LEVELS OF POLONIUM-210 IN THE GRAPEVINE LEAVES IN ALASEHIR DISTRICT OF TURKEY

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ABSTRACT

The objective of present work is the estimation of Po-210 (polonium) content in the edible grapevine leaves (Vitis vinifera, L.cv Sultana syn.) collected from Gediz plain in Western Turkey. Alasehir District in Gediz plain is one of the most important wineculture region of Turkey. Grapevine leaves are important food material for Dolma in Turkish cuisine. Dolma is a name applied to such vegetables as grapevina leaves, cabbage leaves and green peppers stuffed groundmeat or spiked rice. Levels of Po-210 in the grapevine leaves had not been analyzed before in Turkey.

In this study, after wet ashing of grapevine leaves, Po-210 was spontaneously plated onto a copper disc from dilute hydrochloric acid medium and deposited activity was measured. The results for Po-210 in the grapevine leaves are compared with the other foodstuff values in the literature.

INTRODUCTION

Po-210 belongs to the natural uranium-radium family; it is a naturally occurring radionuclide in the environment and it is considered as one of the highly toxic radioisotopes. It is an alpha emitter ($t_{1/2}$= 138.4 d), but in spite of its relatively short half-life, it is maintained in the atmosphere due to longer lived precursors such as Pb-210 ($t_{1/2}$=22 y).

The gas Rn-222 ($t_{1/2}$= 3.8 d) which has extreme mobility is the first decay product of Ra-226. Its rapid decay in the atmosphere generates Pb-210 and Po-210 that are adsorbed by aerosols and returned to earth as surface deposition or rainout (Watson, 1985). Pb-210 and Po-210 are taken up directly either from the soil or by foilar absorption from the air. They are also generated in the plant after absorption of Ra-226 from soil and water (Radford and Hunt, 1964; Tso et al., 1964).

The analytical chemistry of polonium covers a wide range of methods such as deposition, sorption, extraction, ion exchange, elecrodeposition...etc used for its determination in aqueous solutions (Narita et al., 1989; Nevissi, 1991; Moskvin et al., 1993; Ordonez-Regil and Iturbe, 1993). Among these methods, electrodeposition techniques are widely used for the determination of alpha emitting nuclides. Without using electrical energy, spontaneous

chemical deposition technique produces a thin uniform layer for high resolution alpha spectroscopy.

Grapevine leaves are important food material for Dolma in Turkish cousine. Dolma is a name applied to such vegetables as grape vine leaves, cabbage leaves and green peppers stuffed groundmeat or spiked rice.Levels of Po-210 in the grapevine leaves had not been analyzed before in Turkey.

Principle areas of vine growing in the province are Alasehir, the district around the provincial capital, Salihli, Turgutlu and Sarigol (Tahiroglu, 1993).

MATERIAL AND METHOD

Study Site:

Study area called "Gediz Graben" is situated at the North of Menderes Massif in Western Turkey. The Gediz Valley is one of the major E-W trending graben in Western Turkey. It is about 150 km long and is bounded by a normal fault system (Paton, 1992).

The grapevine leaves were collected during April 1998 at Alasehir-Manisa Region in Turkey. A total 20 grapevine leave samples were collected at this site.

Experimental:

For efficiency studies we have preferred a Pb-210 standard solution (2.9 nCi/mL, Baird Atomic) which is equilibrium with Po-210. The Pb-210 standard solution with the known activity was added to 0.5 M HCl acid solution of 150 mL in the polyethylene deposition cell for which the disc were used as the bottom of the cell, the deposition was carried out for 120 min at 65-70°C. After drying the disc at room temperature, they were counted for their alpha particle activity with a ZnS (Ag) scintillation detector.

Application of the technique for the determination of activity in grapevine leaves:

Grapevine leaves collected from Alasehir/Manisa Region in Turkey were dried for 2h at 105°C before the chemical procedure was started so as to reduce the water content and to achieve constant mass. The grapevine leaves (2g) were digested in 50 mL concentrated HCl and and 50 mL concentrated HNO_3 mixture at 70°C and then passed through filter paper (Whatman No:44). It was diluted with distilled water to 50 mL to reduce the acidity of the filtrate. A sample solution was transferred to a deposition cell and stirred with a Teflon rod to obtain a uniform deposit. Po-210 was deposited from the acidic solution on the copper disc for 2 h at 65°C. The copper plate was removed and rinsed with distilled water and acetone Then it was dried at room temperature. The α-particle activities onto the disc were measured with a scintillation detector.

Total efficiency= Chemical efficiency x Counting efficiency

<u>For the standard solution:</u>

Total (34.1±2.2 %)= Chemical efficiency (86.6 ± 2.3 %) x Counting efficiency (39.4 ± 0.7 %)

For the grapevine samples:

Total (24.0±1.5 %)= Chemical efficiency (62.0 ± 2.2 %) x Counting efficiency (39.4 ± 0.7 %)

RESULT AND DISCUSSION

The concentrations of Po-210 in the grapevine leaves of Alasehir Region in Turkey were minimum 3.3 Bq/kg, maximum 20.0 Bq/kg and mean 9.5 Bq/kg.

The differences in Po-210 concentrations in the grapevine leaves collected from different places around Alasehir in Gediz Plain may depend on the lithology and pH value of soil, application of the phosphate fertilizer and disinfection of grapevine leaves in some periods through the year.

According to these results, concentration of Po-210 in edible grapevine leaves in Alasehir Region is appreciable higher than the tomatoes (0.035 Bq kg^{-1}), cauliflower (0.022 Bq kg^{-1}), rice (0.11 Bq kg^{-1}), spinach (0.32 Bq kg^{-1}), potatoes (0.016 Bq kg^{-1}), coffee (0.27 Bq kg^{-1}). It is reported that concentration of Po-210 in yerba mate ranged from 16 to 19 Bq kg^{-1} and tea leaves ranged from 1 to 13± 0.6 Bq kg^{-1} (Colengelo et al., 1992).

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