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THE INFLUENCE OF ENVIRONMENTAL POLLUTION ON THE QUALITY OF LAVENDER

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Introduction

In urban and industrial areas, the air, water and soil have a high load of metal ions. The flora present in these areas is influenced by the presence of metal ions. The metals have the ability to accumulate in plants, when these are subject to contamination. Heavy metals toxicity in plants is well known due to the severe phytotoxic effects that can cause. The use of aromatic and medicinal plants in remedial techniques has increased regarding environmental pollution problems.

The metal ions contamination of air and water is a very important problem for human health, because they can generate carcinogenic and mutagenic effects, causing diseases for exposed population. Furthermore, contamination with metal ions can lead to the death of trees and flowers and, consequently, to the deterioration of green areas in urban regions.

Lavender is known for its multiple pharmacological effects, namely anticonvulsants, sedatives, antispasmodics, analgesics, antioxidants and local anesthetic activity, and thanks to its delightful smell it has been used in aromatherapy, cosmetics and perfumery. Lavender is also used in food production, being used to flavor drinks, ice cream, candies, pastry products, chewing gum and honey. For these reasons, the uptake of heavy metals by aromatic plants and their subsequent accumulation along the food chain is a potential risk to human health.

This paper presents a comparative study of the degree of retention of toxic metal ions and effect on the lavender plant species (*Lavandula spp.*) grown in polluted congested areas and relatively clean areas.

Materials and methods

The experimental studies were carried out on samples of lavender (*Lavandula spp.*), sampled from pollution free areas (crops from Moara Domneasca) and from intense polluted areas with intense car traffic (kilometer zero of Bucharest – Unirii Boulevard). Two plant samples were taken from each area. Also, soil samples were taken from each area. The concentration of toxic and essential metal ions, namely As, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Al, Fe, Zn, Ca, Mg, Na, K from the whole lavender plant was tracked, but also separately on organs respectively from the stem, leaves and flower.

Equipment: A Christ Alpha 1-2 LD Lyophilizer (Martin Christ GmbH, Germany) was used to dry the samples and an Ethos Up Microwave Digestion Systems - Milestone was used to prepare the vegetation samples. For the determination of metals, the ICP-OES technique - Inductively Coupled Plasma Optical Emission Spectrometry was used, with a Perkin Elmer Avio 500 spectrometer.

Reagents: The calibration curves were drawn using type Multi-element Certified Reference Material, 1000 mg/L, Sigma-Aldrich quality. Hydrochloric acid 37% and nitric acid 65%, quality p.a. Merck.

Procedure: The metal content of the soil was determined after extraction in aqua regia (15 mL of hydrochloric acid and 5 mL of nitric acid) from a sample mass of approximately 1.0 g, later the samples were filtered and diluted with ultrapure water until constant volume of 50 mL.

In terms of the vegetation samples, after drying in a lyophilizer, each sample was crushed, a quantity of 0.50 g was weighed and mineralized with a mixture of superpure nitric acid and hydrogen peroxide in a ratio of 10:3 (v/v). The samples were initially mineralized at room temperature for 24 hours to destroy the organic matter (cold digestion), followed by a microwave digestion program. The microwave digestion procedure was carried out with a 3-step program as follows: 15 minutes at 1800 W and increasing the temperature to 180°C; 15 minutes maintaining the temperature at a maximum of 180°C; cooling 10 minutes. After that, the samples were filtered and diluted with ultrapure water to a constant volume of 25 mL.

Results and conclusions

The results obtained from the intensively polluted area, in the whole lavender plant show high concentrations for Al (80 mg/kg and 147 mg/kg); Pb (2.03 mg/kg); Cu (8 mg/kg); Ni (1.32 mg/kg and 1.62 mg/kg); Cr (0.80 mg/kg); Mo (0.36 mg/kg); Zn (23.2 mg/kg); Mn (14.4 mg/kg and 22.5 mg/kg) and Fe (246 mg/kg and 352 mg/kg), compared to the pollution free area, where the concentrations in this area are low, Al (10.7 mg/kg and 15.6 mg/kg); Pb (<1.5 mg/kg); Cu (4 mg/kg); Ni (0.56 mg/kg); Cr (0.07 mg/kg and 0.11); Mo (0.12 mg/kg); Zn (12.2 mg/kg); Mn (8.29 mg/kg and 12.1 mg/kg) and Fe (32.9 mg/kg and 49.6 mg/kg), therefore the toxicity is insignificant on lavender from the pollution free areas. The lavender was grown directly in the soil, in natural environment. The analysis of the soil in the intense polluted area shows values that exceed the MAC (Maximum Admissible Concentration) according to the legislation in force. In conclusion, the characteristics of the area where lavender is grown in terms of atmosphere and soil are very important because lavender accumulates metal ions in various forms causing the deterioration of its quality.

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