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ASSESSMENT OF HEAVY METALS CONTAMINATION IN VEGETABLES GROWN UNDER WASTE WATER IRRIGATED AREA OF AMRAVATI (M.S). INDIA.

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ABSTRACT

The present study was carried out to evaluate the heavy metal contamination in vegetables grown under waste water released from Amravati city. The Ambanala site (waste water pulluted site) were chosen for selection of vegetable samples of *Spinacia oleracea, Coriandrum sativum, Brassica oleracea, Allium cepa, Solanum melongena, Lagenaria siceraria, Brassica oleracea* var. *Botrytis.* The collected samples were evaluated for heavy metals contamination by AAS. The observed values were compared with permissible range of heavy metals given by Food and Agricultural Organization (FAO) and World Health Organization (WHO).

The difference in the content of Cr, Fe, Cu, Cd was observed in the samples under investigation. The Fe and Cd in *Spinacia oleracea* found to be above permissible range given by WHO i.e. 467.1 mg\kg and 1.2 mg/kg respectively. Whereas, the Cd was not detected in *Coriandrum sativum, Brassica oleracea, Allium cepa, Solanum melongena, Lagenaria siceraria, Brassica oleracea, var. Botrytis.* Moreover, the level of Cr (2.0 mg\kg) in *Lagenaria siceraria* was near to permissible limits of WHO 2.3 mg\kg. While in *Brassica oleracea, Allium cepa, Solanum melongena* Cr was not observed. Conclusion: The evaluation of heavy metals in vegetables grown in waste water contaminated soil reveals that the heavy metals concentration was above the safe limit set by WHO and FAO (2007). Although the regular use of more or less heavy metals contaminated vegetables could not be safe for health of human life. The regular survey of heavy metals content should be done on vegetables to protect the end users. The capacity of accumulation of heavy metals by the vegetables found to be variables due to its difference in uptake and accumulation ability.

Key words: Heavy Metals, Vegetables, Evaluation, WHO.

Introduction:

Vegetables are one of the common resources for necessary dilatory elements which have been taken by human population throughout the world. The vegetables are rich in vitamins, minerals, fibres and anti-oxidative compounds which have create an attention for the peoples.

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Moreover, the leafy vegetables such as amaranths and cabbage are found to be a significant absorber of heavy metals from the soil. (Lokeshwari, H. and Chandrappa, G. 2006). The heavy metals toxicity has been discover by many researchers and found several heath risks associated with it. The heavy metals probably not show any biological role but they are found in biological system in various forms and shows harmful effects. The heavy metals are also neutral in nature when they were in least amount but as its concentration increases they interfering with biological system. The metals toxicity level relies on how much dose is absorbed; ways of exposure and duration of exposure. It causes various disorders and damages due to oxidative stress activated by free radical formation (Jaishankar. M *et al.,* 2014). Heavy metals which are derived from the industries and vehicles may be deposited on the vegetable surfaces during their production, transport and marketing. (Jassir A *et al.*, 2005) and involved in the food chains. Now a days it bas became a burning issue due to their increased accumulation in biologiocal systems via contaminated water, soil and air. Therefore, an awareness of heavy metal sources, their accumulation in the soil and in water and continuous assessment seem to be an important issue in health risk management (Rajesh Sharma R *et al.,* 2004). The atmospheric deposition leads to increased level of heavy metals contamination in vegetables commonly found in the market of Varanasi, India (Sharma *et al*., 2008). The continuous large scale use of heavy metals rich vegetables lead to the chronic accumulation of heavy metals in the kidney and liver of human that can severely affects on biochemical processes and responsible for cardiovascular, nervous, kidney and bone diseases (Jarup, 2003).

Material and method

Plant Material

The vegetables namely *Spinacia oleracea, Coriandrum sativum, Brassica oleracea, Allium cepa, Solanum melongena, Lagenaria siceraria, Brassica oleracea* var. botrytis which were grown in field irrigated with industrial waste water were chosen for experimental analysis.

Sample Collection, Preparation and Analysis:

The leaves samples of plant under study were collected around the vicinity of Ambanala drainage in Amravati (M.S). India, in this filed site the waste water (sewage & industrial) was used by farmers for growing vegetables. Leaves sample were collected randomly in polythene bag from the field. Samples were washed with tap water followed by distilled water to get rid of soil particles and sun dried. The sun dried samples were crushed and grinded for heavy metals assessment. 0.5 gram of each of the fine powdered samples was

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weighed into test tubes and tri-acid mixture (HNO3 + HClO4 + H2SO4; 5: 2: 1) was used to digest the samples at 100°C on the hot plate for two hours. The digested samples were cooled and filtered through Whatman No.42 filter paper and filtrate volume was made up to 100ml by adding distilled water. The filtrate was used for determination of heavy metals by Atomic Absorption Spectrophotometer (AAS) model no: AA300, M/S Perkin Elmer,USA. The Daily Intake of Metals was calculated according to method of WHO (1992) and Health risk Index (HRI) was estimated according to IRIS, (2003).

Observations:

Table. No. 1. Concentration of heavy metal in samples under study (mg/L).

Sr.No	Name of sample	Common name	Heavy metal (mg/L)			
			Cr	Fe	Cu	Cd
1	*Spinacia oleracea*	Spinach	0.010	4.671	0.040	0.012
2	*Coriandrum sativum*	Coriander	0.005	0.432	0.009	ND
3	*Brassica oleracea*	Cabbage	ND	0.092	0.007	ND
4	*Allium cepa*	Onion	ND	2.422	ND	ND
5	*Solanum melongena*	Brinjal	ND	2.411	0.035	ND
6	*Lagenaria siceraria*	Bottle gourd	0.020	2.942	0.11	ND
7	*Brassica oleracea var. botrytis*	Cauliflower	0.015	0.896	0.026	ND

(Cr = Chromium, Fe = Iron, Cu = Copper, Cd = Cadmium, ND = Not detectable)

Table No.2: Concentration of heavy metal in samples under study (mg/kg)

Sr.No	Name of sample	Heavy metal (mg/kg)			
		Cr	Fe	Cu	Cd
1	*Spinacia oleracea*	1.0	467.1	4.0	1.2
2	*Coriandrum sativum*	0.5	43.2	0.9	ND
3	*Brassica oleracea*	ND	9.2	0.7	ND
4	*Allium cepa*	ND	242.2	ND	ND
5	*Solanum melongena*	ND	241.1	3.5	ND
6	*Lagenaria siceraria*	2.0	294.2	1.0	ND
7	*Brassica oleracea var. botrytis*	1.5	89.6	2.6	ND
	WHO/FAO(2007)	2.3	425	40	0.05

(Cr = Chromium, Fe = Iron, Cu = Copper, Cd = Cadmium, ND = Not detectable)

Daily Intake of Metal and Health Risk Index

Table No.3: Daily intake of metal (DIM) and health risk index (HRI) for children and adults (mg/kg/person/day) for Chromium.

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Sr.No.	Sample	DIM		HRI	
		Children	Adult	Children	Adult
1	*Spinacia oleracea*	0.281	0.245	0.4017	0.35507
2	*Coriandrum sativum*	0.026	0.022	0.0376	0.03188
3	*Brassica oleracea*	0.005	0.005	0.0072	0.00695
4	*Allium cepa*	0.146	0.127	0.2115	0.18405
5	*Solanum melongena*	0.145	0.126	0.2101	0.1826
6	*Lagenaria siceraria*	0.177	0.154	0.256	0.2236
7	*Brassica oleracea var. botrytis*	0.054	0.047	0.0782	0.0681

Table No.4: Daily intake of metal (DIM) and health risk index (HRI) for children and adults (mg/kg/person/day) for Iron

Sr.No.	Sample	DIM		HRI	
		Children	Adult	Children	Adult
1	*Spinacia oleracea*	0.00060	0.00052	0.0004	0.00034
2	*Coriandrum sativum*	0.00030	0.0003	0.0002	0.0017
3	*Brassica oleracea*	ND	ND	ND	ND
4	*Allium cepa*	ND	ND	ND	ND
5	*Solanum melongena*	ND	ND	ND	ND
6	*Lagenaria siceraria*	0.0012	0.0014	0.0008	0.0009
7	*Brassica oleracea var. botrytis*	0.0009	0.0007	0.0006	0.00046

Table No.5: Daily intake of metal (DIM) for children and adults (mg/kg/person/day) and health risk index (HRI) for Copper,

Sr.No.	Sample	DIM		HRI	
		Childr en	Adult	Childre n	Adult
1	*Spinacia oleracea*	0.0024	0.002	0.06	0.05
2	*Coriandrum sativum*	0.0005	0.0004	0.0125	0.01
3	*Brassica oleracea*	0.0004	0.0036	0.01	0.09
4	*Allium cepa*	ND	ND	ND	ND
5	*Solanum melongena*	0.0021	0.001	0.0525	0.025
6	*Lagenaria siceraria*	0.0006	0.017	0.015	0.425
7	*Brassica oleracea var. botrytis*	0.002	0.001	0.0375	0.025

Table No.6: Daily intake of metal (DIM) for children and adults (mg/kg/person/day) and health risk index (HRI) for Cadmium

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Sr.No.	Sample	DIM		HRI	
		Children	Adult	Children	Adult
1	*Spinacia oleracea*	0.00072	0.0006	0.07272	0.06060
2	*Coriandrum sativum*	ND	ND	ND	ND
3	*Brassica oleracea*	ND	ND	ND	ND
4	*Allium cepa*	ND	ND	ND	ND
5	*Solanum melongena*	ND	ND	ND	ND
6	*Lagenaria siceraria*	ND	ND	ND	ND
7	*Brassica oleracea var. botrytis*	ND	ND	ND	ND

Discussion:

Heavy metals concentration in different vegetable samples from the waste water irrigated field was mentioned in tables. From the observations the daily intake of metals (DIM) and Health risk Index (HRI) has been calculated and represented in tables. The vegetables grown under waste water irrigated fields are vulnerable to different contaminants. The consumption of heavy metals contaminated vegetables leads to different heath issues and chronic diseases associated with biological system. Therefore, assessment of heavy metals and other trace elements is a prior need for public heath risk management. The present investigation was conducted to determine the contamination of heavy metals which were grown on waste water irrigated field. Based on the observations it was found that the concentration of heavy metals viz Cr, Fe, Cu, Cd was variable in different vegetables under study. The Fe and Cd in *Spinacia oleracea* found to be above permissible range given by WHO i.e. 467.1 mg\kg and 1.2 mg/kg respectively. Sharma *et al.*, (2009) has reported higher accumulation of heavy metals in *Spinacia oleracea* (1.6 mg/kg) which were belongs to Indian market places. Whereas, The Cd was not observed in the samples of *Coriandrum sativum, Brassica oleracea, Allium cepa, Solanum melongena, Lagenaria siceraria, Brassica oleracea var. Botrytis.* The level of Cr was found to be 2.0 mg/kg in *Lagenaria siceraria* which is near to permissible limits of WHO 2.3 mg\kg. While in *Brassica oleraceae, Allium cepa, Solanum melongena* Cr was not observed. A various study suggested that the leafy vegetables absorb the heavy metals present in atmosphere by their leaves (Jassir M., *et al*., 2005).

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