# ASSESSES THE CONTENT OF HEAVY METALS IN THE LOCAL ENVIRONMENT CAUSED BY AN ASH DEPOSIT

**Nica-Badea Delia, Assoc. PhD.,** "Constantin Brancusi" University of Targu-Jiu, ROMANIA
**Bălăcescu Aniela, Assoc. PhD.,** *"Constantin Brancusi" University of Targu-Jiu,* ROMANIA

**ABSTRACT:** *Plants can be used as bioindicators providing information on environmental quality or environmental change and as biomonitors when providing information on the amount of pollutants. The main polluter of the influence area of the thermal power plant is ash, resulting from the combustion of coal with a low content of heavy metals. The paper assesses the content of heavy metals in the local environment caused by Thermal Station. The control of the degree of pollution with heavy metals Zn ,Cu, Co, Ni, Cr, Pb, Cd from soil, and vegetables crops are achieved by AAS instrumental analysis under optimum conditions.*

***Keywords****: biomonitoring, thermal power stations, soil, vegetables, heavy metals, AAS.*

## 1. INTRODUCTION

Energy installations, especially coal-fired power plants, can influence the environment, sometimes even affecting the ecological balance in the areas where they are located, with a complex impact on all the environmental factors in the surrounding area (atmosphere, water, soil, flora and fauna, food and passenger compartments) so that the energy sector is considered as the main source of pollution.

The assessment of the environment in an area at a given moment is given by the quality of air, water, soil, population health, the deficiency of registered plant and animal species. Each of these factors can be characterized by quality indicators representative of the assessment of the degree of pollution and for which there are established admissible limits.

The main polluter of the area of influence of the thermal power plant is ash. Fly ash eliminated through chimneys, fine ash dust drifting from the ash dump and coal dust from coal deposits or transporting and preparing it together constitute a solid poison, which is also found in the form of aerosols. If the ash resulting from the combustion of coal has a low content of heavy metals, the formed aerosols are nontoxic. From a harmful point of view, they are important only in large quantities.

The monitoring of environmental pollutant compounds includes multiple areas of air, water, soil, vegetation investigation in both urban and rural areas. The large number of pollutant species, their distribution involves sampling strategies and analytical analytical methodologies, especially with regard to the development, implementation and application of these methods in environmental protection programs.

As a result of the increase in the degree of industrialization, implicitly of the pollutants, it has been established that the plants can give qualitative and quantitative information about the changes caused by the impact of industrialization on the environment, arguing the ecological relationship of the balance between the environmental factors and the real needs of the different plant species.

The assessment of the degree of environmental pollution by plants is based on their important characteristics, namely: rapid response to chemical changes in plant composition, due to their reduced capacity to maintain homeostasis and the ability of plants to accumulate certain pollutants as a result of their adaptation to new environmental conditions. Plants can be used as bioindicators providing information on environmental quality or environmental change and as biomonitors when providing information on the amount of pollutants [1, 2, 3].

# 2. ANALYTICAL RESEARCH

## 2.1. OBJECTIVES

The sampling and the methodology for investigating the pollution of the environment in general the degree of pollution in the vicinity of pollution sources is achieved by: identifying the potentially polluting sources, the pollutants and their concentration, the longer-term monitoring of the degree of pollution and its rate [4, 5].

Starting from the literature to assess the degree of pollution with heavy metals, we have proposed to use as bioindicators and biomonitors the vegetation in the area of a solid fuel-based thermal power plant and an area considered unpolluted.

For both areas the concentrations of heavy metals in soil, vegetation and vegetal products (pepper, cucumber onion), to observe the influence of pollutants on crops grown for consumption.

## 2.2. INSTRUMENTATION

Determination of heavy metals in soil by mineralization in concentrated strong acids and wet with hydrogen peroxide. Wet mineralization $HNO_3$, HCl and $H_2O_2$ using a microwave digestion system from Milestone: weigh 1g soil mineralization vials of digestion system; oxidant mixture is added: 6 mL 65% $HNO_3$ + 3 mL HCl + 0.25 mL 35% $H_2O_2$ 30%; sealed ampoules and starts the mineralization (Table 1). Cool samples: 30 min ventilation; to keep the samples in digestion vessels at least 12 hours (overnight) covered with filter paper to avoid contamination, filter samples in flasks of 50 mL (washing with distilled water filter).

**Table 1.** Mineralization steps program

| Stage | Time (min) | Power (W) | Temperature (°C) |
|---|---|---|---|
| 1 | 15 | 850 | 150 |
| 2 | 15 | 850 | 210 |
| 3 | 15 | 850 | 210 |

Determination of trace elements in plant analysis was done according to the methodology for assessment of plant mineral nutrition by dry mineralization (mineralization ignition). Mineralization of plant material: weigh 1 g dried herb in a porcelain or platinum crucible, burn the plant material to a gas burner flame, ash in the oven at 450 °C, leave evidence in the oven until a white-gray colour can vary depending on the nature of plant material between gray and white with shades of yellow or red, if the colour is too dark, ash is treated with a few drops of concentrated $HNO_3$, then sits on a sand bath and allow to evaporate again be placed in the oven at the same temperature of 450 °C ashes are treated with 1 mL of HCl 6 N, HCl evaporation in a sand bath, repeat the treatment with HCl, samples are put in flasks of 25 mL 0.5 N HCl, filtered in 50 mL Erlenmeyer glasses, distribute extracts obtained by atomic absorption spectrometry to determine trace elements in soil and plants.

The solutions obtained were determined by AAS: Zn, Cu, Co, Ni, Cr, Pb, Cd [6, 7]. The amount of metal is calculated based on the straight line equation, most likely the calibration curve.

For each sample, three parallel analyses were performed, and absorbance readings were repeated five times each [8, 9]. The detection limits and sensitivity of the atomic absorption spectrophotometer are presented in Table 2.

**Table 2.** Detection limits and sensitivity of atomic absorption spectrometer

| Metal | Detection limits (mg.L$^{-1}$) | Sensitivity (mg.L$^{-1}$) |
|---|---|---|
| Zn | 0.005 | 0.02 |
| Cu | 0.02 | 0.1 |
| Mn | 0.01 | 0.05 |
| Pb | 0.1 | 0.5 |
| Ni | 0.04 | 0.15 |
| Co | 0.05 | 0.2 |
| Cd | 0.005 | 0.025 |
| Hg | 0.0002 | - |

## 3. RESULTS AND DISCUSSIONS

The locality Turceni is anthropically polluted plain area, with ashes from the CET Turceni. The experimental results of the dispersion level of the metallic pollutants in the area of influence of the energy objective are presented in tables 3, 4. The values of the climatic parameters of the area of Turceni can be considered normal and have no significant influence on the accumulation of heavy metals in the soil and plants.

**Table 3**. Content in heavy metals – total forms – in the soil horizon 0-20 cm, Turceni area

| Experimental values | Metal content (ppm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Zn | Cu | Co | Ni | Cr | Pb | Cd |
| Minimal values | 80,0 | 18,7 | 21,0 | 17,0 | 21,5 | 16,5 | 1,00 |
| Maximum values | 123 | 55,0 | 50,5 | 29,0 | 35,0 | 55,0 | 3,20 |
| Average values | 89,0 | 45,8 | 35,8 | 25,6 | 26,2 | 40,5 | 2,05 |
| Normal values[a] | 100 | 20 | 15 | 20 | 30 | 20 | 1 |
| Alert thresholds / sensitive soils[a] | 300 | 100 | 30 | 75 | 100 | 50 | 3 |

[a] OUG 756/1997

**Table 4**. Concentration of heavy vegetable products grown in the area of Turceni

| Analised product | Metal content (mg/kg fresh edible product) maximum values | | | | | | |
|---|---|---|---|---|---|---|---|
| | Zn | Cu | Co | Ni | Cr | Pb | Cd |
| Cucumbers | 10,2 | 0,68 | 0,16 | 0,15 | 0,14 | 0,20 | 0,50 |
| Onion | 14,8 | 1,37 | 0,81 | 0,38 | 0,33 | 0,53 | 0,08 |
| Pepper | 15,1 | 3,50 | 0,29 | 0,40 | 0,31 | 0,08 | 0,05 |

The content of heavy metals in the area of the surveyed area (average values) is in the nationally validated range [10] for the content of potentially polluting elements and substances (PPES) in the soil of the agricultural soil monitoring parcels, level I

(16 x 16 km, (mg.kg -1): Zn (87.34 ± 61.4), Pb (43.71 ± 3.69), Ni (64.14 ± 11.24), Cd (0.82 ± 0.12) of the area of the surveyed area according to national rules [11].

Considering that the ash pile is located in the east of Turceni, it is expected that the winds will trace dry ash, determine the concentration of heavy metals in the soil and plants and create pollution phenomena on the agricultural land of this area. Ash has an appreciable content of heavy metals-total forms [3], higher than normal values for agricultural soils, but not at such a high level as to be limiting for plant culture.

The soil of the Turceni area is a soil with anthropogenic charge with heavy metals, especially cadmium, lead, cobalt, copper and even zinc. The physico-chemical parameters of this soil maintain these metals still in inaccessible forms of plants. This state of affairs is temporary because the impact of ash with the soil of this area over a longer period determines the concentration of heavy metals in soil and plants. The pH and heavy metal content in surface water samples harvested in the ash pond perimeter shows that it does not have a significant contribution to the contamination of heavy metal plant products.

The experimental results obtained in the determination of heavy metals in vegetables grown in the vicinity of the ash deposit of CET Turceni reveal some of their increased concentrations in vegetables. Although some heavy metals have been identified in higher amounts at the toxicity limit or slightly above this limit, the average values of their concentrations in the analyzed vegetables generally fall within the normal range in concordance with European Reglementations, national legal limit and recent studies [12, 13].

The pollution phenomenon is still incipient and, therefore, we can not talk about an obvious process of heavy metal pollution. The phenomenon may increase if anthropogenic impact is prolonged without taking specific agropedoameliorative measures.

## 4. CONCLUSIONS

A series of plants, in particular herbaceous vegetation, vegetables, fruits can be used as biomonitors for the degree of pollution in general with heavy metals, in particular, by chemical analysis of the components in the areas adjacent to the sources of pollution with the combustion products of the plants thermoelectric power on coal.

Control of the degree of pollution with heavy metals Cu, Cd, Pb, Ni, Zn, Co in vegetal agri-food products can be achieved by AAS instrumental analysis under optimum conditions.

In both areas the maximum toxicity limits allowed for heavy metals in the agri-food products analyzed were not exceeded, without affecting the health of the population. In this context intends to demonstrate the extent of this vulnerability and to elaborate measures for controlling and diminishing the effects of heavy metal pollution to increase food safety and security for ecological fresh vegetables

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