

## THE EFFECT OF ARSENIC (As) CONTAMINATION ON SEVERAL MATERIALS

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**Abstract:** During plant production and animal breeding the clearness of irrigation water is a most important commitment. Hungary is the water save area of Carpathian Basin. The quality and accumulation of arsenic of ground water of Carpathian Basin is controlled by EU. Studies have demonstrated that the ground waters in southern counties of Carpathian Basin are unsuitable for irrigation and drink due to arsenic contamination. Our real task is the use of a high-efficiency filter, which can insure the clear water for irrigation and drink. During our research to filtration of irrigation water a special Japanese cerium filter is used by us. We have controlled the concentration of arsenic contamination in vegetables and the accumulated arsenic from cow fur.

**Keywords:** arsenic contamination, cerium filter, irrigation water

### INTRODUCTION

Arsenic is a chemical element with symbol **As**, its atomic number is 33. It can exist in various allotropes, although only the gray form has important use in industry. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds (John, 2001; Grund et al., 2005). Elementary arsenic normally does not react with water in absence of air. Arsenic compounds are abundant in the earth's crust. Particles are released during mining, and spread throughout the environment. Arsenic from weathered rocks and soils dissolves in groundwater. Arsenic concentrations in groundwater are particularly high in areas with geothermal activity (Raiswell, 1980). Arsenic was used in various agricultural insecticides and poisons. Arsenic is easily absorbed by vegetables from irrigation water. The two forms of inorganic arsenic, arsenate (AsV) and arsenites (AsIII), are easily taken up by plant root cell (Finnegan et al., 2012). Arsenic contamination of water and soil can also adversely affect food safety (Golam et al., 2009).

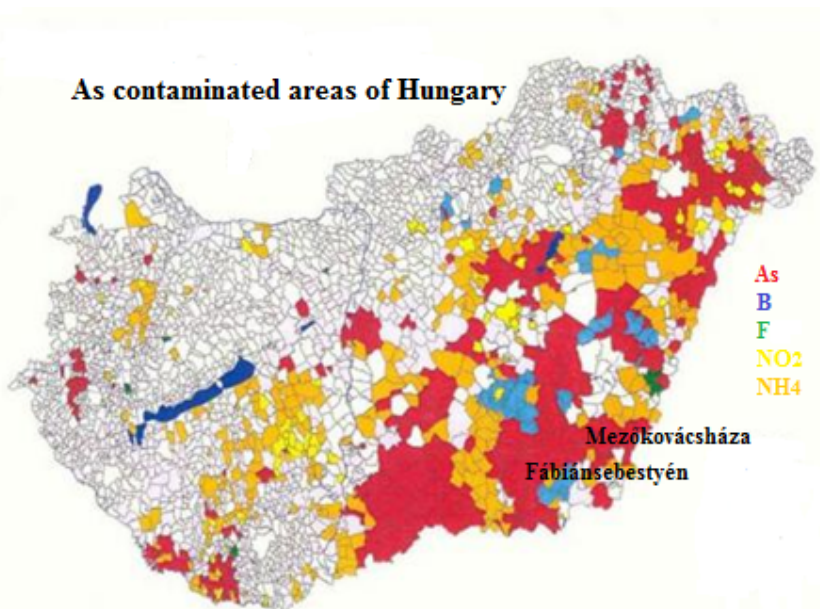
### MATERIALS AND METHOD

Our investigation was performed in the summer vegetable forcing period of 2013, on area with arsenic contamination fairly above average levels in two private farms in Mezőkovácsháza and Fábiansébestyén (Figure 1). Vegetable forcing was performed in two neighboring plastic tunnel greenhouses of 50 m length, 9 m width and 450 m<sup>2</sup> floor area each. Sweet pepper and tomato were cultivated and tested in the two plastic tunnel greenhouses, respectively. During the test forcing period a drop irrigation system was used. One half of the plants were irrigated with unfiltered water, while the other half with filtered water. In order to eliminate arsenic, decontamination was achieved by use of a Japanese-developed special *cerium filter* distributed in Hungary by S-Metalltech Ltd. During forcing the Poli-feed complex fertilizer recommended for pepper and tomato forcing was used. Sweet pepper bells and tomato berries in biologically ripe status were harvested. During the test forcing period we have controlled arsenic contamination of both the irrigation water and the vegetables grown. (MSZ EN 14627:2005 6.1. by Food Analytica Kft. Laboratory, Mezőkovácsháza). Results represent averages of four independent experiments. The animal investigation was performed in a private farm of Mezőkovácsháza, where tree, several age cow furs were controlled by us. The animals are

watered by As contaminated drinking water. The As contamination of drinking and irrigation water was same.

**Cerium filter:** Cerium is a malleable, soft, ductile, iron-grey metal, slightly harder than lead. It is very reactive: it tarnishes readily in the air, it oxidizes slowly in cold water and rapidly in hot water. Uses: Pollution control technologies such as catalytic converters and fuel additives, glass polishing and UV shielding, water filtration, fluorescent lighting. (<http://www.lenntech.com/periodic/elements/ce.htm#ixzz2vjzsnYxv>).

**Figure 1.** Locales of investigations.



### RESEARCH RESULTS

Laboratory assays demonstrated that arsenic concentrations in unfiltered materials were higher than permitted (201/2001. (X.25.) Gov.decree). However, arsenic concentrations in filtered materials were significantly lower (Table 1). Our assays demonstrated that arsenic contamination can be easily taken up from irrigation water and absorbed in cells of vegetables. Elevated arsenic concentrations in these crops were not detectable macroscopically, i.e. discoloration caused by arsenic was not observed.

After our investigation (13. 03. 2014.) the furs of animals are controlled by laboratory of NÉbiH. The control measurements demonstrated the accumulation of arsenic in furs of animals (Table 2).

**Table 1.**

**Averages of arsenic concentrations in controlled plant materials (100g).**

Controlled materials	Filtered	Unfiltered
irrigation water	>1µg	3.8 µg
sweet pepper ( <i>Capsicum annuum</i> L.)	1 µg	5.2 µg
tomato ( <i>Solanum lycopersicum</i> L.)	<0.02 µg	1.9 µg

Table 2.

**Averages of arsenic concentrations in controlled furs (mg/kg).**

<b>Controlled animals</b>	<b>As accumulation in furs</b>
calf	under 0.01
heifer	0.04
cow ( times calved)	0.06

**CONCLUSIONS**

Based on literature data it seems that the southern part of the Carpathian Basin is an area of Hungary highly contaminated by arsenic. The primary objective of irrigation water filtering is to achieve production of healthy vegetables. We can demonstrated the accumulation ability of arsenic by animal investigation. The investigated furs of animals are - depending from age - As contented by contaminated drinking water. The age of animals and arsenic accumulation in their furs was in tight correlation.

Our research demonstrated the cerium filter used by us can efficiently clean irrigation water. Levels of arsenic contamination of biological and cultivation factors (sweet pepper, tomato, irrigation and drinking water) can be held below toxic levels. By use of the cerium filter tested in this study the consumption of vegetables seems to be safe.

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