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HEAVY METAL CONTAMINATION OF VEGETABLES GROWN IN AND AROUND NASHIK CITY, (MS)

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ABSTRACT

The study and analysis was conducted to find out heavy metal contamination of vegetables grown in and around Nashik city, (Maharashtra state, India.) Vegetable samples from four different sites were collected and analyzed by using atomic absorption spectrophotometer.

KEYWORDS : Atomic Absorption Spectrophotometer, Vegetables, Contamination, Heavy metal.

INTRODUCTION

Vegetables play a crucial role in human diet since they contain carbohydrates, proteins, vitamins, minerals and trace elements. [1, 2] Excessive accumulations of heavy metals in agricultural soils result in environmental contamination, as well as food quality and safety. The increasing trends in food contamination in urban areas are largely due to the polluted environment in urban agriculture, contaminated food transport and poor market sanitary conditions. The other source includes, use of contaminated or waste water for irrigation purpose, industrial activities such as metal finishing, paint pigment and battery manufacturing, mining activities, traffic emissions and other human activities like municipal waste water sludge depositions and use of pesticides and phosphate fertilizers [2, 3].

Heavy metals such as lead, mercury, cadmium and copper are cumulative poisons. These metals cause environmental hazards and reported to be exceptionally toxic [3-4]. Heavy metals may

enter the human body through inhalation of dust and consumption of food plants grown in metal contaminated soil [5-7]. Use of polluted water in the immediate surroundings of big cities for growing of vegetables is a common practice. Although this water is considered to be a rich source of organic matter and plant nutrients, it also contains sufficient amounts of soluble salts and heavy metals like Fe, Mn, Cu, Zn, Pb, Ni, Sn, Hg, Cr, As, Al. When such water is used for cultivation of crops for a long period, these heavy metals may accumulate in soil and may be toxic to the plants and also cause deterioration of soil [10].

MATERIALS AND METHODS

Four different sites were selected from the Nashik District, Maharashtra. (India)

(S1) Site-1: Ambad industrial area, (S2) Site-2: Malegaon industrial area, Sinnar, (S3) Site-3: Panchak and Nandur Village (near municipal waste water disposal centre), (S4) Site-4: Dindori and Lakhamapur (Near from industrial area) and (S5) Site-5: Pimpalgaon Baswant Tahasil Niphad (away from city and industrial area)

SAMPLE COLLECTON, PREPARATION AND TREATMENT

The vegetable samples were collected in triplicates from different site and washed with double distilled water. 100 gram of edible portion of all three samples was homogenized, and immediately oven dried at 170^0C and then ground to fine powder in a manual grinder. Dried powder of each sample was digested in 100 ml Pyrex glass beaker by adding 1 gram in 10 ml Concentrate Nitric acid .Cold digestion was done for 24 hours and then heated at 50^oC for 4 hours. The solution was finally boiled with 1:5 mixtures of Concentrate HCl & HNO_3 in order to digest all organic matter. Finally solution was filtered and volume of the extract was made up to 25 ml using double distilled water [9].

STANDARDS AND ANALYSIS

All the analytical grade chemicals, reagents and solvents were obtained from Sigma Aldrich, Spectrochem, Mumbai (India) and E.Merck (India). Standard solutions of heavy metals viz. Copper (Cu), Chromium (Cr), Lead (Pb) and Cadmium (Cd) were prepared using Copper sulphate ($CuSO_4$, $5H_2O$), Potassium dichromate ($K_2Cr_2O_7$), Lead chloride ($PbCl_2$) and Cadmium chloride ($CdCl_2$) were prepared using distilled water having 1000 ppm concentration. Heavy Metals analyses were carried out using Atomic Absorption Spectrophotometer at NHRDF Nashik, Maharashtra Industrial & Research Institute Nashik and K.T.H.M.College, Nashik.

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Concentration of heavy metals in (mg/kg) different vegetable sample.

Sr. No.	Heavy Metal	Site	Coriander	Onion	Cauliflower	Brinjal	Cabbage	Tomato	Palak
1	Pb	S1	11.52	16.31	12.45	13.25	19.20	11.58	7.48
		S2	10.15	12.40	12.56	9.12	7.96	12.08	7.19
		S3	6.13	7.15	4.92	9.31	6.02	5.62	4.29
		S4	4.69	5.98	2.34	6.94	3.61	6.56	4.23
		S5	1.25	0.98	0.25	N.D.	0.69	1.09	1.13
2	Cd	S1	4.92	5.13	1.31	1.53	1.25	1.63	1.43
		S2	4.10	3.52	1.43	2.64	0.94	1.44	1.04
		S3	2.23	2.62	1.33	1.24	1.44	1.40	0.56
		S4	1.62	2.43	1.09.	1.69	1.20	0.89	0.58
		S5	0.38	0.65	N.D.	0.39	N.D.	N.D.	0.45
3	Cr	S1	15.32	20.12	32.20	10.60	14.20	15.50	13.10
		S2	12.30	16.20	20.12	13.10	10.60	8.30	5.60
		S3	13.43	15.34	19.23	11.83	9.10	6.12	5.75
		S4	12.56	12.45	18.25	10.21	8.69	5.45	5.69
		S5	1.58	2.02	9.23	N.D.	2.64	4.31	5.03
4	Cu	S1	21.35	19.75	23.50	11.26	10.28	15.98	17.90
		S2	16.35	13.65	19.45	9.65	11.34	10.96	6.92
		S3	6.12	13.98	16.21	10.34	9.25	6.39	8.27
		S4	4.69	9.58	11.36	7.56	8.10	4.88	8.73
		S5	2.13	2.69	5.36	2.62	5.12	1.96	1.46

CONCLUSION

1. The metal concentration in the different vegetable sample was higher than the permissible limits according to Indian Prevention of Food Adulteration Act (PFA), 1954.
2. Nearly 70 % of samples were showing higher levels of Pb than the permissible limit of 2.5 mg/kg as per PFA, 1954.
3. Nearly 50 % of Onion and Coriander samples were showing higher levels of Cd than the permissible limit of 1.5 mg/kg as per PFA 1954. Rest of the samples including palak, coriander and cabbage had Cd within the safe limits.

4. The high concentration of Cr and Cu was recorded in Cauliflower.
5. Vegetables grown in the vicinity of an industrial area (Satpur and Musalgaon) were most contaminated.
6. Vegetables grown away from the city and industrial area (Pimpalgaon Baswant) were least contaminated.
7. The results show that consumers are at greater risk of purchasing fresh vegetables with high levels of heavy metals beyond permissible limits as defined by the Indian Prevention of Food Adulteration Act, 1954.

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