EFFECT OF HYDROCARBON DEGRADATION ON VARIOUS PHYSICOCHEMICAL PARAMETERS OF SOIL OF HILL AREAS OF ASSAM

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ABSTRACT

Soil is the basis of rooted plants upon which the animal kingdom is dependent for, but soil is now-a-days a depleting natural resource. Nutrients, oxidizing agents etc. expedited the process of biodegradation of oil hydrocarbons which involves process of oxidation and subsequent fragmentation of higher hydrocarbons. This paper lights on the changes of some organic parameters namely PH, electrical conductivity, soil texture and organic carbon due to hydrocarbon pollution on soils of hill areas of Assam with and without oxidizing agent hydrogen peroxide and a mixed nutrients in a period of 150 days.

KEYWORDS: Hydrocarbon Degradation, Soil PH, Electrical Conductivity, Soil Texture, Soil Organic Carbon

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1. INTRODUCTION

The pollution of soils by petroleum hydrocarbons results in unfavourable conditions and raises the question of this degradation if the effected soil is to be quickly rehabilitated for crop production. Degradation of crude oil is carried out in soil by micro-organism are not only found in petroleum prospecting areas, but are also found in soils remote from areas of petroleum production. Hydrocarbon pollution on soil changes some physico-chemical parameters such as soil PH, Electricalconductivity, soil texture and soil organiccarbon.

1. The PH value has an important role in determining the fertility of a soil sample. A suitable soil has the PH value in the range 7 to 8 i.e. a soil sample should be neutral or alkaline.
2. Soil Electrical conductivity is a measurement that correlates to soil properties affecting crop productivity including soil texture, cation exchange capacity, drainage conditions, organic matter level, salinity and subsoil characteristics.
3. Soil texture refers to the relative proportions of clay, slit and sand in a sample of soil. The dominant size fraction is used to describe the texture e.g. as clay, sandy day, slity day etc. If no fraction is dominant the soil is describe as a loam.
4. Soil organic carbon, being the biggest part of the soil organic matter is considered perhaps the most important indicator of soil quality and productivity. Soil organic matter effects a soil structure, water storage capacity and nutrient supply. It helps in maintaining the soils tilth, aiding filtration of water and air and reducing erosion.

2. MATERIALS AND METHODS

The soil samples collected from spots having no background of oil pollution. The soils are then air dried, mixed thoroughly, sieved by a 2mm×2mm sieved and measured quantity of it are taken in polythene bags. The original soil sample is used for determination of some physico-chemical parameters such as organic carbon by walkley and black method, electrical conductivity, PH and soil texture by Bouyoucos hydrometer method based on stokes law. Crude oil was them mixed with the soil taken in polythene bags with the help of water and emulsifier so as to make pollutant concentration 20,000 ppm in each of the bags as given in Table 1: Eco friendly oxidizing agent hydrogen peroxide and nutrients are also added to expedite the process of degradation. In a period of 150 days, at an interval of 50 days again the soil samples are used for determination of above mentioned four parameters.

Sample No.	Mass of soil taken	Crude oil conc. Ppm	Labolene Added	NPK added gm	H_2O_2 added gm	Water ml
A0	1½ Kg	0	10 ml	0	0	100
A1	1½ Kg	20,000	10 ml	0	0	100
A2	1½ Kg	20,000	10 ml	10	0	100
A3	1½ Kg	20,000	10 ml	0	10	100
B0	3 Kg	0	20 ml	0	0	200
B1	3 Kg	20,000	20 ml	0	0	200
B2	3 Kg	20,000	20 ml	20	0	200
B3	3 Kg	20,000	20 ml	0	20	200

Table 1: Composition of Experimental Samples

3. RESULTS

Sl. No.	Name of Parameter	Value	
		A	B
1	P^H	6.26	6.36
2	Electrical conductivity	0.02	0.02
3	Organic Carbon	0.52	0.134
4	Soil Texture	Sandy loam	Sandy

Table 2: Values of some Physicochemical parameters of the original soil sample

Sample	P^H values after		
	50 days	100 days	150 days
A0	3.67	3.50	3.41
A1	4.22	4.15	4.10
A2	4.53	4.40	4.29
A3	4.27	4.19	4.12
B0	5.31	4.98	4.63
B1	4.96	4.50	4.28
B2	4.15	4.10	3.94
B3	4.43	4.35	4.22

Table 3: Changes in PH of the samples with respect to time in days

Sample	Electrical Conductivity values after		
	50 days	100 days	150 days
A0	0.02	0.019	0.014
A1	0.02	0.015	0.011
A2	0.02	0.016	0.012
A3	0.02	0.015	0.010
B0	0.02	0.019	0.013
B1	0.02	0.017	0.012
B2	0.02	0.016	0.014
B3	0.02	0.018	0.015

Table 4: Changes in Electrical conductivities of the samples with respect to time in days

Sample No.	Mass of soil taken	Vol^m of 1N $K_2Cr_2O_7$ sol^n added ml	Vol^m of con H_2So_4 ml	Vol^m of water added ml	Org c Present in % 50 days	Org. c Present in % 100 days
Blank	--	10	20	200	--	--
Original	1	10	20	200	0.52	--
A0	1	10	20	200	0.14	0.36
A1	1	10	20	200	1.6	1.7
A2	1	10	20	200	0.94	1.14
A3	1	10	20	200	1.3	1.12
B0	1	10	20	200	0.110	1.10
B1	1	10	20	200	2.38	1.74
B2	1	10	20	200	1.98	1.9
B3	1	10	20	200	1.86	1.84

Table 5: Determination of soil organic carbon

Sample No.	Total Organic Carbon (% of org carbon ×1.723	
	50 days	10 days
Original	= (0.52×1.723)=0.895%	--
A0	= (0.14×1.723)=0.241%	= (0.36×1.723)=0.620%
A1	= (1.6×1.723)=2.75%	= (1.7×1.723)=2.92%
A2	= (0.94×1.723)=1.618%	= (1.14×1.723)=1.964%
A3	= (1.3×1.723)=2.239%	= (1.12×1.723)=1.929%
B0	= (0.110×1.713)=0.189%	= (1.10×1.723)=1.895%
B1	= (2.38×1.723)=4.1007%	= (1.74×1.723)=2.998%
B2	= (1.98×1.723)=3.411%	= (1.9×1.723)=3.273%
B3	= (1.86×1.723)=3.204%	= (1.84×1.723)=3.170%

Table 6: Total organic carbon determination

CONCLUSION

It has been found that degradation of hydrocarbons is a long process, expedicted by an oxidizing agent. The activity of degradation renders the soil sample acidic, less conductive to electricity, soil texture are found sandy in all cases, total organic carbon content of the soil sample in increased.

REFERENCE

1. E A Davidson and I L Ackerman, Biogeochemistry 20,161(1993).
2. Biodegradation of hydrocarbons in soil of upper Assam: M.Baruah, H.P.Barthakur Jr. Indian Soil Science(47/1)62-67,1999
3. Microbial degradation of fuel oil hydrocarbons in soil: C.H. Chaineam, M.L.Moreal, C.Outdot Environ Sc. Technol (29), 1615-21,1999
4. Effect on pH and electrical conductivities of soil w.r.t. extent of degradation of petroleum hydrocarbons in soil under natural environment :P.C,Sarmah, K.G.Bhattacharjee, S.K.Choudhury Research Journal of Chemistry and environ,vol 7(3) 28-32,2003
5. Soil-Plant Analysis & Methods mannual-ICAR,New-Delhi
6. Effect of Hydrocarbon degradation on soil organic carbon: U.Sadhonider, P.C.Sarmah RJCC,Vol-5,2007, 8-12
7. Environmental Chemistry, Third Edition: A.K.De
8. Soil Pollution & soilorganism: P.C.Misra,
9. Basic Concept of Soil Science: A.K. Kolay
10. Environmental Pollution: RT Conant and K.Paustion 116, 127 (2002)