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Prediction of Manure Maturity using pH Dynamics

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Abstract

The use of pH measurement as an indication of manure maturity was evaluated in this study. This was done using the pH kinetics as a model during bio-digestion of selected chicken layers manures at four abiotic conditions predicting the maturity of manure digestates for a period of 112 days. pH range for the duration of the experiment was found to be 6.00 – 11.50 with some days having the pH relatively stable at about neutral value. For instance the pH in the bioreactors containing the digestates of manure to water ratio, 1; 2.5, was 7.01 and 7.30 at days 27 and 40respectively with a slight change in pH values of 0.29 within the period. Similar slight change on pH values were also observed in the digestates with same manure to water ratio but treated under different abiotic conditions. In all the bio-reactors, periods of relatively stable pH were observed and these periods were found to correspond to when their ratio of ammonia: nitrate was ≤ 1 It was also observed that conditions such as manure to water ratio, enhanced aeration by stirring and presence of sunlight significantly affect the maturity periods of the manures. Maturity periods of 27 - 40, 25 - 36 and 17 - 33 days were observed when manure (wet weight) to water ratios of 1: 2.5, 1:5 and 1:10 were used respectively. This study has revealed that the evaluation of pH dynamics during bio-digestion of organic wastes is a useful, easy and cost effective method for the prediction of manures maturity during compost productions.

Key words: Prediction, manure maturity, pH dynamics**.**

Introduction

The use of organic manures as alternative to inorganic fertilizers for agricultural purposes has gained intensive attention in recent decades due to the cost effectiveness and environmental compatibility of these manures [1]. However, freshly collected livestock manures cannot be applied directly to farms because of their toxicity and environmental impact at that stage and thus require curing or storage for a period of time to ensure maturity before use. Several methods have been adopted over the years for composting organic manures as reported and well-reviewed by[1]. Conventionally, livestock droppings and dung are composted with green, and or food wastes or singly prior to agricultural applications [1]. In Nigeria livestock droppings and dung are kept on the yard, on the slab, on the shade or on the farm for composting prior to their usage as organic fertilizers. These composting methods are common and their usages depend on the available spaces. Sometimes, farmers keep these organic materials in perforated bags or apply to the farms directly. The type of organic materials and composting method used affects the nutrients content of the resultant compost [2, 3]. Bio-digestates are one of the various composts generated from organic wastes. They are inclusive byproducts of bio-digestion of organic wastes [3]. They are sometimes referred to as liquid manures or bio-digesters residues [4]. There are two major sources of biodigestates: those produces as effluents from biogas production reactors and those from side-streams and bio-lagoons. Biodigestates have been well reported as types of organic fertilizers rich in both macro and micro nutrients [5-8] In some developed nations such as some Europe countries, China, United States, Australia and Canada, biotechnology for biogas production is at advanced stages. Enormous amount of biodigestates have been generated in these countries over the years [3, 9]. Also, in these countries, livestock farming are usually large and intensive such that livestock houses cleaning involves washing and flushing of the livestock's' droppings and dungs into side-streams or earth or tank built ponds for natural bio-digestion [10]. It normally takes about three months for these bio-digestates to mature for agricultural usage [1, 11] . Here in Nigeria, the biotechnology for biogas production is still at baby stage. Beside, most livestock houses are normally cleaned up by scraping and shifting and dumping on sites or on farms for composting or direct application to crops. The maturity or cure period of organic composting is paramount for safe application of the manures to crops being it solid composts or bio-digestates [1]. Bio-digestate pH kinetic depicts the complex bio-chemical reactions and processes in biodigestion of organic substances [12] The digestate pH value is mainly controlled by the species $NH_4^+ \leftrightarrow NH_3$, $CO_2 \leftrightarrow HCO_3^- \leftrightarrow CO_3^{2-}$ and $CH_3COOH \leftrightarrow CH_3COO^-$[13, 14]. A pH increase is usually due to formation of ammonium carbonate ($(NH_4)_2CO_3$) [15, 16] and the removal of CO_2[17] as a result of the transformation of CO_3^{2-} and $2H^+$ to CO_2 and H_2O. Digestate pH is also affected by the concentration of basic cations (e.g. Ca^{2+}, K^+); they increase digestate pH because the electric charge balance of the solution has to be neutral, thus, decreasing the concentration of H^+[14]. Simultaneously, precipitation of carbonates (e.g. calcite $CaCO_3$) reduces manure pH [14]. Mineralization and reduction of multivalent ions in feedstock (e.g. SO_4^{2-}, $Fe(OH)_3$) increase pH, as well as the addition of Fe^{3+} ions to remove hydrogen sulfide (H_2S). Precipitation of Fe^{2+} phosphates releases protons, decreasing the pH [14]. Also, the reaction between Mg^{2+}, NH_4^+ and PO_4^{3-} ions (to form struvite) causes the release of H^+ ions in solution [18]. In any case, the processes that release H^+ are usually more at the start of digestion compared to the formation of OH ions hence the pH of the lagoon or bioreactors would always decrease at the initial stages [19]. But as the decomposition and digestion progresses, the formation and dissolution of ammonia and alkalization of base metals control the pH of the system. Understanding this dynamism is very important in composts and digestates chemistry.

Several methods of predicting compost maturity have been well documented in literature which can be classified into Physical tests: temperature, odour and colour. Study of microbial activity parameters: measuring metabolic activity, biomass count and the study of the easily biodegradable constituents. These include: respirometric studies, ATP and hydrolytic enzyme activity determinations, hydrolysable polysaccharide content, relation between total organic carbon and soluble glycosides, and ratio of carbon in reducing sugars to total carbon. Study of humified organic matter: determining the richness in total humus and the degree of polymerization of humic compounds by means of paper chromatography and photo-colorimetric methods. Chemical methods: C/N ratio in solid phase and in water extracts, pH, cation-exchange capacity and tests for ammonia, hydrogen sulphide, nitrates and nitrites. Biological methods: based on the determination of the germination index of seeds incubated in water extracts of the compost [1]. However, the most common methods of assessing compost maturity are based on carbon to nitrogen ratio of 10 or 12 : 1 or on the ratio of ammonium nitrogen (NH_4^+-N) to nitrate nitrogen (NO_3^- -N) $\leq$ 1 [11, 20] Most of these methods involve complex chemical and or spectrometric analyses for total organic carbon and nitrogen or NH_4^+-N and NO_3^- -N which are costly and time consuming. Asimple and cost effective approach such as the use of the system pH dynamics may be better alternative to the aforementioned methods for the determination of organic manure maturity.Therefore the objectives of this study are to: 1) monitor the pH changeswith time in the bioreactors (bio-lagoons);2) carry out periodical evaluation of the NH_4^+ -N and NO_3^- -N in the bioreactors and 3) correlate the NH_4^+-N and NO_3^- -N ratios to the pH kinetics of the bioreactors. In the study, abioticbiodigestates were locally produced in mimic bio-lagoons under four physicochemicalparametersof concentration, influence of sunlight, oxygen supply and time (duration) ina screen housewith average temperature of 29 ±3°C. The effects of these parameters on the total plants nutrients capacitywere also evaluated.

2.0 Materials and Methods

2.1 Materials processing

This work was carried out in a screened house. The chicken layers droppings used were collected from a dump site (at Sorghai Delta farms Plc, Amuokpe Delta State, Nigeria) about 2 hours after dumping. The wet droppings were packed into plastic containers and transfer to the greenhouse. Prior to the use of the chicken layers droppings, harmonization was done as much as possible by removing larges substances such as feathers, broken eggs, twines, wood shaving etc. and then thoroughly mixed (Plate 1). The moisture content was then determined using the oven drying method.

Plate 1: Harmonizing Chicken layers

Plate 2: Bio-reactors mimic of bio-lagoons

From the chicken droppings (fresh matter (FM)), 1: 2.5, 1:5 and 1:10 manure to water were made into plastic containers to mimic bio-lagoons here after refer to as lagoons (Plate 2). The lagoons were properly labeled as UPN, UPW and KD (Table 1), arranged in the greenhouse using Randomized Complete Block Design (RCBD) and were monitored for the influence of four abiotic parameters: concentration, oxygen supply (by stirring), light, and period of maturity. Other prefixes used in the labeling: D1 = Droppings: water ratio = 1:2.5, D2 = Droppings: water ratio = 1: 5; D3 = Droppings: water ratio = 1: 10

On daily basis, the pH and the electroconductivity of the lagoons were measured up to day 28 and then measurement changed to twice weekly up to day 112. All the lagoons except the UPNs (for the determination of the effects of oxygen supply to the lagoon) were stirred gently for about 5 minutes prior to pH measurement. For the KDs, the black polymer coverage (Plate 2.) was only removed when stirring and measurement were to be taken.

Table: 1: Labels of the bio-lagoons

Digestates labels	Particulars
UPN	Lagoon with no stirring
UPW	Lagoon with stirring
KD	Lagoon kept in the dark

2.2 pH and Chemical Analyses

pH readings were done using Orion model 420A pH meter, UK, which was calibrated with buffer solution of pH 4, 7 and 9 prior to usage [21].

Ammonium nitrogen (NH_4^+– N) was determined by Direct Nesslerization cum colorimetric method as prescribed by APHA [22]. Ten milliliter(10 ml) of the digestate was measured into 100 ml beakers (in triplicate) and was heated gently (at temperature range 60^{o}C – 70^{o}C) with regular stirring until a paste or sludge was formed. The sludge was allowed to cool then the NH_4^+ –N in the sludge was extracted with 2.5 M KCl solution according to IRSA CNR, (1994) method as described byKo*et al*., [20]. The extract was then filtered twice into 50ml volumetric flasks (to obtain clear solution) using No.2 Whatman filter papers. The extraction bottle was rinsed with about 10ml of distilled each and passed through the filter the filtrates' volumes made to marks. Colorimetric analyses were carried out after treating the samples with Nesslier reagent prepared by adding (slowly with stirring) solutions A and B together and diluting to 100ml. Solution A was prepared by dissolving 1.0g HgI_2 and 0.70 g KI in 10ml of distilled water and solution B was prepared by dissolving 16g NaOH in 50 ml distilled water. Six points concentrations(0.0, 0.5, 1.0, 1.50, 2.00 and 2.50 mg/l) of working standards for NH_4^+– N were prepared from 1000 mg/kgNH_4Cl. To 25 ml of the sample extracts [21] and the working standards in plastic tubes, 0.5ml each of the Nesslier reagent was added and allowed to stand for 15 minutes for colour development. Colorimetric reading was done at 425nm using Hach 2010 UV VIS Spectrometer [22]. The instrument was adjusted to zero using distilled water prior to the measurementof the standards and samples. The concentration of NH_4^+ – N was calculated as:

$$NH_4^+ - N\left(\frac{mg}{kg}\right) = c * \frac{v}{w} (1)$$

[21].

Where C is the concentration of NH_4^+- N in the sample in mg/l (as calculated from the calibration curve regression equation), v = the final volume of the digest in liters (i.e. 50ml = 0.050l)and w is the weight of the digestate used expressed in kg

Nitrate nitrogen (NO_3^-– N) was determined by colorimetric method as described by Okalebo*et al*.,[21] and The procedure for NO_3^--N extraction followed the same way as described for NH_4^+- N above except that 1M K_2SO_4 was used instead of KCl solutions for the samples extractions. Six working standards (0, 2, 4, 6, 8 and 10 mg/l) were prepared in 1M K_2SO_4 solution from 50 mg/l potassium nitrate stock. The stock standard was prepared by dissolving 5ml of Potassium nitrate stock solution in 25ml of 1M K_2SO_4 solution in 50ml volumetric flask and made to mark with the K_2SO_4 solution while the Potassium nitrate stock (1000mg/l) was prepared by dissolving 0.722g (overnight oven-dried at 105 ^{o}C) potassium nitrate in 25ml of 1M K_2SO_4 solution in 100ml volumetric flask and made to mark with the K_2SO_4 solution. To each 0.5 ml portions of the soil extracts and the working standards in 25ml plastic test tubes, was added 1 ml 5% salicylic acid, mixed well and allowed to stand for 30 minutes, Then 10ml 4MNaOH solution was added ,vortex and allowed to stand for about 1 hour for a yellow colour to be fully developed. The resulting solutions were screen using UV VISSpectrometer at 419 nm. The nitrate – N in the samples were calculated as:

$$NO_3^- - N\left({}^{g}/_{kg}\right) = C\,x\,\frac{v}{w} \qquad (2)$$

Where C is the concentration of NO_3^--N in the sample in mg/l (as calculated from the calibration curve regression equation), v = thefinal volume of the digest in litre and w is the weight of manure digestates used expressed in kg.

2.4 Data processing

The values of ammonia nitrogen: nitrate nitrogen ratios were evaluated. Graphical interpretation of pH kinetics with time change during the bio-digestion period was done using excel version 2010 programme.

3.0 Result and Discussion

Table 3a and b: present the pH dynamics in the bio-active lagoons for fourteen days. The results showed the gradual drop of the pH in the bio-lagoons from day 2 to about day 10 and 11 and then a gradual rise up to about day 27 after which they remained in about neutral pH range (6.91 – 7.40) for about two week before rising again into the alkaline pH ranges. For instance, in lagoons D1/UPN, D1/UPW and DI/KD, the pH dropped from 6.81, 6.81 and 6.90 at day 1 to 6.12, 6.03 and 6.12 respectively at day 2 (Table 3a). The D2 and D3 series (Tables 3a and b) of the lagoons also showed similar trend in their pH dynamics. It is pertinent to note that the letter D1, D2 and D3 represented the manure to water ratio with D1, D2 and D3 representing digestates dilution of manure to water ratio of 1:2.5, !:50 and 1: 10 respectively. Similarly, UPN, UPW and KD in the labels were used to differentiate digestates of the same concentration but treated under different abiotic conditions with UPN, UPW, and KD representing the digestates that were not stirred at all; those stirred regularly and those kept in the dark respectively.

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Table 3a: pH dynamics of the Bio-active Lagoons

Samples	Days						
	0	1	2	3	4	5	6
D1/UPN	6.81 ±0.02	6.81 ±0.02	6.12 ±0.02	6.01 ±0.02	5.91 ±0.01	6.06 ±0,04	6.15 ±0.05
D1/`UPW	6.81 ±0.01	6.81 ±0.01	6.03 ±0.03	5.91 ±0.03	5.82 ±0.04	5.91 ±0.02	6.06 ±0.03
D1/KD	6.90 ±0.02	6.90 ±0.02	6.12 ±0.02	6.05 ±0.03	5.93 ±0.06	6.10 ±0.00	6.06 ±0.03
D2/UPN	6.80 ±0.01	6.80 ±0.01	6.42 ±0.02	6.25 ±0.06	6.15 ±0.02	6.22 ±0.03	6.42 ±0.03
D2/`UPW	6.90 ±0.02	6.90 ±0.02	6.30 ±0.01	6.13 ±0.03	6.08 ±0.04	6.15 ±0.04	6.14 ±0.02
D2/KD	6.82 ±0.03	6.82 ±0.03	6.32 ±0.03	6.14 ±0.04	6.05 ±0.05	6.15 ±0.03	6.12 ±0.02
D3/UPN	7.00 ±0.01	7.00 ±0.01	6.83 ±0.04	6.79 ±0.03	6.43 ±0.03	6.72 ±0.03	6.72 ±0.02
D3/`UPW	7.10 ±0.02	7.10 ±0.02	6.41 ±0.03	6.48 ±0.04	6.42 ±0.03	6.52 ±0.03	6.48 ±0.03
D3/KD	7.00 ±0.02	7.00 ±0.02	6.42 ±0.03	6.37 ±0.04	6.29 ±0.02	6.32 ±0.04	6.31 ±0.02

Table 3b: pH dynamics of the Bio-active Lagoons continued

Samples	**Days**							
	7	**8**	**9**	**10**	**11**	**12**	**13**	**14**
D1/UPN	6.22 ±0.02	6.18 ±0.03	6.20 ±0.01	6.31±0.01	6.34 ±0.03	6.40 ±0.00	6.52 ±0.02	6.55 ±0.02
D1/`UPW	6.13 ±0.02	6.09 ±0.01	6.14 ±0.02	5.99 ±0.03	5.89±0.04	6.07 ±0.02	6.13 ±0.00	6.18±0.05
D1/KD	6.13±0.02	6.09 ±0.02	6.15 ±0.03	6.09 ±0.04	6.09 ±0.04	6.11±0.03	6.12±0.03	6.18 ±0.04
D2/UPN	6.41 ±0.02	6.43±0.03	6.34±0.04	6.43 ±0.02	6.44±0.02	6.39 ±0.01	6.42 ±0.02	6.45±0.03
D2/`UPW	6.13 ±0.04	6.10±0.02	6.08±0.02	6.15 ±0.03	6.03±0.03	6.13 ±0.02	6.28 ±0.02	6.28±0.03
D2/KD	6.04 ±0.04	6.05±0.03	6 .11 ±0.02	6.18 ±0.01	6.26 ±0.03	6.30±0.02	6.40 ±0.01	6.42 ±0.03
D3/UPN	6.70±0.02	6.65 ±0.02	6.80±0.01	6.82 ±0.03	7.00 ±0.03	7.32 ±0.02	7.61 ±0.02	7.81 ±0.02
D3/`UPW	6.40 ±0.02	6.42 ±0.03	6.48 ±0.02	6.52 ±0.03	6.60 ±0.03	6.71 ±0.01	7.03 ±0.03	7.33 ±0.04
D3/KD	6.32 ±0.03	6.42 ±0.03	6.48 ±0.02	6.54 ±0.04	6.49 ±0.01	6.62 ±0.00	6.55 ±0.03	6.63 ±0.03

Plots of pH changes against days clearly explained the correlation between the pH kinetics and duration of bio-digestion of the chicken layer droppings (CLD) at different abiotic conditions. Figures 3a-c: showed the plots of the pH changes for all the bio-lagoons (UPNS, UPWS and KDs) for 112 days.

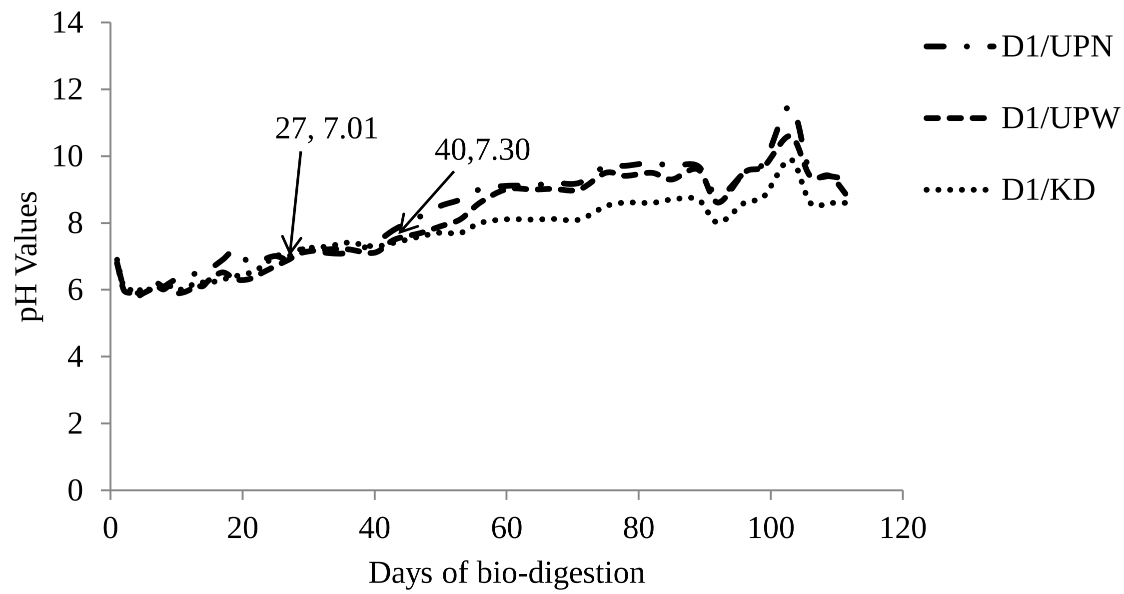

Figure3a: pH dynamics during bio-digestion of CLD (1:2.5 manure: water)

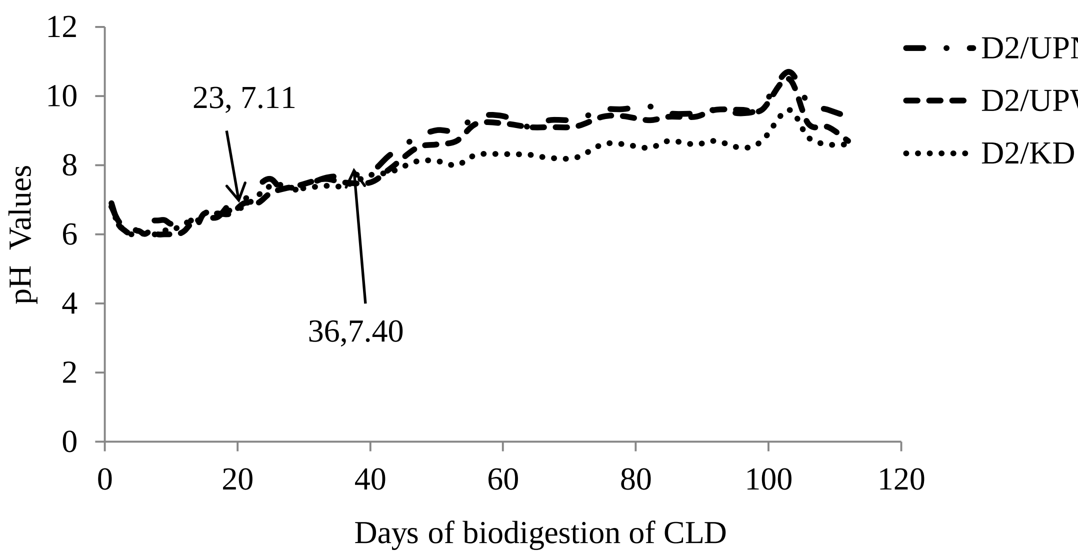

Figure 3b: pH dynamics during bio-digestion of CLD (1:5 manure: water)

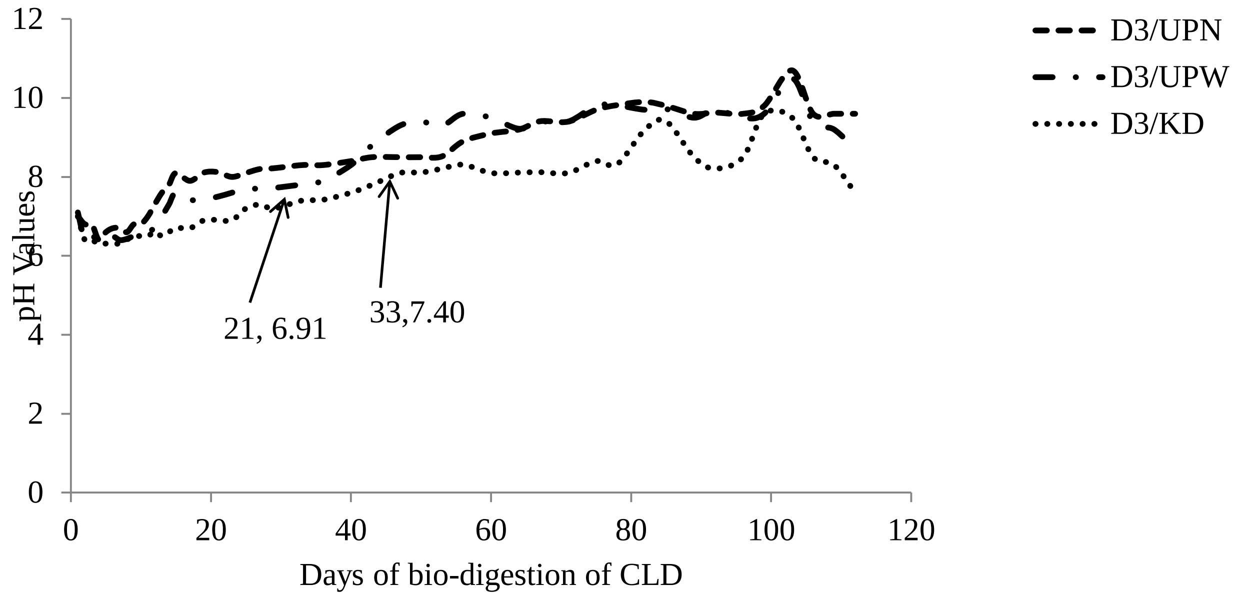

Figure 3c: pH dynamics during bio-digestion of CLD (1:10 manure: water)

The results showed that all the bio-lagoons passed through about neutral pH ranges of 6.91 – 7.40 at different days. For instance, all the digestates starting with labels D1, D2 and D3 series entered the neutral pH range at a day 27, 23 and 21 respectively and each remained in these ranges for about 12 days (as shown by the graphs coordinates (Figures 3a–c) before increasing further into alkalinepH. The D1 and D2 digestates had similar trend in their pH kinetics but slight deviation from this behavior was observed in the D3/UPN and D3/UPW lagoons (Figure 3c). Nutrients analyses of the digestates at these stages (Tables3a and b) indicated that the digestates were matured for use (at these periods of relative stable neutral pH) adjudged from Ko*et al*.,(2008) standards of manure maturity prediction. This implies that the more the amount of manure to water (as in D1 series), the longer it takes to maturity of the digestates for use Previous works have also established the effects of organic matter type and quantity on the maturity of its compost[1, 2]. In general, it took the D1, D2, and D3 series of bio-lagoons maximum of about 40, 36 and 33 days respectively (Figures 3.1a – c) from the beginning of the bio-digestion to maturity for usage as nutrient supplement or fertilizers. In other words, it was observed that the neutral pH stages of 6.91 – 7.04 in the various lagoons corresponded to the maturity of their digestates with regards to ammonia nitrogen to nitrate nitrogen ratio of ≤1 (Ko*et al*., 2008). For instance, the D1, D2 and D3 series gave NH_4+-N: NO_3--N ratio of ≤1 at days 42, 35, and 28 respectively (Tables 3.2a and b). It is pertinent to note that these were the days of samples taken for nutrient analyses. The actual digestates maturity may have proceeded the sampling time as shown by Figures 3a-c discussed earlier. The observation was collaborated by algae bloom noticed in the lagoons at the periods depicted by Figures 3.1a-c. These maturity periods were far shorter than those of about 3 months reported for conventional bio-lagoons but lower than 60 days reported for digestates sludge[3]. The reasons for this behavior may be attributed to the photo and or aeration enhancement of the lagoons in this work or the well-controlled chemical environment in bioreactors. Besides, the physicochemical properties of manure digestate and its sludge are never the same which may account for the different maturity time[23-25]

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Table 3.2a: Plant nutritional values (mg/l) and maturity ratios of the CLD at Days 1 - 21

	Day 1				Day 14			Day 21	
Lagoons	NH_3 - N (A1)	NO_3^- - N (A2)	Ratio A1/A2	NH_4^+ - N (B1)	NO_3^- - N (B2)	Ratio A1/A2	NH_4^+ -N (C1)	NO_3 - N (C2)	Ratio A1/A2
D1/UPN	393.66 ±29.84	185.05 ±12.11	2.13	553.60 ±29.34	245.15 ±16.33	2.26	583.66 ±31.23	295.55 ±19.05	1.97
D1/UPW	428.42 ±23.45	196.76 ±10.91	2.18	652.41 ±33.32	290.73 ±18.11	2.24	702.02 ±46.23	310.16 ±21.22	2.26
D1/KD	468.56 ±32.44	157.34 ±8.88	2.98	551.50 ±41.23	207.32 ±13.44	2.66	591.16 ±30.72	287.74 ±20.71	2.05
D2/UPN	196.14 ±14.32	102.98 ±6,17	1.90	286.24 ±22.16	152.88 ±11.11	1.87	316.17 ±23.51	202.58 ±13.14	1.56
D2/UPW	210.27 ±15.55	120.56 ±8.34	1.74	290.21 ±21.53	150.06 ±9.13	1.93	310.37 ±19.59	172.05 ±11.13	1.80
D2/KD	216.14 ±13.36	104.30 ±6.77	2.07	266.34 ±18.66	134.33 ±9.87	1.98	296.61 ±22.15	154.33 ±9.91	1.92
D3/UPN	116.71 ±7,09	56.57 ±3.21	2.06	132.51 ±7.11	80.51 ±6.09	1.65	126.11 ±8.77	96.17 ±5.73	1.31
D3/UPW	108.48 ±6,56	50.13 ±3.11	2.16	135.18 ±6.31	58.33 ±4.14	2.32	126.44 ±10.08	105.63 ±8.15	1.20
D3/KD	117.91 ± 8.99	45.06 ±3.12	2.62	147.01 ±9.71	85.99 ±5.32	1.71	137.31 ±7.11	101.86 ±6.55	1.35

Table 3.2b: Plant nutritional values (mg/l) and maturity ratios of the CLD at Days 28 - 42

Lagoons		Day 28			Day 35			Day 42	
	NH_3 - N	NO_3 - N	Ratio D1/D2	NH_3 - N	NO_3 - N	Ratio E1/E2	NH_3 - N	NO_3 - N	Ratio F1/F2
D1/UPN	623.76 ±42.19	355.05 ±30.58	1.76	633.66 ±53.36	425.05 ±31.57	1.49	453.66 ±32.55	500.25 ±45.31	0.91
D1/UPW	698.12 ±51.37	330.71 ±23.17	2.11	677.23 ±47.73	450.55 ±37.25	1.50	528.32 ±42.27	710.76 ±60.71	0.74
D1/KD	608.56 ±60.32	297.14 ±21.97	2.05	623.33 ±47.73	390.04 ±29.23	1.60	468.51 ±31.18	607.34 ±51.75	0.77
D2/UPN	311.11 ±21.17	277.81 ±20.11	1.12	296.44 ±22.99	282.98 ±21.82	1.05	226.98 ±18.77	252.98 ±23.29	0.90
D2/UPW	320.77 ±23.76	280.51 ±20.43	1.14	260.27 ±19.08	302.26 ±25.18	0.86	201.22 ±15.51	300.16 ±24.61	0.67
D2/KD	296.61 ±22.22	269.43 ±22.22	1.10	228.33 ±16.52	244.36 ±18.72	0.93	200.13 ±17.86	242.31 ±40.31	0.83
D3/UPN	136.71 ±11.09	142.65 ±11.61	0.96	106.71 ±7.86	125.17 ±8.37	0.85	96.71 ±8.71	126.57 ±9.76	0.76
D3/UPW	125.18 ±10.25	165.33 ±14.11	0.76	116.66 ±9.54	135.23 ±8.13	0.86	100.48 ±8.22	149.13 ±13.09	0.67
D3/KD	107.79 ±9.71	175.08 ±13.55	0.62	100.11 ±8.73	125.98 ±8.14	0.79	97.21 ±6.41	168.31 ±13.13	0.58

The pH dynamics of bio-digesters had been explained on the release mainly of volatile fatic acids (VFA) and amino acids and ammonia during the course of digestion or decomposition of organic matters [26].

Conclusion

pH is one of the major indicators of the physicochemical status of a bio-lagoon or bioreactor. In this study, it was observed that evaluation of composts particularly digestates maturity based on their pH kinetics could be feasible and reliable. The toxicity of improperly curedorganicmaturesto crops and microbes has been well documented. Thus manures' maturing prior to use for agricultural purposes cannot be over emphasized. A good understanding, proper monitoring and interpretation of pH kinetics during composting or biodigestion of organic substances for fertilizers would lead to prediction of maturity of such organic fertilizers. Most researchers based prediction of composts maturity on C:N or NH_4^+-N :NO_3^- -N ratios . To be a good chemical indicator for compost stability and maturity, a chemical parameter should fulfill the following requirements: (a) follow a consistent trend during the composting process; (b) provide reference, critical or threshold values; (c) require relatively rapid and cheap analytical procedures and (d) be easily interpretable. Some of the chemical parameters often referred to in the literature regarding the evaluation of compost stability and maturity do not meet these requirements. This is compounded by the complex bio-chemistry of various compost materials and the targeted end use. This approach of predicting manure maturity based on its pH kinetics (as shown in this study) is deemed to be simple, time saver and cost effective as compared to the existing common practice methods that involve complex spectrometric and or chemical analyses

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