Impacts of Coal Based Industries: Analysis of A Toxic Metal In vegetables

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ABSTRACT:

Vegetables grown in environmentally disturbed Singrauli may collect and accumulate toxic metals. Toxicological effects of metals in Singrauli vegetables were examined. We employed AAS to detect heavy metals in vegetable samples from multiple farms near a thermal power station (Perkin Elmer model no. 1100B). Vegetable metal absorption was connected to species-specific heavy metal tolerance. None of the five vegetable samples exceeded lead standards. According to research, lead consumption is considerably below the TMDI (theoretical maximum daily intake), showing that the metal provides no health risk. If everyone eats more veggies, the situation may intensify. Industrial wastewater treatment and phyto-extraction of metals from polluted sites may reduce health concerns.

Key words: Toxic metal, Vegetable Species, Thermal Power Plants.

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INTRODUCTION

Singrauli coal basin is located in the north-east of India. Its surface area is 2200 Km2 in two states principally Singrauli district in Madhya Pradesh. With progress discovery of large coal reserves Singrauli region is decided to develop as a power station centre at national level. As the low grade coals are used, ash generation becomes high. Mining and thermal power plants caused land degradation, air pollution, ground and surface water contamination, fly ash disposal, forest damage, and socioeconomic issues.

Fly ash, created in vast amounts when coal is burned, includes poisonous elements including Barium, Copper, Molybdenum, Zink, Beryllium, Cadmium, Selenium, Lead, Mercury, and others. Other metals are found in traces (Theis T. L. and Fulekar M. H.)1,2. As particle size decreases, fly ash Pb, Cd, Se, As, Zn, Ni, Cr, and S concentrations rise. Fly ash heavy metals alter forms in soil. It dissolves in water and becomes plant food. Transition metals cause neurotoxicity, hepatotoxicity, and nephrotoxicity (Stohs and bagchi1995)3 .The chemical form of heavy metals in soil solution is dependent of the metal concerned, pH and the presence of other ions (Das et al, 1997).4 Heavy metal toxicity in plants may result from cellular interactions (Hall, 2002). 5 Metals binding to protein sulphydryl groups can limit function or alter structure, causing toxicity. (VanAssche and Clisters 1990).6 In addition, heavy metal excess may stimulate the formation of free radicals and reactive oxygen species (Dietz et al, 1999; Groppa et al,2001; Sandalio et al; 2001; Fornazier et al, 2002).7,8,9,10 The objective of this study was to analyze metal concentration of some vegetables by using Atomic Absorption Spectroscopy grown in Singrauli region of Madhya Pradesh, India.

MATERIAL AND METHODS

Collection of samples

The study objects were the leaves of 5 popular vegetable species (Spinacia olaracia, Solanum tuberosam, Raphanus sativus, Brasica comprestis, Trogonella fonium) widely cultivated in numerous private home-gardens within different area of Singrauli. Sampling was done from 200 points all over the region.

Pretreatment

The samples were transported to the lab for additional processing and analysis after they were collected. Those samples were used for analysis, but those with damaged or decaying leaves were discarded.

Sample cleaning:

All of the harvested vegetables had their leaves carefully removed and cleaned to get rid of any dirt or debris. We next used a knife to finely mince the samples. Air drying was followed by oven drying at 35 degrees Celsius to preserve the veggies (15).

The sample grinding process:

Vegetables were dried, then processed into a fine powder (80 mesh) using a professional blender, then kept in plastic bags until acid digestion.

Abnormally High Levels of Stomach Acid

Samples of vegetables were digested in acid, and the following heavy metals were extracted: Each sample taken in a distinct Singrauli district was dried and weighed; then, 10 ml of 98% nitric acid was poured to the tube. Next, it was put into a water bath and boiled for roughly 72 hours. A 25ml volume of the resultant light yellow solution was made up with de-ionized water when digestion was complete and then stored. For each region, a composite sample was created.

Analyzing the Effects of Heavy Metals

Using an atomic absorption spectrophotometer, the levels of Pb in the plant solutions were determined (AAS, Perkin Elmer model 1100 B). The analytical readings were found to be within the approved value range, and this was only possible because a certified standard reference material was utilised. After five separate measurements, the equipment was calibrated by running blank and standard samples.

Results and Discussion

Vegetable farming has a long tradition in the Singrauli area. Vegetables are still grown in urban and rural regions close to ash ponds, power plants, coal mines, and industries despite the fact that many vegetable gardens have been converted to industrial space as a result of industrialization. Lead examination of vegetables will take place in a location close to an industrial zone and ash ponds.The results are being tabulated as below.

Table- 1 Concentration of Lead in *Spinacia Olaracia*

S. No.	Name of Sampling Station	No. of Samples Collected	Mean level of Pb (µg/gm)
1.	Near Kanoria Chemicals	10	0.09
2.	Near SSTPP*	10	0.06
3.	Near VSTPP*	10	0.08
4.	Near Ash Pond	10	1.03

Table- 2 Concentration of Lead in *Solanum Tuberosam*

S. No.	Name of Sampling Station	No. of Samples Collected	Mean level of Pb (µg/gm)
1.	Near Kanoria Chemicals	10	0.09
2.	Near SSTPP*	10	0.05
3.	Near VSTPP*	10	0.02
4.	Near Ash Pond	10	0.70

Table- 3 Concentration of Lead in *Raphanus Sativus*

S. No.	Name of Sampling Station	No. of Samples Collected	Mean level of Pb (µg/gm)
1.	Near Kanoria Chemicals	10	0.09
2.	Near SSTPP*	10	0.07
3.	Near VSTPP*	10	0.06
4.	Near Ash Pond	10	1.01

Table- 4 Concentration of Lead in *Brassica comprestis*

S. No.	Name of Sampling Station	No. of Samples Collected	Mean level of Pb (µg/gm)
1.	Near Kanoria Chemicals	10	0.09
2.	Near SSTPP*	10	0.07
3.	Near VSTPP*	10	0.05
4.	Near Ash Pond	10	0.92

Table-5 Concentration of Lead in *Trigonella Fonium*

S. No.	Name of Sampling Station	No. of Samples Collected	Mean level of Pb (µg/gm)
1.	Near Kanoria Chemicals	10	0.05
2.	Near SSTPP*	10	0.03
3.	Near VSTPP*	10	0.04
4.	Near Ash Pond	10	0.72

* Shaktinagar Super Thermal Power Plant (SSTPP)
* Vindhyachal Super Thermal Power Plant (VSTPP)

Lead poisons plants and vegetables. Lead buildup seldom affects appearance. Lead in food may harm humans. PTEs are chemically indestructible. PTEs bioaccumulate in organisms (Zhuang et al 2009)11 and reduce vegetable production (Khodaverdillo et al 2011). 12 Thus, vegetable lead accumulation research is important. 13 Analyzed were five veggies. Table 1-5 lists 10-50 examples. Leaf lead was measured. Out of four spinach sampling locations, lead levels were 0.06-1.03 ?g/gm near the TPPs and ash dike. Lead affects potato leaves and roots around 0.02-0.70 ?g/gm. Ash dykes have more lead. Radish has 0.06-1.01 ?g/gm lead. Mustard has 0.05-0.92 ?g/gm lead. Mustard may absorb lead more quickly than other plants. Feenug contains 0.04-0.72 ?g/gm lead. Lead is susceptible to feenuf. Lead content increases along ash dykes. Lead in ash travels through water systems, soil, and vegetable plant roots. Pesticides may also cause lead contamination.

CONCLUSION

Land deterioration, ground and surface water pollution, and mining operations all resulted from the production of fly ash in thermal power plants in the Singrauli region. Lead is now consumed in amounts below the concentration at which it begins to negatively impact health, making it safe for most people to be exposed to it on a daily basis.

Conflict of interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

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