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Short Scientific Reports

Radial Dispersion of Micronutrients through Cement Dust in Coconut Ecosystem

Cement dust carries considerable amount of essential trace elements such as Fe, Mn, Cu and Zn. This report summarises the results of micronutrient emission through cement dust from two cement factories located at Tumkur District of Karnataka, India.

Typical representative samples of raw materials like tiles, gypsum, limestone, clay, coke-breeze, sand and also samples of clinker and cement were collected for the assessment of trace element status. Typical representative composite soil samples were collected from coconut basins at 1.2m away from the bole from 0-25 and 25-50cm depths at 100m, 200m and 2 km distant intervals in respect of Vedamani factory and at 200m, 2km, 3km and 5km distant intervals in respect of Hamsundra factory. The coconut leaf samples in both the locations were also collected from middle leaflets on either side of 4th and 14th fronds by following well-established techniques for coconut. All the samples were analysed in the laboratory by following appropriate analytical techniques; the trace metals were estimated by using Atomic Absorption Spectrophotometer.

The data presented in Table I depict trace element concentrations in different raw materials and also in clinker and cement. The magnitude of micronutrients was found to be as follows :

Tiles : Fe>Mn>Zn>Cu. Fe and Cu contents were in the order of 4.08% and 38.56 ppm respectively. The trend of results for gypsum was almost similar to that of tiles. On the other hand, the limestone contained more Mn followed

Table I. *Micronutrient contents in cement manufacturing raw materials, clinker and cement*

Elements	Tiles	Gypsum	Limestone	Clay	Coke-breeze	Sand	Clinker	Cement
Fe%	4.08	1.52	0.70	6.07	2.10	T	2.36	2.58
Mn*	16.64	5.25	152.65	52.54	17.51	T	206.65	210.16
Cu ppm	38.56	16.34	12.33	77.78	14.38	T	33.33	28.76
Zn ppm	51.42	51.42	39.74	49.15	4.08	0.82	62.03	27.21

* (Mn ppm × 0.02) for getting comparable values)

by Fe, Zn and Cu. The Mn concentration was in the order of 7633 ppm (152.65 × 50 ppm). The clay contained more Fe (6.07%) followed by Mn, Cu and Zn. The coke-breeze contained more Fe (2.10%) than the other metals. Among all the materials analysed the clinker and cement also contained high concentration of Fe (2.36% and 2.58% respectively) followed by other metals. Thus it is evident that the cement dust would carry high contents of Fe, Mn and Zn into the coconut ecosystem.

The data presented in Table II indicates the EDTA and DTPA extractable trace metals in the soil. The soils collected close to the Vedamani Cement Factory showed higher contents of DTPA extractable Fe, Mn and Zn compared to soils located far away from the factory. On the other hand the soils collected around Hamsundra Cement Factory contained higher concentration of EDTA and DTPA extractable trace metals than those sampled at 5 km distance.

Table III reveals the trace metal concentrations in coconut tissue samples at different distances from the factory. It is seen from the data that the Fe and Mn contents in coconut leaf are more in the samples collected near the factory than otherwise beyond the critical levels (Cu – 5 to 7 ppm; Zn – 15 ppm; Fe – 50 ppm, Mn – 60 ppm) for coconut (Manciot, Ollagnier and Ochs, 1979; Manikandan et al., 1986). However, the copper content progressively increased in the leaf tissues with distances away from the factory, probably due to interactions between the essential (Fe, Mn, Cu and Zn) and nonessential heavy metals (Biddappa, Nagarajan and Rethinam-unpublished; Foy, Chaney and White, 1978) for the uptake of Cu by coconut. The Zn content did not show significant variation between locations.

Thus it is evident from the results that cement dust carries considerable amount of trace metals into the environment and the radial speciation depends

Table II. *Micronutrient contents (ppm) in the soil around cement factories*

Location	Distance	Depth Cm	0.1M EDTA Extractable Fe	Mn	Cu	Zn	0.05M DTPA Extractable Fe	Mn	Cu	Zn
Vedamani	100m	0–25	20	33	4.6	1.91	44	372	4.1	2.45
	200m	0–25	34	46	3.1	1.21	62	444	3.6	1.95
	2km	0–25	13	68	3.0	0.69	39	265	3.2	0.52
		25–50	42	58	2.1	0.44	49	227	2.6	0.48
Hamsundra	200m	0–25	53	161	19.4	5.27	79	378	15.7	4.11
		25–50	52	255	8.9	2.53	82	362	8.2	2.36
	2km	0–25	51	291	9.5	1.82	76	237	8.1	1.62
		25–50	56	282	9.7	1.10	82	308	7.9	1.32
	3km	0–25	51	102	3.1	1.06	78	146	2.7	0.89
	5km	0–25	40	93	1.9	0.76	44	111	1.7	0.46
		25–50	31	86	1.3	0.37	30	116	1.8	0.13

Table III. *Micronutrient contents (ppm) in coconut tissue*

Vedamani						Hamsundra					
Distance	Leaf position	Fe	Mn	Cu	Zn	Distance	Leaf position	Fe	Mn	Cu	Zn
200 m	14th	86	328	1.3	46	200 m	4th	351	131	2.6	46
							14th	472	230	5.1	45
2 km	4th	183	48	7.6	48	2 km	4th	325	192	3.8	51
	14th	294	59	4.8	43	3 km	4th	220	121	6.4	46
							14th	270	143	6.4	44
						5 km	4th	150	38	5.1	47
							14th	172	79	6.4	44

on the mobility of cement dust in the air. Eugene Odum (1983) summarised biogeochemical cycling of both trace and heavy metals in the polluted ecosystem. Since Fe and Mn contents in the coconut tissues are high, a study in depth regarding their cumulative effect over a period of time is warranted.

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