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REGULAR ARTICLE

EFFECT OF BRIQUETTING AND CARBONIZATION PLANT EFFLUENT ON MORPHOLOGICAL, BIOCHEMICAL AND MINERAL CONTENT OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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SUMMARY

The present investigation has been carried out to assess the effect of B & C effluent on morphological, biochemical and mineral content of groundnut seedlings. The physico-chemical analysis of the effluent revealed that the B & C effluent was alkaline in nature and it was rich in suspended and dissolved solids. Germination studies were conducted with various concentration of effluent. The morphological growth parameters (seed germination percentage, seedling growth, fresh weight and dry weight of seedling) and biochemical aspects (Chlorophyll a, b and total chlorophyll, carotenoid, sugar, protein, aminoacid and phenolic contents) showed the increased trend at 10% concentrations of effluent. However, the increased concentrations of effluent reduced the above-mentioned parameters. Among the mineral contents estimated, the phosphorus and potassium showed the same trend. But the nitrogen content showed the increasing trend with the increase of effluent concentrations.

Keywords: Briquetting, photosynthetic pigments, biochemical, morphological characters.

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1. Introduction

Water pollution due to industrial discharge is obtaining a greater dimension day to day in India. The discharge of industrial waste into water bodies has led the farmers to irrigate their crops by effluent. The effluents not only contain nutrients that enhance the growth of crop plants but also have other toxic materials which retards the growth. However to recycle nutrients through land application of waste effluent requires the use of crops capable of utilization these nutrients [1]. Industrial effluents rich in organic matter and plant nutrients are finding agricultural use as cheaper way of disposal [2]. The present paper describes the result of a laboratory experiment to study the effect of briquetting and carbonization plant effluent on morphological, biochemical and mineral contents of *Arachis hypogaea* L.VRI-4.

2. Materials and Methods

Materials

The effluent sample from Briquetting and Carbonization plant of Neyveli Lignite Corporation Limited, Neyveli, TN, India were collected in plastic containers from the point of disposal. The effluent was brought to laboratory for the physico chemical analysis and it was stored in walk in cooler in the plant physiology laboratory.

Table 1. Physico Chemical Properties of TANFAC industrial effluent

Sl. No	Parameters	Values
1	PH	7.4
2	EC	36.6
3	Temperature	32.8
4	Total solids	3.128
5	TSS (mg/l)	1.892
6	BOD	2.108
7	COD	2.252
8	Phosphate	32.5
9	Nitrate	48.6
10	Fluoride	165.8
11	Sulphur	1.18
12	Sodium	965
13	Potassium	1.122
14	Aluminum	635
15	Ammonia	718

Seed materials

VRI-4 groundnut seeds were obtained from Regional Research station, Virudhachalam, Tamilnadu. The seeds with uniform size, colour and weight were selected for experimental purpose.

Seed germination

The groundnut seeds (VRI-4) were surface sterilized with 0.1% Mercuric chloride and washed 5-6 times with distilled water. Seeds are placed in sterilized petridishes, lined with filter paper soaked with different concentration of the effluent. These petri dishes were irrigated with different concentration of the effluent uniformly. The seedlings from each treatment are randomly selected for the seedling growth, fresh weight and dry weight. The 7th day groundnut seedlings were separated into root, stem, leaf and cotyledon and they were used for biochemical analysis, (chlorophyll, protein, aminoacid, starch and sugar) and Mineral contents (Total nitrogen, potassium and phosphorus).

3. Results and Discussion

The physico chemical parameters of B and C plant effluent were presented in Table 1. Seedling growth, fresh weight and dry weight of groundnut seedlings grown in various concentration of effluent were furnished in Table 2.

The increase in seedling growth is observed upto 10% and then it decreases with the increase of effluent concentration. The inhibitory effect was more on the root length than that of shoot. The promotion of seedling growth by the lower concentration of effluent might be due to the presence of optimum level plant nutrient in the effluent. The fresh and dry weight of the 7th day analysed root and shoot of the groundnut seedlings increased at lower concentrations, whereas the cotyledonous fresh and dry weight decreased at lower concentrations and then increased with increase of effluent concentration.

Chlorophyll contents, carotenoid and sugar contents are furnished in Table 3. The seedlings grown in 10% effluent concentration shows an increase in the chlorophyll content at lower concentration may be due to the favourable effect of elements present in the effluent on the pigment system [3, 4]. The increase in carotenoid content might be due to enhanced influence of nitrogen and other inorganic element present in the effluent [5, 6]. The sugar content was showed decreasing trend at higher concentration of the effluent in this investigation. The same trend was recorded in *Arachis hypogaea* in the dying factory effluent [7]. Protein and amino acid contents are furnished in Table-4. The maximum content is seen in 10% effluent concentration and minimum content is seen in 100% effluent concentration. The increase in protein content may be due to the absorption of most of the nitrogen by plant [8, 9]. Decrease in protein content may be due to the increase in the concentration of various cations, anions present in the effluent.

Table 2.
Effect of Briquetling and carbonization Plant effluent on seedling growth, Fresh weight and Dry weight of groundnut (*Arachis hypogaea* L.) seedlings (mg/g f wt)

Concentration of the effluent	Seedling growth cm/plant	Fresh weight (gm/seedling)				Dry weight (gm/seedling)			
		Root	Stem	Leaf	Cotyledon	Root	Stem	Leaf	Cotyledon
C	17.86 ±3.44	0.375 ±0.0042	0.625 ±0.0032	0.783 ±0.0028	0.280 ±0.0010	0.038 ±0.0018	0.082 ±0.0014	0.092 ±0.0008	0.059 ±0.0008
10%	18.9 ±3.985	0.407 ±0.0078	0.692 ±0.0044	0.885 ±0.0086	0.265 ±0.0017	0.044 ±0.0021	0.089 ±0.0068	0.128 ±0.0013	0.048 ±0.0036
25%	17.4 ±2.580	0.337 ±0.0028	0.620 ±0.0054	0.690 ±0.0050	0.312 ±0.0028	0.035 ±0.0050	0.070 ±0.0017	0.086 ±0.0038	0.064 ±0.0004
50%	16.07 ±1.691	0.287 ±0.0014	0.570 ±0.0048	0.610 ±0.0058	0.328 ±0.0019	0.032 ±0.0044	0.066 ±0.0030	0.079 ±0.0018	0.066 ±0.0014
75%	14.58 ±3.306	0.255 ±0.0024	0.534 ±0.0040	0.560 ±0.0040	0.390 ±0.0022	0.028 ±0.0010	0.056 ±0.0019	0.064 ±0.0024	0.072 ±0.0031
100%	12.16 ±2.322	0.206 ±0.0030	0.482 ±0.0034	0.489 ±0.0028	0.415 ±0.0048	0.024 ±0.0016	0.052 ±0.0036	0.058 ±0.0040	0.084 ±0.0009

± Standard deviation

Table 3.
Effect of Briquetting and carbonization plant effluent on chlorophyll contents, carotenoid and total sugar content of groundnut (*Arachis hypogaea* L.) seedlings (mg/g f wt)

Concentration of the effluent	Chl- a	Chl- b	Total Chl	Carotenoid	Total sugar			
					Root	Stem	Leaf	Cotyledon
C	0.0822 ±0.0011	0.0677 ±0.0007	0.1524 ±0.0005	0.0622 ±0.0012	11.5277 ±0.001	9.6953 ±0.0010	15.6815 ±0.0006	13.0151 ±0 .0010
10%	0.0952 ±0.0005	0.0723 ±0.0013	0.1664 ±0.0011	0.0632 ±0.0007	14.5355 ±0.007	23.4086 ±0.0058	18.0392 ±0.0005	11.8845 ±0.0010
25%	0.0934 ±0.0005	0.0708 ±0.0007	0.1637 ±0.0017	0.0054 ±0.0012	9.4505 ±0.061	18.7001 0.0009	13.7005 ±0.0007	14.2869 ±0.0002
50%	0.0917 ±0.0007	0.06410± 0.0011	0.1558 ±0.0005	0.0043 ±0.0007	7.2212 ±0.005	15.374 ±0.0100	11.9658 ±0.0005	14.7474 ±0.0009
75%	0.0724 ±0.0005	0.0586 ±0.0004	0.1324 ±0.0011	0.0020 ±0.0009	6.1922 ±0.010	13.9641 ±0.0016	9.8169 ±0.0140	15.2488 ±0.0012
100%	0.0456 ±0.0009	0.0372 ±0.0003	0.0837 ±0.0011	0.0016 ±0.0007	4.6667 ±0.052	10.9883 ±0.0007	9.3747 ±0.0012	15.6413 ±0.0006

± Standard deviation

Table 4.
Effect of Briquetting and carbonisation plant effluent on protein and aminoacid content of groundnut (*Arachis hypogaea* L.) seedlings (mg/g f wt)

Concentration of the effluent	Protein				Aminoacid			
	Root	Stem	Leaf	Cotyledon	Root	Stem	Leaf	Cotyledon
C	4.267 ±0.0012	4.121 ±0.0007	6.370 ±0.0008	4.380 ±0.0008	1.630 ±0.0405	2.880 ±0.0075	3.860 ±0.0080	2.460 ±0.0009
10%	5.540 ±0.0005	5.280 ±0.0004	7.280 ±0.0011	3.820 ±0.0005	2.120 ±0.0125	3.640 ±0.0079	4.130 ±0.0047	2.110 ±0.0026
25%	3.432 ±0.0068	2.960 ±0.0004	6.092 ±0.0007	5.420 ±0.0009	1.480 ±0.0059	2.690 ±0.0635	3.260 ±0.0086	2.780 ±0.0160
50%	3.280 ±0.0005	2.680 ±0.0005	5.680 ±0.0008	5.720 ±0.0110	1.323 ±0.0026	2.460 ±0.0024	2.720 ±0.0012	3.120 ±0.0110
75%	3.110 ±0.0009	2.460 ±0.0006	5.210 ±0.0005	6.450 ±0.0010	1.1.24 ±0.0052	2.260 ±0.0094	2.680 ±0.0016	3.960 ±0.0061
100%	2.860 ±0.0010	1.960 ±0.0004	4.860 ±0.0012	7.230 ±0.0009	0.963 ±0.0006	1.930 ±0.0070	4.051 ±0.0056	4.051 ±0.0056

± Standard deviation

Table 5.
Effect of Briquetting and carbonization plant effluent on Total nitrogen, phosphorus and potassium content of groundnut (*Arachis hypogaea* L.) seedlings (mg/g/d. wt)

Effluent Concentration	Total Nitrogen			Phosphorus			Potassium		
	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf
C	3.72 ±0.264	4.68 ±0.62	6.29 ±0.89	0.52 ±0.024	0.56 ±0.036	0.65 ±0.058	2.81 ±0.324	5.60 ±0.268	7.68 ±0.482
10%	4.09 ±0.98	4.99 ±0.24	6.40 ±0.76	0.56 ±0.020	0.60 ±0.070	0.72 ±0.013	2.900 ±0.108	5.76 ±0.382	7.89 ±0.288
25%	4.21 ±0.72	5.42 ±0.38	6.92 ±0.64	0.50 ±0.086	0.54 ±0.074	0.62 ±0.058	2.73 ±0.464	5.47 ±0.212	7.54 ±0.386
50%	4.43 ±0.89	5.72 ±0.48	7.18 ±0.12	0.43 ±0.074	0.50 ±0.068	0.55 ±0.052	2.25 ±0.584	5.02 ±0.364	7.03 ±0.284
75%	4.79 ±0.10	5.80 ±0.68	7.72 ±0.09	0.40 ±0.038	0.48 ±0.022	0.52 ±0.039	1.97 ±0.310	4.87 ±0.269	6.90 ±0.174
100%	5.52 ±0.26	7.28 ±0.78	8.74 ±0.55	0.35 ±0.012	0.41 ±0.030	0.43 ±0.084	1.63 ±0.143	4.50 ±0.220	6.54 ±0.189

± Standard deviation

Mineral Content

Total nitrogen content, phosphorus and potassium contents are given in Table 5.

Nitrogen is an important constituent of protein and protoplasm. The nitrogen is an important constituent of protein and protoplasm. The nitrogen contents in the shoots and roots of seedlings increased with the increase in effluent concentration. This may be due to the continuous supply of ammonical nitrogen through every irrigation. Phosphorus and potassium content in the seedling increased with the increase in effluent concentration up to10 percent. Further increase in effluent concentration proportionately decreased the phosphorus and potassium contents of both shoot and root of the groundnut seedlings. In this investigation, 10% concentration of effluent enhance the photosynthetic, biochemical and mineral contents, however, other doses decreased these biomolecules due to toxic effect of effluent.

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