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Original Research Article

Studies on the Effect of Petrochemical Products on Sewage Degredation in a Septic Tank

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Abstract

In Nigeria, it is standard practice to discharge petrochemical compounds on sewage degradation in a septic tank, which has led to consistent sewage dislodgement in the septic tank that serves our household. The study was carried out to determine the effect of some petrochemical products, such as petrol, kerosene, and diesel. Some laboratory tests were conducted, which included biochemical oxygen demand (BOD), chemical oxygen demand (COD), pH, conductivity, and total coliform count. Under aerobic conditions, the researchers built four different experimental sewage treatment systems in the lab. We used a scale ratio of 2: 1 for the effluent and petrochemical products in order to get a total mixture of 200ml for both since the reagent bottle, we used for the test has a total measurement of 300ml. With respect to the above ratio, 33 mL of effluent and 67 mL of petrochemical products such as petrol, kerosene, and diesel were poured into each of the three samples (i.e., the 300 mL reagent bottle), and the last sample was used as the control. Samples were collected at a weekly interval for a period of four weeks for the laboratory tests. The findings of the tests revealed that there was a slow rise in the BOD and the COD during the second week, but that this rise eventually slowed down and became smaller over the course of time. Weekly, the pH, conductivity, and total coliform count decrease. The abrupt spike in the second for BOD and COD is due to the presence of additional carbon, hydrogen, and oxygen molecules, which eventually decrease with time. This merely indicates that petrochemical products have the potential to be utilised in the reduction of biological oxygen demand (BOD), chemical oxygen demand (COD), and coliform bacteria found in sewage.

Keywords: Petrochemical, Sewage, Degradation, and Effluent.

1.0 INTRODUCTION

Sewage as defined by (Aguwamba, 2001) is the Waste-water of a community consisting of human excreta, urine, sullage (wastewater from bathroom, laundry and kitchen) (wastewater from bathroom, laundry and kitchen). Sewage may be classified mainly into two types, namely; domestic mid industrial. Domestic sewage includes waste from households as well as excrement from humans, animals, and other organisms, whereas industrial sewage refers to waste from businesses.

The treatment of industrial sewage is much more challenging than the treatment of domestic sewage because the composition of industrial wastes can vary greatly. Some industrial wastes, like soda wastes, can be highly alkaline, while other industrial wastes, like acid-mine drainage, can be highly acidic. Additionally, some industrial wastes are toxic due to the presence of heavy metals, antibiotics, and pesticides (Manisha, 2004). The primary goal of the research that Washington *et al*., (1998) conducted was to ascertain what happens to absorbable organic halide that is produced by household bleach when it is introduced into a septic system. The secondary goal of their research was to evaluate how bleached laundry affects the performance of septic tanks. Novac *et al.*, (1990) conducted a study that was quite similar to this one, and in it, they assessed the effects that chemicals contained in marine holding tanks have on the operation of septic tanks. In the study that was referenced above, the elimination of COD was employed as a performance measure, and both slug doses and progressive doses of the compounds were tested for their effectiveness. Similar findings were reported by Washington *et al*., (1998), who discovered that the septic system recovered rapidly after the chemicals were removed from the tank and flushed out by new "wastewater influent" that did not contain the chemical. Above a certain critical dosage, it was observed that the compounds were

fatally poisonous to microorganisms, and the COD removal efficiency did not recover completely. Below the critical dosage, only inhibitory effects were found as the COD removal efficiencies recovered completely. However the objective of this study is to investigate the effect of petrochemical products on sewage degradation in a septic tank. It goes further to determine the biological growth of microorganisms on sewage degradation in a septic tank. Lastly, to determine the rate of decomposition of BOD and COD in a septic tank.

2.0 MATERIALS

The materials used for this study include:

i.) 10 litres of faeces
ii.) 250mm diameter pipe
iii.) Water
iv.) Funnel
v.) 200 -300 mlconical bottle
vi.) Measuring cylinder
vii.) Stirring Rod
viii.) Conductivi ty meter
ix.) pl-I labtech 1neter
x.) 300ml reagent bottle
xi.) Colony counter
xii.) pH detecti ng electrode
xiii.) Conductivity detecting cell
xiv.) Au toclave machi ne
xv.) Incubator
xvi.) Jug
xvii.) l .5m length of stick
xviii.) Pipette and itspump
xix.) petri dish
xx.) Test tube
xxi.) Beaker
xxii.) Cement
xxiii.) Sharp sand
xxiv.) Lovi bond BOD IR-sensomat
xxv.) Hand Gloove
xxvi.) Nose mask
xxvii.) Antiseptic Dettol
xxviii.) Cotton wool

3.0 METHOD

The effluent used in this work was obtained from prisons at Owerri-Onitsha road and kept into a 10 liters container in the laboratory of the Department of biology, FUTO. It was divided into four equal parts, and kept in pipes diameter 250mm with a length of 0.65m whose base was properly concreted. These pipes were used to simulate septic tanks (see appendix 1) for the effluents to be experimented on. Since the reagent bottle we are working on has a total measurement of 300ml, we decided to use a scale ratio of 2: 1 for the effluent and petrochemical products in order to get a total mixture of 200m1 for both. With respect lo the above ratio, 133ml of effluent and 67ml of petrochemical products such as petrol, kerosene and Diesel were poured into each of the three samples (i.e the 300m1 reagent bottle) and the last sample which is known as the fourth sample was then used as the control.

The samples were labeled k, P, and D corresponding to samples containing kerosene, Petrol and Diesel respectively while the control sample was labeled C (see appendix 2). After labeling, the various samples were then .weighed using a Digital weighing balance (see appendix 3) and their weights were recorded. The following tests were carried out on each of the samples as explained below.

3.1 Determination of BOD

The BOD was evaluated by first diluting the sample appropriately seeded fixed with wrinkles method, sample bottles were corked and wrapped with aluminum foil incubating it in the dark at 20°C for five days and measuring the amount of oxygen consumed. A measured amount of the sample was poured into 500ml BOD standard bottle and lithium Hydroxide was added as nutrient covered satisfactory with foil cap and left for 5day. The bottles were placed in the HACH BOD Trac incubator (Model 205-2, HACH, USA) at 20 + 10°C and the incubation was observed for 5days after which the results were recorded. The measuring apparatus used was the Lovibond BOD IR-sensomat, which co11sists of an IR-pressure sensor acting as the 111easurement device, BOD-sensomat and stiring system. The resultant carbon (iv) oxide from microbial respiration is absorbed with potassium hydroxide (l(OH), which creates a decrease of the air pressure in the BOD flask. The pressure decrease is detected by the IR-sensor, logged into the BOD-sensor and converted direct1y in mg/I of BOD

3.2 Determination of COD

A 500ml stock solution was prepared and the samples were preserved with H2SO4 sample was then transferred to calibrated volumetric flask with appropriate dilution with deionized water and mixed oxidation of samples is done with standardized K2Cr2O7, sample was completely digested. Titration was carried out with 0.15M ferrous ammonium salts using ferrous as indicator. The we compute the number of moles of K2Cr2O7 consumed in oxidizing the organic material in each sample.

COD mg/l= (B-A)(N)/(8000) …….. 3.1

Where A= Volume of ferrous ammonium sulphate solution used for sample titration (ml). B= Volume of ferrous ammonium sulphate solution used for blank titration, (ml).
N= Normality of the ferrous ammonium sulpl1ate solution. V= Sample volume, in ml

3.3 Determination of pH

The sample pH was determined usi ng glass electrode pH meter 3015 (Jenway, U.K). It was allowed to stand for 30 minutes. A O.lM phosphate buffer

solution was used to standardized the pH meter. Then the electrode of the pH meter was inserted into the mixture and the pH reading were taken. The probe was washed after the pH of each sample was taken.

3.4 Determination of Temperature

This was determined at the point of sample collection by dipping the bulb of mecury- in-glass thermometer into the soil suspension and recording the reading. Reading was taken when there was a steady temperature from the calibration on the capillary tube.

3.5 Determination of Conductivity

Conductivities were measured at 29°C in µs /cm using a digital conductivity meter (DD 193). After it was calibrated, the electrode was inserted into the portion of the sample and the conductivity button was pressed. Thevalve was then read.

3.6 Determination of Total Coliform Count

The membrane Filter Technique defines total coliforms as all organisms that produce colonies of pink to dark red and some (but not all) have a greenish gold metallic sheen with in 24hours of incubation at 35°C on Endo-type medium lactose and are aerobic or facultative anaerobic, gram-negative, non-spore forming rods. ln this method, measured volumes of sample or sample dilution are vacuum-filtered through 47m mdiameter, micro porous cellulose membrane filters that retain bacteria. The membrane are transferred to petri-dishes containing m-Endo medium and incubated inverted fir the development of bacteria colonies. Using a microscope to observe, colonies having the characteristics appearance of coliforms are counted and the coliforms bacteria density is computed. Coliforms density is the number of colonies of 100ml of sample. For analysis, use a sample volume that gives 20-80 coliforms colonies on the membrane filter.

4.0 RESULT

4.1 Results

The results of the biochemical oxygen Demand of various samples are shown in Table 4.1.

Table 4.1: BOD of samples

Dura tion	**Week 1**				**Week 2**				**Week 3**				**Week 4**			
Pp treatment	C	K	D	P	C	K	D	P	C	K	D	P	C	K	D	P
Weight (g)	29	35	320	33	28	347	312	30	27	32	305	28	32	32	30	28
	0.0	1.2	.5	2.3	6.1	.7	.8	2.2	8.5	8.5	.7	3.9	8.5	8.7	5.7	3.8
BOD (mg/ l)	43	81	145	79	39	151	149	83	30	42	103	74	10	98	70	85
	4.0	6.9	5.1	1.4	8.8	6.4	7.9	0.1	8.9	1.2	9.0	2.4	2			

Table 4.2 show the results of the Chemical Oxygen Demand (COD)

Table 4.2: COD of Samples

Duration	**Week 1**				**Week 2**				**Week 3**				**Week 4**			
Pp treatmen t	C	K	D	P	C	K	D	P	C	K	D	P	C	K	D	P
Wei ght (g)	29	35	32	33	28	34	31	30	27	32	30	28	32	32	30	28
	0.0	1.2	0.5	2.3	6.1	7.7	2.8	2.2	8.5	8.5	5.7	3.9	8.5	8.7	5.7	3.8
CO D (mg/ l)	12	22	40	21	10	42	47	24	85	11	28	23	72	74	14	15
	05.	69.	42.	98.	80.	12.	44.	28.	8.	70.	86.	40.	0.	3.	77.	00.
	5	2	0	3	0	2	2	1	0	0	1	1	5	4	2	1

Table 4.3 show the results of pH of various samples

Table 4.3: pH of sample

Dura tion	**Week 1**				**Week 2**				**Week 3**				**Week 4**			
Pp treat ment	C	K	D	P	C	K	D	P	C	K	D	P	C	K	D	P
Weight (g)	29	35	32	33	28	34	31	30	27	32	30	28	32	32	30	28
	0.0	1.2	0.5	2.3	6.1	7.7	2.8	2.2	8.5	8.5	5.7	3.9	8.5	8.7	5.7	3.8
pH 29^{o}C	6.8	6.9	6.9	7.0	6.9	6.9	6.9	6.9	7.2	6.8	6.9	6.9	7.3	6.7	6.8	6.3
	8	6	8	0	0	4	5	7	0	0	2	4	0	8	9	0

Table 4.4 show the results of conductivity of various samples

Table 4.4: Conductivity of Samples

Duration	**Week 1**				**Week 2**				**Week 3**				**Week 4**			
Pp treatment	C	K	D	P	C	K	D	P	C	K	D	P	C	K	D	P
Weight (g)	29	35	32	33	28	34	31	30	27	32	30	28	32	32	30	28
	0.0	1.2	0.5	2.3	6.1	7.7	2.8	2.2	8.5	8.5	5.7	3.9	8.5	8.7	5.7	3.8

Duration	Week 1				Week 2				Week 3				Week 4			
Conduc tivity	20	18	18	18	10	10	15	13	10	10	12	10	10	57	95	87
	50	40	30	50	80	80	30	40	50	20	40	70	30	0	0	0

Table 4.5 show the results of Total coliform count of the samples

Table 4.5: TCC of samples

Duration	Week 1				Week 2				Week 3				Week 4			
Pp treatme nt	C	K	D	P	C	K	D	P	C	K	D	P	C	K	D	P
Weight (g)	29	35	32	33	28	34	31	30	27	32	30	28	32	32	30	28
	0.0	1.2	0.5	2.3	6.1	7.7	2.8	2.2	8.5	8.5	5.7	3.9	8.5	8.7	5.7	3.8
TCC (MPN/ 100ml)	53	57	57	60	45	30	30	29	34	28	29	28	33	25	23	27
	7	8	7	7	6	4	2	9	8	8	8	7	0	0	0	8

5.0 DISCUSION

The results from the laboratory are presented in Figures 4.1 – 4.5 and Table 4.1 – 4.5 above. The results are discussed below:

5.1 Biochemical Oxygen Demand (BOD)

Figure 5.1 shows the result of BOD versus time. It shows that BOD increases with time during the first two weeks for the samples containing petrochemical product before it later started decreasing as the week goes by. The reason for the increase is as a result of the high amount of organic compound such as carbon, hydrogen and oxygen after the addition of the petrrochemical product into the effluent.

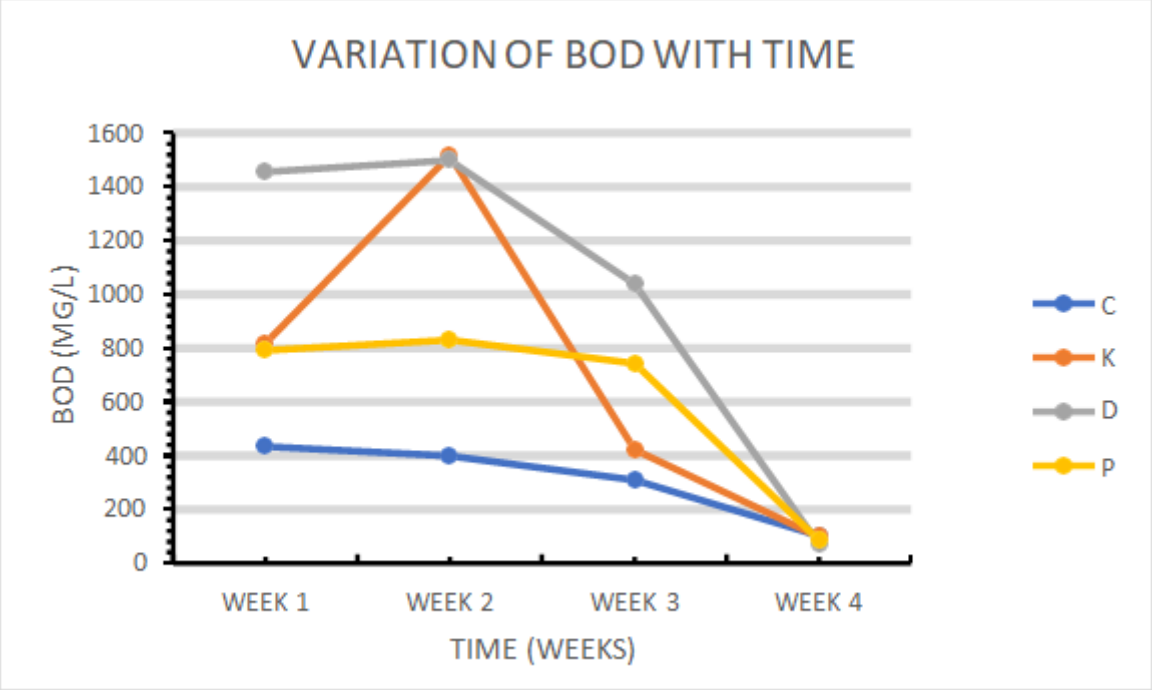

Fig 5.1: Variation of BOD with Time

5.2 Chemical oxygen Demand (COD)

Figure 5.2. shows the result of COD versus time. It shows that COD increases with time during the first two weeks for the samples containing pet rochemical product before it later started decreasi ng as the week goes by. The reason for the increase is as a result of the high amount of organic compound such as carbon, hydrogen andoxygen after the addition of the petrochemical product into the effluent.

During comparison of the results for the BOD and COD, the result gotten from the COD test is higher than the result gotten from the BOD test. Thereason for this is that the COD measures the presence of biologically resistant organic matter which the BOD does not pH Value.

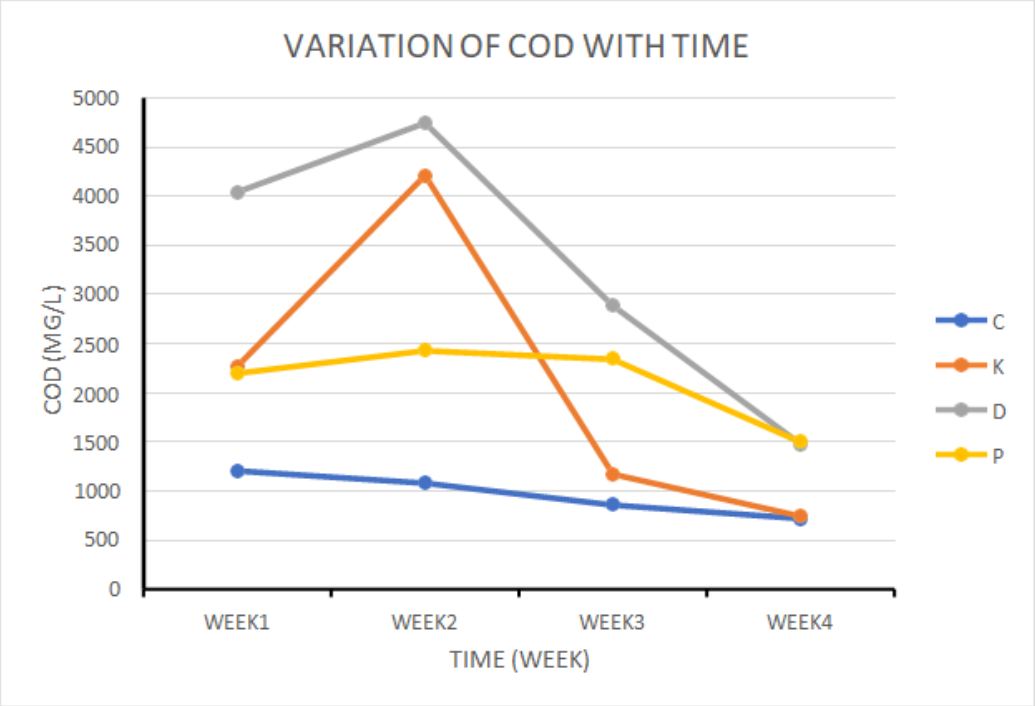

Fig 5.2: Variation of COD with Time

5.3 Ph Value

Fig 5.3 shows the result of the pH test versus time. The result shows that the pH of the sampl es containing petrochemical product decreases as the week goes by while the pH of the sample used as control increases as the week goes by.

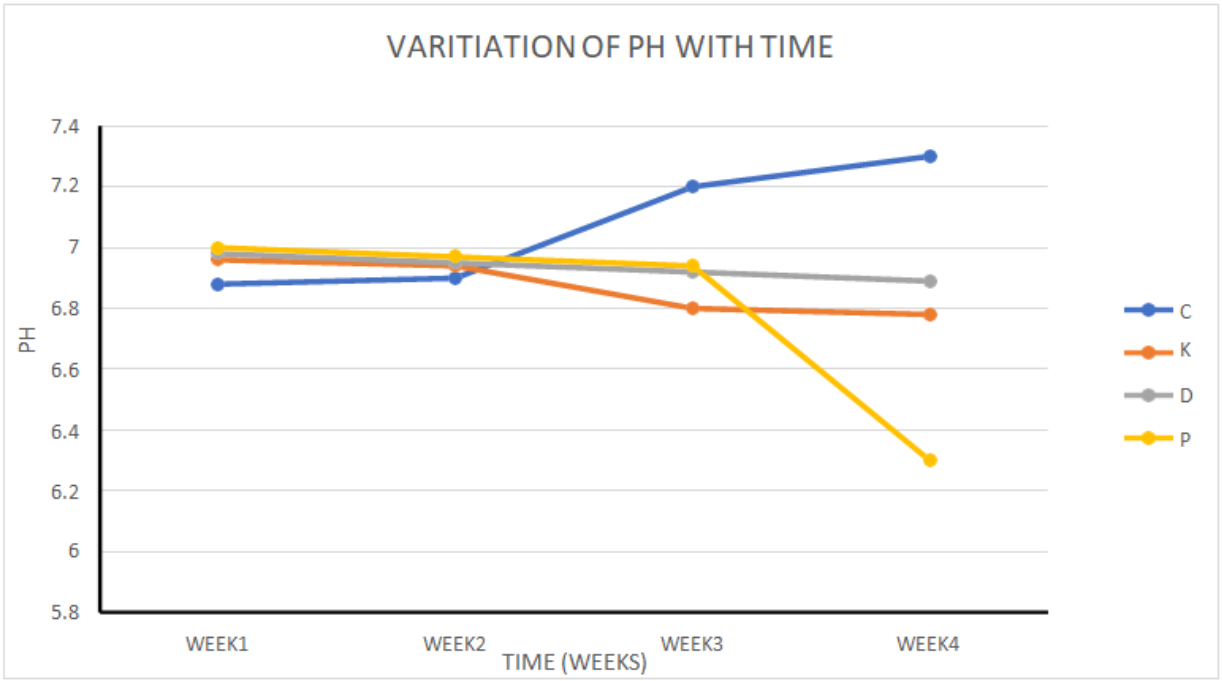

Fig 5.3: Variation of pH with Time

5.4 CONDUCTIVITY

Fig 5.4 shows the result of the Conductivity versus time. The result shows that the conductivi ty decreases during weekly interval for the sample containing petrochemical l products and the one used as control.

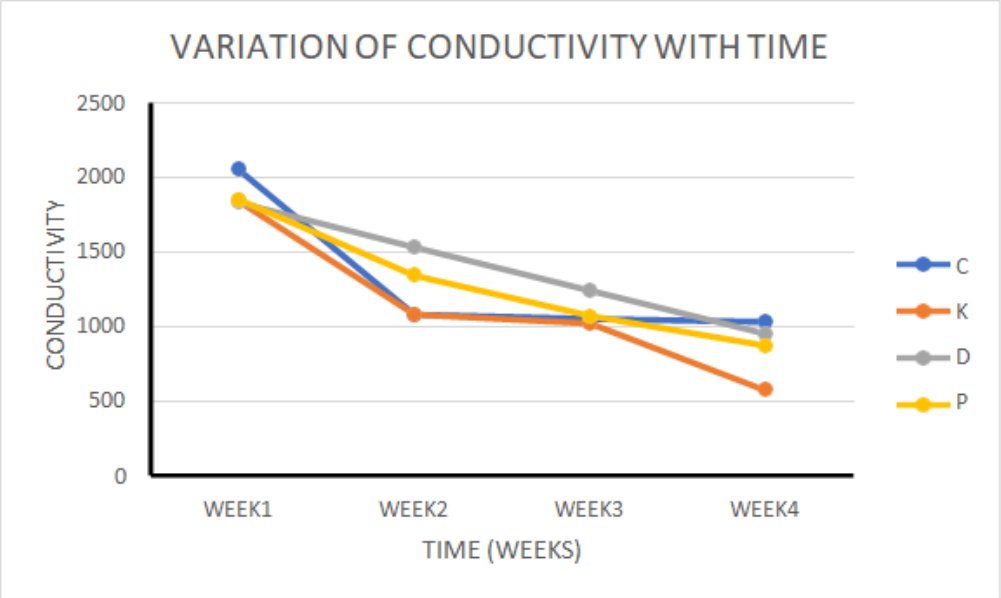

Fig 5.4: Variation of Conductivity with Time

5.5 Total Coliform Count

Figure 5.5 show the result or the Total Coliform Count versus time. The resul t shows t ha t the TCC decreases during the weekly interval for the sample containing petrochemical products and the one used as sample.

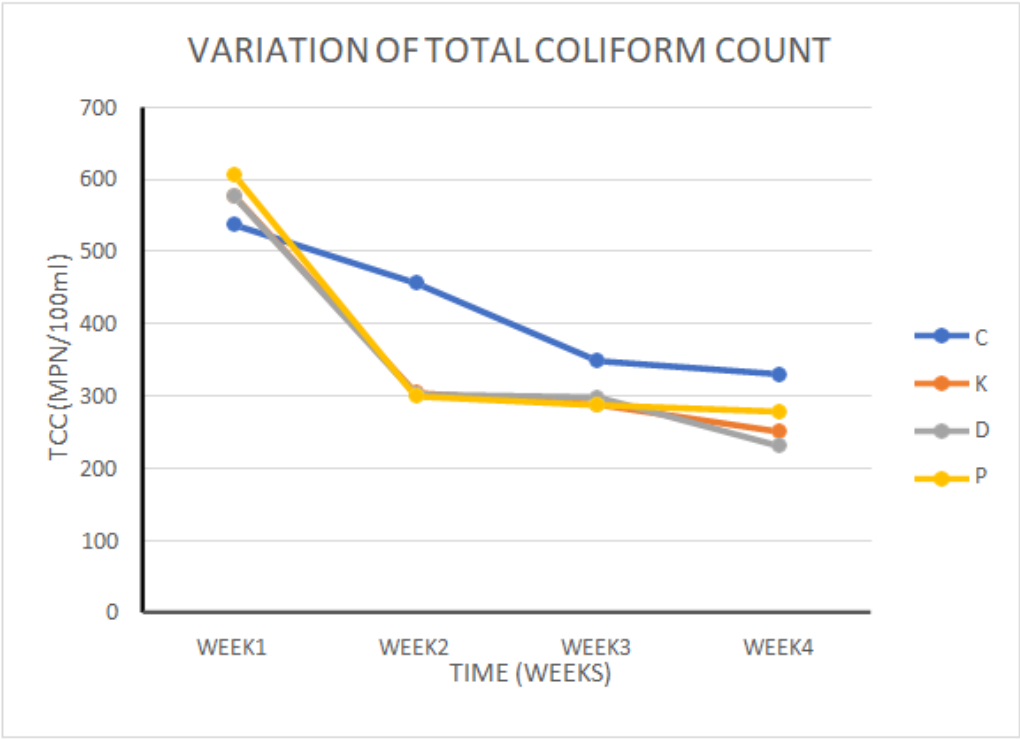

Fig 5.5: Variation of Total coliform count with Time

6.0 CONCLUSION

The BOD and COD increases d u ring the first two weeks before decreases · as the week goes by, indicating the presence of high amount of organ ic compound present during the first two weeks. The biological growth of micro- organism decreases drastically during the first two weeks before there exist a gradual decrease as the week goes by, indicating no enough room for micro- organisn1s to breed on during the first two weeks as a result of the covering of the surface area of the sample with petrochemical product.

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