Indian J. Applied & Pure Bio. Special Vol. 2(1): 272-276 (2021). **ISSN: 0970-2091**
National e-Conference on Biodiversity Building and Natural Resource Management (NC BBNRM) Date: 22nd-23rd, December, 2021 **A web of Science Journal**

Assessing the Phosphorus Concentration of Plants Found in A Hydrocarbon Exploration Sites

Huidrom Babina Devi[1] and Sabyasachi Dasgupta[2]

Department of Forestry and Biodiversity, Tripura University (India)
Email-bab7015@gmail.com, Whatsapp No.- 8794267535

Abstract

The plants found in the hydrocarbon exploration sites needs to be identified and the concentration of different minerals need to be determined. The present study has been conducted to determine the phosphorus content in the soil and plants of hydrocarbon exploration site. The phosphorus content in the soil and plants found in the adjacent site were also determined. The highest phosphorus content in root and shoot was recorded in *Cynodon dactylon* (L.) Pers. and *Lantana camara* respectively of ONGC Kanchanmala Adjacent site. *Ageratum conyzoides* L. of ONGC Kanchanmala site has the lowest root and shoot phosphorus content. The Translocation factor and Bioconcentration factor was also calculated. The study will give an idea of the phosphorus content in the soil and plants found in the two sites. The plants which have highest phosphorus concentration in their tissue can be used in future experiment in phosphorus contaminated sites.

Phosphorus is regarded as an essential nutrient required for plant growth and reproduction. To produce more crops, phosphorus fertilizers are used intensively and it has led to eutrophication and water quality deterioration which has led to serious environmental concerns[6]. Therefore, the techniques to reduce or eliminate the excess phosphorus from the soil or water needs to be developed. We should also keep in mind that those techniques should be easily accessible, environment friendly and less costly. Phyto-remediation appears to be a very promising technology for the clean-up of metal pollutants from the environment and it approaches towards commercialization at present[8]. The process uses plants to remove contaminants from the soil or water. Since, plants are readily available and grow with little or no care, using plants to clean-up contaminated soil seems to be a very reliable idea. Hyperaccumulators are plant species that concentrate metals in their root, shoot and leaves to levels far exceeding those present in the media or in plant species growing nearby[2]. A number of different types of plants are found to be effective at stimulating

Table-1. Phosphorus content in soil sample

Site	pH	Total Phosphorus (mg/kg) content (Mean± SEM) n=3
ONGC Kanchanmala site	6.1	33.47±4.24
ONGC Kanchanmala Adjacent site	6.2	30.97± 5.75

Table-2. Phosphorus content in plants collected from ONGC Kanchanmala site

Plant Name	Plant tissue	Total Phosphorus (mg/kg) content (Mean± SEM) n=3	TF	BCF_{shoot}	BCF_{root}
Ageratum conyzoides L.	Root	1.52±0.06	4.51		
	Shoot	6.85±0.13		3.70	0.05
Cynodon dactylon (L.) Pers.	Root	19.17±0.11	0.58		
	Shoot	11.17±1.44		0.33	0.57
Centipeda minima Linn.	Root	6.72±0.61			
	Shoot	11.99±0.23	1.78	0.36	0.20
Digitaria sanguinalis (L.) Scop.	Root	19.93±0.11	0.73		
	Shoot	14.60±0.11		0.44	0.60

the breakdown of organic molecules in the root zone and these plants are found to have an extensive and fibrous root[5]. The factors that should be considered for selection of trees or grasses are: 1) resistance to contaminants, 2) tolerance to a range of environmental conditions, 3) production of large biomass with high productivity, 4) low bioaccumulation and trophic transfer potential, and 5) suitable for various types of soil[1]. Currently, phytoremediation is found to be used in the treatment of contaminants like petroleum hydrocarbons, pesticides, chlorinated solvents, heavy metals, explosives, radionuclides and landfill leachate[11].

The translocation factor, the ratio of shoot to root metals, indicates internal metal transportation[9]. Translocation factor was calculated following the formula given by Deng, Ye & Wong,[4].

$$TF= Metal_{shoot}/\ Metal_{root}$$

The ability of plants to take up heavy metals from soil was calculated by Bioconcentration Factor (BCF).

The Bioconcentration factor was calculated as done by Zayed, *et al.*[12].

$$BCF = \frac{\text{Trace element concentration in plant tissues (mg /kg at harvest}}{\text{Initial concentration of the element in the external nutrient solution } (\frac{mg}{L})}$$

Table-3. Phosphorus content in plants collected from ONGC Kanchanmala Adjacent site (Herb and Shrub)

Plant Name	Plant tissue	Total Phosphorus (mg/kg) content (Mean± SEM) n=3	TF	BCF_{shoot}	BCF_{root}
Axonopus compressus (Sw.) P.Beauv	Root	66.45±0.92	1.86	4.00	2.15
	Shoot	123.77±1.59			
Cynodon dactylon (L.) Pers.	Root	144.12±0.94	0.76	3.54	4.65
	Shoot	109.62±0.47			
Centipeda minima Linn.	Root	40.25±0.50	1.93	2.51	1.30
	Shoot	77.59±1.10			
Chrysopogon aciculatus (Retz.) Trin.	Root	62.73±0.31	0.88	1.77	2.03
	Shoot	54.95±0.77			
Desmodium triflorum (L.) DC.	Root	62.38±1.97	1.03	2.07	2.01
	Shoot	63.97±0.47			
Ageratum conyzoides L.	Root	5.52±0.69	2.52	0.45	0.18
	Shoot	13.90±0.61			
Centella asiatica (L.) Urban	Root	11.42±0.47	3.05	1.12	0.37
	Shoot	34.78±1.08			
Vernonia cinerea (L.) Less.	Root	16.91±0.47	1.50	0.82	0.53
	Shoot	25.40±0.47			
Mimosa pudica L.	Root	65.38±0.61	0.91	1.93	2.11
	Shoot	59.72±0.18			
Ipomea alba L.	Root	49.11±1.08	2.19	3.47	1.59
	Shoot	107.32±0.31			
Chromolaena odorata (L.)	Root	45.75±0.61	2.43	3.60	1.48
	Shoot	111.38±0.47			
Melastoma malabathricum L.	Root	26.64±0.61	0.96	0.83	0.86
	Shoot	25.58±0.81			
Urena lobata L.	Root	45.50±0.53	0.67	0.99	1.47
	Shoot	30.64±0.79			
Lantana camara L.	Root	50.52±0.31	2.52	4.11	1.63
	Shoot	127.31±0.47			

This study has been conducted to determine the phosphorus concentration in the hydrocarbon exploration site. The adjacent site was also study to compare the levels of phosphorus level in the soil and plants collected from the two sites. The study will help in knowing which plants can absorb and store phosphorus and which sites has more phosphorus concentration. It will also show which plants can survive in the hydrocarbon exploration site.

The soil and plants sample found in the site was collected. The soil was air dried and then crushed into small pieces using mortar and pestle and then sieved.Phosphorus was determined by using Bray's method. The plants samples were identified, washed and then separated into roots and shoots. The fresh weight was recorded and it was then oven dried. After drying to a constant weight, the sample was again weight, powdered and then sieved. Phosphorus content was then determined using UV-Vis Spectrophometer.

The highest phosphorus content in the root and shoot of ONGC Kanchanmala site was recorded in *Digitaria sanguinalis* (L.) Scop. It also has the highest BCF_{root}. while the lowest phosphorus content in both root and shoot was recorded in *Ageratum conyzoides* L. However, the highest TF and BCF_{shoot} was recorded in *Ageratum conyzoides* L.

In ONGC Kanchanmala Adjacent site, the highest phosphorus content in root and shoot was recorded in *Cynodon dactylon* (L.) Pers. and *Lantana camara* respectively. *Ageratum conyzoides* L. has the lowest root and shoot phosphorus content. The highest TF, BCF_{shoot} and BCF_{root} was found in *Centella asiatica* (L.) Urban, *Lantana camara* and *Cynodondactylon* (L.) Pers. respectively. BCF values > 2 were regarded as high values[10]. Out of the 18 plants found in both the sites, 8 plants have BCF_{shoot} values more than 2 and 5 plants have BCF_{root} values exceeding 2. Plants with BCF value (generally > 1) are considered as suitable for phyto-extraction experiment[3]. 11 plants were found to have BCF_{shoot} values more than 1 and 10 plants have BCF_{root} values exceeding 1, which means that they are suitable for phytoreme-diation experiment.

TF values more than 1 implies that the plants store metals in the shoot more than in the root part. 11 plants were found to have TF values > 1, which means that they store phosphorus more in the shoot part. This can be a useful information in finding out which plants can be used if we are to study the above ground portion of the plant.

The selection of right plants from a wide range of hyperaccumulators is the most important step. In general, plants which have high bioaccumulation factor and high translocation factor is regarded as key points[7]. The soil phosphorus content was higher in the ONGC Kanchanmala site. However, the plant phosphorus content was found to be higher in the ONGC Kanchanmala Adjacent site. One of the reasons for the low phosphorus content in the plant collected may be that the site was just abandoned at the sampling time and so, the plants that are found in the site have just started establishing in the site. Since, it was abandoned recently, the area was also continuously used for restoring and heavy machinery were continuously observed in the site which led to the difficulty in the plant to establish. As a result, only 4 herb species were found in the site and there were no shrub species. In the ONGC Kanchanmala Adjacent site, 10 herbs and 4 shrubs were found. However, the presence of plants in the hydrocarbon exploration sites is itself an indication that plants are able to survive in the site.

From the study, it is evident that there are a lot of potential plants species which can be used in the phytoremediation experiment. The plants species can be used as a potential plant for the phytoremediation of phosphorus contaminated soil. The highest phosphorus content in root and shoot was recorded in *Cynodon dactylon* (L.) Pers. and *Lantana camara* respectivelyof ONGC Kanchanmala Adjacent site. The lowestroot and shoot phosphorus content were found in *Ageratum conyzoides* L. of ONGC Kanchanmala site. The biomass of the plants which have been used in the experiment can be used as a source of phosphorus in phosphorus deficient soil. The biomass can be spread in the soil and when it degrade, it will release the phosphorus in the soil.

I would like to thank my supervisor for allowing me to conduct my work in the department. I would also thank ONGC Tripura for giving permission to carry out sample collection from their site. I would also thank my fellow scholars for helping me in my work and also giving me valuable suggestions.

References :

1. Cook RL, and D Hesterberg (2013). *International Journal of Phytoremediation*, *15*: 844–860. https://doi.org/10.1080/15226514.2012.760518
2. Das S, S Goswami, and DA Talukdar (2013) *International Journal of Toxicological and Pharmacological Research*, *5*(1): 30–32.
3. Deepa P, B Sheetal, K Ashok and D. Nisha (2015). *Research Journal of Chemical Sciences*, *5*(8): 18–22.
4. Deng, H, ZH Ye, and M H Wong (2004). *Environmental Pollution*, *132*: 29–40.
5. Glick, BR (2003). *Biotechnology Advances*, *21*: 383–393. https://doi.org/10.1016/S0734-9750(03)00055-7
6. Hye-Ji K and L Xinxin (2016). *Hort Science*, *51*(8): 1001–1009. https://doi.org/10.21273/HORTSCI.51.8.1001
7. Jiang Y, M Lei, L Duan, & P Longhurst (2015). *Biomass and Bioenergy*, *83*: 328–339. https://doi.org/10.1016/j.biombioe.2015.10.013
8. Kavitha K K, and M Jegadeesan (2014). *International Journal of Scientific and Research Publications*, *4*(1): 2250–3153.
9. Mazumdar K and S Das (2015). *Environ Sci Pollut Res*, *22*: 701–710. https://doi.org/10.1007/s11356-014-3377-7
10. Mellem J, H Baijnath, and B Odhav (2009). *Journal of Environmental Science and Health Part A*, 44: 568–575. https://doi.org/10.1080/10934520902784583
11. Susarla S, VF Medina, and VF McCutcheonx (2002). *Ecological Engineering*, *18*(5): 647–658.
12. Zayed A, S Gowthaman and N Terry (1998). *J. Environ. Qual.*, *27*: 715–721.