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A study of Heavy metals in Spinach(*Spinacea oleracea* Linn.) plants of Bhopal city

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Abstract

Heavy metals are the elements having a density greater than 5 in their elemental form .Metals that are discharged by industry *i.e*. cadmium, chromium, cobalt, copper, iron, mercury, manganese, molybdenum, nickel, lead, tin & zinc. Study of pollutants in vegetables has been a great importance. Industrialization and human activity for a better quality of life has always resulted in some impact on the environment leading to equilibrium imbalance of the natural system. The present study was aimed to determine the amount of toxic heavy metals ,chromium and cadmium in spinach (*Spinacea oleracea* Linn.) plants of Bhopal city. The plant belongs to the family Chenopodiaceae. These heavy metals are toxic in nature and have become a serious health problem. Analysis of heavy metals were carried out by atomic absorption spectrophotometrically. The paper also highlights the phytochemical constituents and medicinal efficacy of spinach.

Key words : Heavy metals, Pollutants, Toxic, *Spinacea oleracea* Linn., Phytochemistry.

Environmental pollution is a burning topic of the day. Air, water and soil are being polluted alike. Heavy metals are the chronic pollutants. The main source of heavy metals are urban industrial areas created by combustion of fuels, metal refining and other fertilizers[2]. Fertilizers are intended to fertilize the soil for the raising of crops, but incidentally may add heavy metals in the soil. To provide adequate nitrogen, phosphorous and potassium for crop growth, large amount of these fertilizers are regularly being added to soil. The compounds used to supply these elements contain trace amounts of heavy metals as impurities, which after continued fertilizer application may significantly increase their contain in the soil. Phosphate fertilizer containing 38 to 48 µg cadmium g^{-1}. Cadmium may also be added to soil adjacent to road the sources being tyres and lubricant oils.[4,6].

Some workers [1,4,7] have investigated

the phytochemical constituents of spinach (*Spinacea oleracea* Linn.). These are as under:

1. Flavonoids: *Spinacia oleracea* is very rich in the flavonoids. Various flvonoids reported to be present are querecetin; myricetin; kampeferol; apigenin; luteolin; patuletin; spinacetin; jaceidin; 4'-glu-curonide; 5,3',4'-trihydroxy-3-methoxy- 6:7-methylenedioxyflavone-4'-glucuronide; 5,4'-dihydroxy-3.3'-dimethoxy-6:7-methylene dioxyflavone-4'-glucuronide;[5,4]-dihydroxi-3,3'-dimithoxi-6,7-methylene-dioxi- flavone (C18H14O8.); 3,5,7,3',4'pentahydroxi-6-methoxiflavone.

2. Phenolic Compounds: The polyphenols isolated from the plant are *para*-coumaric acid, ferulic acid, *ortho*- coumaric acid.

3. Carotenoids: Spinach shows presence of different carotinoids like lutein, β-carotene, violaxanthin and 9'-(Z)-neoxanhin.

4. Vitamins: Spinacia oleracea contains high concentration of vitamin A, E, C, and K. and also folic acid, oxalic acid.

5. Minerals: Along with these chemicals various minerals present in the spinach. These are magnesium, manganese, calcium, phosphorus, iron, zink, copper and potash.

Spinach (*Spinacea oleracea* Linn.) samples were collected from different areas of Bhopal city. Analysis of heavy metals were carried out by standard methods. Cadmium and chromium metals analyzed by atomic absorption spectroscopy.[2]

Table 1 Concentration of chromium and cadmium in different parts and areas of spinach cultivation.

S. No	Area Bhopal city	Chromium in leaves(mg/kg)	Cadmium in shoot(mg/kg)	Cadmium in root (mg/kg)
1.	Bairagarh	0.37	0.12	0.37
2.	Arera colony	1.20	0.84	1.33
3.	New market	3.72	2.69	5.83
4.	Indrapuri	4.71	7.48	11.23
5.	Govindpura	22.92	8.29	12.00

The uptake of metals ions has been the subject of diverse investigations based both on solution and the soil. The adsorption cation is under the control of metabolic or non metabolic . an initial rapid phase is considered to be to non metabolic process(physical). The adsorption of heavy metal cation is promoted as pH increases and is inhibited by some alkali and alkaline earth cations and by other heavy metals. As heavy metals are frequently added to soils in combination with organic matter as in sewage sludge's and sometimes as synthetic chelates. In Bhopal, extensive areas of land, usually within or near urban areas, are employed for controlled dumping of domestic refuges. Cadmium effects on human health at

low level of cadmium. It causes hypertension, degenerative bone diseases at high level of cadmium. The adsorption of cadmium by plants is reduced by Zn^{2+} and Mn^{2+}. The presence of cadmium even below 1 ppm is very harmful to life. At higher concentration chromium is a toxic element for mammals and other animals. When the fertilizers/sewage sludge spread over the land, metals present are distributed up to different depths in the soil. It has been observed that cadmium accumulated to the maximum on the surface layer and its concentration decreased with depth in farm soil. In non sewage irrigated soil chromium accumulation in surface layers is higher than in sewage irrigation soil.

Spinach leaves not only provide us an important vegetable but at the same time are attributed with several medicinal properties. According to Chopra *et al.*,[3] the spinach leaves are cooling, and useful in febrile affections, inflammation of lungs and bowels. The whole plant is effective in the treatment of urinary calculi. The seeds are said to be laxative, cooling and also used in difficult breathing, inflammation of the liver as well as in cases of jaundice.

In conclusion the result of present study suggests that spinach plants of Bhopal city contain cadmium and chromium metals in different amounts depending upon area of cultivation and degree of heavy metal pollution. Spinach plants of Govindpura industrial area were found to have maximum quantity of pollutants. Uptake of pollutants by any edible plant may lead to severe health disorders. Hence, the cultivation of spinach and other vegetables should be at places which do not receive water from heavy metal polluted sources.

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