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RECLAMATION OF MINE LEFTOVERS

DR. R.M. DHANARAJU,
Rtd. Principal,
S.K.P. Govt. Degree College,
Guntakal, Anantapuram Dist.
(AP) INDIA

DR. A. LAKSHMAIAH,
Reader in Botany,
Govt. Degree College,
Pattikonda, Kurnool Dist.
(AP) INDIA

DR. K. VEERANJANEYULU
Rtd. Professor,
S.K. University,
Anantapuram .
(AP) INDIA

ABSTRACT

Flora on the copper mine leftovers were enumerated and were analyzed for copper accumulation. Ocimum Species was found to accumulate higher concentrations of Copper. Further certain local plant species were screened for their tolerance potentials to high concentrations of Copper. The economically important species including Hibiscus sabdariffa, H. cannabinus and Crotalaria juncea recorded higher tolerant indices to copper. The importance of the tolerant plants in reclamation of main wastes was discussed.

Keywords: *Reclamation, Tolerance, Mineral resources.*

INTRODUCTION

The increasing demand for metals and minerals is causing extensive exploration for and exploitation of mineral resources. The continuous mining activities are resulting in considerable degradation and damage to productive land surface. Reclamation of these disturbed areas is of great concern to environmental biologists.

The mine wastes, or extracted ore tailings are toxic to biological organisms as they still contain considerable levels of metals. Revegetation of these toxic wastes is the most important part of reclamation programme. The present investigation is therefore aimed to screen the tolerant plants to copper, which may be useful for reclamation of toxic wastes.

MATERIALS AND METHODS:

Plant species present on copper mine wastes of Nallakonda copper mines (area 4.03 Sq.K.M., latitude $16^0$14'-$16^0$12', longitude $79^0$42'-$79^0$44') were collected, identified, and listed in the tables.

The plant species Chloris barbata (Linn), Cymbrpogan coloratus, Cyperus rotundus, Cyndon dactylon, Sporobolus diander, , Brachiaria reptans, Dinebra retroflexa, Digitaria ciliaris, Eragrostis viscosa, Hibiscus cannabinus, Lipia nodiflora, Crotalaria juncea, Hibiscus sabariffa, and were studied for their metal tolerance abilities according to the method of Jowett(1958) as followed by wally et al(1974). Tolerance index was calculated as shown below:

$$\text{Tolerance index} = \frac{\text{Root length in metal solution}}{\text{Root length in control solution}} \times 100$$

The plant samaples were digested according to the method of Humphries(1956). Copper levels in plants and soil samples were estimated according to the method of Cheng and Bray(1953).

RESULTS:

Flora on copper mine left overs of Nallakonda copper mines were studied. 28 species of 16 families were observed on copper mine left overs of Nallakonda copper mines. (Table 1)

Table1: Plant species present on mine leftovers at Nallakunta copper mines (Area9.47 Sq. K.M. latitude $16^0$14'-$16^0$12', longitude $79^0$42'-$79^0$44')

S.No	Plant Name	Family
1	Acacia latronum	Mimosae
2	Acalypha indica	Euphorbiaceae
3	Andrographis echioidea	Acanthaceae
4	Asparagus racemosa	Lilliaceae
5	Barleria prionitis	Acanthaceae
6	Boerhavia diffusa	Nyctaginaceae
7	Borreria hispida	Rubiaceae
8	Calotropis gigantia	Asclepidaceae
9	Chrysopogon fulvus	Poaceae
10	Corchorous trilocularis	Tiliaceae
11	Croton bonplandianum	Euphorbiaceae
12	Euphorbia hirta	Euphorbiaceae
13	Hemidesmus indicus	Asclepidaceae

14	Hibiscus micranthus	Malvaceae
15	Hyptis suaveolens	Lamiaceae
16	Ionidium suffruticosum	Violaceae
17	Justicia micranthus	Acanthaceae
18	Justicia prostrate	Acanthaceae
19	Ocimum sanctum	Lamiaceae
20	Phyllanthus maderaspatensis	Euphorbiaceae
21	Prosopis juliflora	Mimosae
22	Tephrosia purpurea	Fabaceae
23	Tridax procumbens	Asteraceae
24	Tribulus terrestris	Zygophyllanceae
25	Trichodesmum indicum	Boaraginaceae
26	Vanda sp	Orchidaceae
27	Vermonia cinerea	Asteraceae
28	Zizyphus trinervia	Rhamnaceae

Copper levels in plant species on copper mine left overs were estimated. In plant samples, high copper content were observed in leaves and stem of Ocimum sanctum and higher copper content in roots were observed in Acalypha indica. (Table 2)

Table 2: Copper levels in plant present on copper mine leftovers (ug of Cu/g dry weight)

S.No	Plant Name	Leaves	Stem	Root
1	C. bonplandianum	26.19	32.85	99.99
2	P. juliflora	23.35	-	-
3	H. suaveolens	49.56	73.51	169.37
4	O. sanctum	283.02	139.7	422.32
5	A. echinides	38.21	15.71	50.59
6	C. spinarum	31.19	30.47	-
7	B. hispida	110.71	63.39	101.9
8	P. reticulates	36.76	38.09	-
9	D. ellata	46.78	28.57	-
10	Monera sp	11.66	56.07	-
11	A. Indica	84.58	45.95	620.81

Rooting experiments in metal solutions.

The metal tolerant potentials of different plant species were studied by observing their ability to root in a different concentrations of metal solutions. The studied concentrations were for Cu 0.25, 0.5 ppm and for Pb2.0, 4.0 ppm.

The cuttings of plant species including Hibiscus cannabinus, Lucaena laticiliqua, Cymbopogan coloratus, Chloris barbata and Cyperus rotundus were allowed to root directly in $Ca(NO_3)_2$ + metal solution, and root growth was measured by tolerance index.

Tolerant indices of different plant species determined on 3rd, 5th and 7th day in 0.25 ppm and 0.5 ppm copper solutions are shown in Table 3.

Table 3: Tolerance indices of plant species allowed to root in $Ca(NO_3)_2$ + Cu SO_4 solutions

S. No	Plant Name	Cu 0.25 ppm			Cu 0.5 ppm		
	DICOTS	**3rd day**	**5th day**	**7th day**	**3rd day**	**5th day**	**7th day**
1	Crotalaris juncea	-	-	-	89.0	71.18	65.42
2	Hibiscus cannabinus	59.34	73.38	67.2	40.65	41.0	42.47
3	Hibiscus sabdariffa	-	-	-	12.84	9.79	11.06
4	Lippia nodiflora	110.83	61.51	67.03	41.66	23.52	29.24
5	Lucaema laticiliqua	204.25	168.98	134.32	68.08	56.17	61.94
6	Vigna sinensis	-	-	-	34.14	27.67	46.78
	MONOCOTS						
7	Brachiaria reptans	7.57	5.1	4.22	10.6	8.27	6.84
8	Chloris barbata	25.35	32.85	33.16	6.19	4.92	3.96
9	Cyperus rotundus	60.26	39.67	35.09	23.99	15.32	12.25
10	Cyperus rotundus	9.72	4.83	3.97	5.55	1.29	0.99
11	Cyndon dactylon	2.35	3.12	2.6	2.35	1.87	1.3
12	Dinebra retroflexa	8.6	7.18	6.0	5.59	3.11	3.2
13	Digiaria cilliaris	43.7	32.51	30.0	10.48	8.96	8.0
14	Eragrostis viscose	65.71	20.32	16.02	22.85	7.47	5.74
15	Sporobolus diander	15.66	17.14	15.31	7.83	8.57	7.65

From the table it is evident that the tolerant index of the plant species is higher in 3rd day, when compared to 7th day observation. This indicates that root growth was less affected in the initial days of exposure. Among the weed species Lippia nodiflora, Eragrostis viscose, Cymbopogan coloratus and Digitaria ciliaris showed higher tolerant indices. In crop plants Crotalaria juncea, Lucaena laticiliqua, Hibiscus cannabinus and Vigna signensis recorded higher tolerant indices for copper. Some plant species including Hibiscus sabdariffa, Crotalaria juncea and Lippia nodiflora recorded higher tolerance indices on 3rd day than 7th day. While the other plant species showed the higher tolerance indices on 7th day than on 3rd day. From the above observations it is clear that a few plant species which possessed high Copper tolerances indices.

DISCUSSION

The mine leftovers and extracted ore tailings are toxic to plants, and are often devoid of vegetation. But rarely sparse, vegetation is seen. In the present investigation few species have been observed on copper mine leftovers. Plants present on the copper mine leftovers have accumulated high levels of copper. Four principal reasons have been suggested for the lack of vegetation on mine working. They are presence of toxic quantities of metals, lack of macro nutrients, presence of extreme acidity and the physical factors including shortage of moisture (Smith and Bradshow, 1970).

Promising technique for reclamation is to make use of tolerant plant species. The importance of such tolerant plant species. The importance of such tolerant species in the regeneration of the toxic waste heaps has been recognized in various countries including South Africa (Chenik, 1960), Rhodesia (Wild and Wiltshire, 1971) and England (Smith and Bradshaw, 1070). The data of present study indicate that C. juncea, H. cannabinus, L. laticiliqua, are tolerant to copper. So these plants may be useful for reclamation of toxic mine wastes.

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REFERENCE

1. Cheng, K.L. and Bray, R.H. 1953, Anal. Chem. 25:655.
2. Chenik, D. 1960. J.S. Afr. Inst. Min. Metal. 60:525.
3. Humphrises, E.C. 1956. Modern methods of plant analysis. 468-502. Eds. Peach, K. and Tracey. M.V., Springer Verlag, Berlin.
4. Jowett, D. 1958. Nature 182:816
5. Smith R.A.H and Bradshaw, A.D.1970, Nature 227:376
6. Walley, K.A. Khan, M.S.I. and Bradshaw, A.D. 1974 Heredity 32:309
7. Wild,H. and Wiltshire, G.H., 1971. J.Chamber of mines, Salisburg; 13:26.