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LANTHANIDES, ACTINIDES AND OTHER ELEMENTS IN THE ATMOSPHERIC FINE AND COARSE FRACTIONS BY INAA

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The particulate matter pollutant, especially PM10 and PM2.5, is considered one of the most difficult tasks in environmental chemistry for its complex composition and implications that complicate notably the behaviour comprehension. Among the various species present in the two fractions, a greater attention is devoted to study elements at elevated toxicity and wide diffusion in environment. In the last years a particular interest is assuming the determination of some elements of which few data exist in literature and that only recently they are considered in certain important industrial processes. Particularly, some precious metals such as Pd, Rh, Ir finding large usage in catalytic pots and rare earths such as Sm, Eu used in optical fibres and in electronics, should be considered even if the analytical determination is difficult for the very low levels to be detected. In this paper we have applied a nuclear technique, i.e. Instrumental Neutron Activation Analysis (INAA), for studying the metal composition in fine and coarse fractions. This nuclear technique allows the determination of about 25 elements: for some of them this is the first determination in the ambient air of Rome and particularly for lanthanides and actinides. The main results (min and max values) are reported and they can be considered representative of Rome. Basically, more elevated distribution in the coarse fraction than in the fine fraction whereas only few elements show a very good distribution between the two fractions (i.d., Br, Fe, Sb). No good correlation between the two fractions is shown by elements such as Ce (natural origin), Cs (no influence by marine air stream), Sc (natural origin and no industrial uses) and Th (consistent variability between summer and winter). From a toxicological point of view, no significant level of attention was found.

DETERMINATION BY INAA OF SELECTED ELEMENTS IN HUMAN FLUIDS OF HAEMODYALYSIS PATIENTS

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Nowadays, in medicine an important research field is the understanding of the metabolism of patients undergone to dialysis. In particular, the relationship between the kidney disease and the role of the elements is not always clear. This communication regards is a framework of a big project aimed to the knowledge of human metabolism in haemodialysis patients: it has been approached to obtain more information as possible from the analysis of each sample. The authors have tried to reach high sensitivity and to obtain accurate values for elements at very low concentrations: the Instrumental Neutron Activation Analysis was used for its characteristics to be a primary analytical method and because it does not require chemical-physical

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pre-treatment. The samples analyzed (about 300) are representative of groups of homogeneous population and specific matrices (whole human blood, serum, urine and haemodialysis liquid). The irradiation was performed in the in the rotating rack (Lazy Susan) of the Triga Mark II reactor of the R.C. Casaccia-ENEA at a neutron flux of 2.6×10^{12} n x cm^{-2} x s^{-1} and an irradiation time of 12 hours. The results on the blood report the values and the behaviour of selected trace elements: the levels of Br and Na show a decrease between the pre- and post-dialysis whereas Fe, K and Zn an increase. The other elements such as Cs, Rb and Se seem to keep constant between the two phases. Similar data are found in the other matrices for the same selected elements. Finally, exploiting the INAA peculiarity it has been investigated the levels of trace and ultra-trace elements interesting from a toxicological (Hg, Ni, Sb), nutritional (Co, Cr), geochemical and environmental (Eu, Sc) point of view and seldom determined by the analytical implications.

SPATIAL AND TEMPORAL TRENDS OF CORD BLOOD LEAD AND MERCURY LEVELS AROUND THE WORLD IN THE PAST DECADES

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The advanced techniques for single and multiple trace metal analysis in the past decades substantially improved the measurements of trace metals in biological samples, like cord blood in this study. The cord blood metal levels are therefore widely used as biomarkers for environmental metal exposure. For the comparison of spatial and temporal fluctuation of cord blood metal levels around the world, relevant studies dealing with these biological markers were electronically searched from the databases of PubMed, Medline, Google Scholar, and relevant university theses for newborns without parental occupational metal exposure. In general, the cord blood lead level was lowered down to about 30—40 μg/L, by an estimated decrement of around 40 μg/L, for the developing countries from 1980s to 2010, while that was lowered down to around 5—15 μg/L, by an estimated decrement of only about 20 μg/L, for the developed countries. As to the cord blood mercury level, it was generally lowered down to 3—10 μg/L, by an estimated decrement of about 15 μg/L in the past 30 years, varying among countries around the world. However, there was no significance between the developed and the developing countries. Based on a cross sectional study of 1526 newborns conducted in Taiwan from April 2004 to July 2005, results of regression analysis indicated that cord blood lead was negatively associated with maternal education ($p < 0.001$), positively associated with maternal age ($p < 0.05$), and also related to the location of residence ($p < 0.01$). On the other hand, cord blood mercury level was significantly positively associated with maternal education, maternal age, population density (all with $p < 0.001$), salty fish consumption ($p < 0.01$), and also related to the location of residence ($p < 0.01$). In conclusion, cord blood lead and mercury levels were generally decreased in the past decades, and the extent of change might be affected by different factors, such as the extent of national economic development, and familial social economic status.

THE EFFECT OF CADMIUM TOXICITY ON BLOOD PRESSURE AND PLASMA VISCOSITY

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Cadmium (Cd) is a quite toxic heavy metal, which affects many systems in humans and animals as a consequence of environmental and industrial pollution. Cd is taken to the human body by animal on plant origin food and through inspiration. The aim of this study is to investigate the effect of chronic Cd toxicity on blood pressure and plasma viscosity. In this study, 30 Wistar albino male rats were included as experimental group and 20 as control group, and they were fed with normal food and tap water for 8 weeks. But, in experimental group water contained 15 mg/L cadmium chloride. Systolic blood pressure and heart rate were measured from the tail of the rats. In blood samples drawn Cd levels were determined by atomic

absorption spectrophotometer and plasma viscosity values by viscosimeter. Blood cadmium levels were found to be significantly higher in the experiment group than the control group ($p < 0.001$). Viscosity values were found to be 2.21 ± 0.54 centipoise (cP) in the experiment group and 1.62 ± 0.31 cP in the control group. This increase in the experiment group was significant ($p < 0.001$). In the experiment group, changes in systolic blood pressure between weeks were significant ($p < 0.001$). Alterations in heart rate in control and experiment groups were not significant ($p > 0.05$). According to our findings, cadmium toxicity leads to increase in blood pressure and plasma viscosity.

GEOGRAPHICAL DISTRIBUTION OF REFERENCE VALUES FOR BLOOD METALS IN THE ITALIAN POPULATION

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A human biomonitoring survey (PROgramme for Biomonitoring of Exposure, PROBE) has started in Italy to assess the internal dose levels of metals in the general population. Sixteen Italian regions for a total of ca. 5,000 urban subjects (adults and children) are involved and 19 metals (Be, Cd, Co, Cr, Hg, Ir, Mn, Mo, Ni, Pb, Pd, Pt, Rh, Tl, U, V and W) are determined. The following results are presented: (i) standardization and quality assurance for the procedures for metal quantification; (ii) analysis over time of the internal dose of toxic metals and the interpretation with regard to specific geographical areas; (iii) the assessment of reference values useful as reference tools for environmental hygiene and health protection. The availability of PROBE data will allow regulatory authorities to: (i) evaluate the effectiveness of the existing public health activities aimed at reducing the exposure of Italians to metals, (ii) prioritize scientific research on this topic; (iii) organize targeted monitoring plans, also at local level, to prevent the health risk for the exposed population.