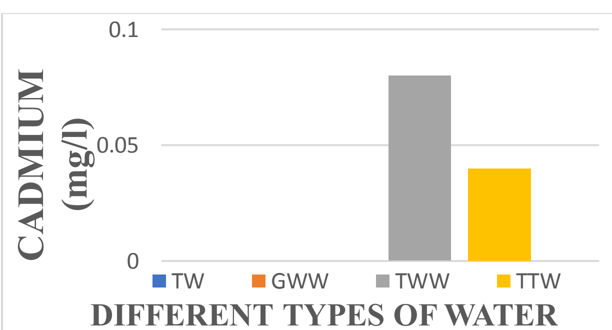


Fig. 21 Cadmium in different types of water

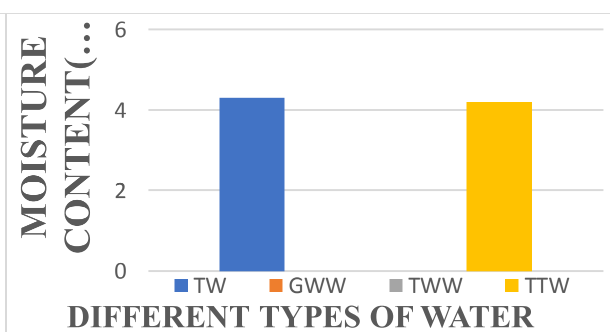


Fig 22 Moisture content in different types of water

Highly significant difference was recorded in data of Cd value in which the textile wastewater recorded the highest value of Cd 0.08mg/l, which considered greater than the upper limit of cadmium in tap water and ground-well water (0.00mg/l) [13]. However, the average value of treated wastewater was 0.04mg/l, which significantly higher than ground-well water and tap water as illustrated in **Fig. 21.**

Fig.22 displays the moisture content of textile wastewater, ground-well water and tap water above. The date irrigated with ground-well water significantly exhibited the highest moisture content. There is significant difference recorded between date irrigated with textile treated wastewater and tap water. In date irrigated ground-well water recorded 0.00%

4.15 Ash content

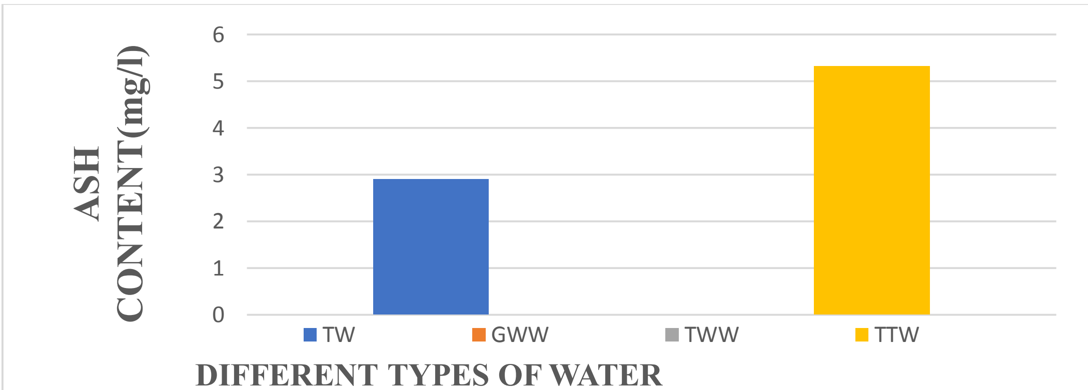


Fig 23 Ash content in different types of water.

The results in **Fig. 23** illustrated the ash content of the date irrigated with different types of water. Date irrigated with treated wastewater showed the highest ash content and lower in ground-well water. Nevertheless, the values recorded in tap water and textile wastewater are 0.00 respectively [14].

5. CONCLUSIONS

The physical and chemical composition of wastewater after treatment is within the standards limits as recommended [9], guidelines for water quality for irrigation and industrial reuses. The present research studied on investigating the adsorption capacity of chicken waste eggshell as green and economic adsorbent for the purification of waste water.

The pulverized chicken eggshell used in this study mainly composed of calcium carbonate ($CaCO_3$). There were no any toxic elements from all three adsorbent. It showed the ease of conversion of $CaCO_3$) to CaO in the calcinate eggshell. Therefore, very suitable adsorbent for removal of the removal of heaven metals and other impurities.

The results obtained in this study showed that the treated wastewater in Atlantic Textile Manufacturing Company Ltd can be reuse after treatment.

6. RECOMMENDATIONS

Wastewater should be disposed in a manner which should not cause environmental hazards [2]. Increase of the awareness of sanitation at all levels with special emphasis at schools, markets and industries.

Encouragement of projects dealing with the wastewater with the aim to reuse for processing and agricultural purposed.

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