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Vanadium - an element both essential and toxic to plants, animals and humans?

2005-09-01

Vanadium is present in the earth’s crust at an average concentration of 110 mg/kg. Vanadium is concentrated, mainly in mafic rocks (basalt 200-250 mg/kg) and shales (100-130 mg/kg), lowest concentrations were found in limestones and dolomites (10-45 mg/kg). The average vanadium content of soils worldwide have been calculated to vary from 18 (peat) and 115 mg/kg (Rotliegende weathering soils). Burning of fossil fuels caused about 110000 t V/a to enter the atmosphere globally. With help of indicator plants (wheat, rye, red clover) the local plant bioavailable vanadium offer is to investigate. All foodstuffs, rich in starch and sugar and of animals are poor in vanadium (5-40 mug V/kg dry matter, dm); mushrooms and leafy vegetable contain higher levels of vanadium (100 to > 1000 mug V/kg dm). Beer and wine (30 to 45 mug/l) deliver much vanadium. In Germany and Mexico women with mixed diet take in 10 to 20 mug V/day and men 20 to > 35 mug V/day. The high intake results from the higher beer consumption of men. Vegetarians take in significantly more vanadium. The vanadium concentration of organs and milk is not homeostatically regulated. Most tissues of the fauna reflect the vanadium status. Fecal excretion of the nutritional vanadium intake amounts to 96% in men and non lactating women and to 79 in lactating women. On an average, adults of both sexes and with either form of diet eliminate 4% of the vanadium intake renally. Lactating women secret 17% of the vanadium intake into the milk. Vanadium is essential for several species of green algae, fungi and nitrogen-fixing microorganisms.

The inactive apoenzymes of bromoperoxidase, iodoperoxidase and chloroperoxidase can be reconstituted by vanadium to active haloenzymes. The normative vanadium requirement for animals is with < 10 mug/kg feed dry matter or < 10 mug V/day of man small. Intrauterine vanadium depleted goats developed poorly, their conception rate were significant by reduced, they exhibited a higher rate of spontaneous abortion, increased ratio of female to male kids born and a higher mortality. Vanadium deficient kids suffered of skeletal deformations in the forelegs. The size of their pancreas, thymus and thyroid were insignificantly increased. Vanadium may well be found essential for some halogenperoxidases, perhaps one, that is involved in thyroid metabolism. It is to distinguish between nutritional (mug/day), pharmacological (mg/day) and toxic (mg/kg food dry matter) of vanadium. Vanadium phytotoxicity (chlorosis and dwarfing) under field conditions is extremely rare. Intake of feed with 10 to 300 mg V/kg feed dry matter animals induced black diarrhea, weakness, spontaneous abortions, decreased milk production and high mortality in animals. Vanadium inhibits the Na+ - K+ ATPase and open the potassium-channels of the erythrocyte membrane. In humans, the threshold level for vanadium toxicity is > 3 mg/day. Higher doses can induces diarrhea, green tongues, haematological changes and lowered cysteine content in hair and nails.

Authors: Anke, Manfred

Full asource: Anales de la Real Academia Nacional de Farmacia 2004, 70(4), 961-999 (Eng)

Assessing exposure to organophosphorus pesticides by biomonitoring in epidemiologic studies of birth outcomes

2005-09-01

For epidemiological studies that evaluate the relation between potential exposures to environmental chemicals and adverse outcomes, accurate assessments of exposures and health outcomes are needed. Three prospective cohort studies recently evaluated the relation between exposure,
as assessed by biomonitoring, of pregnant women to organophosphorus pesticides and several birth outcomes. Here these 3 studies are compared in terms of the exposure scenarios and exposure assessments. The primary focus is on the exposure assessments, all of which employ biomonitoring but use different approaches, which may contribute to the different findings. These approaches and how they may contribute to different relations between exposure and birth outcomes are examined.

Authors: Needham, Larry L.

Full source: Environmental Health Perspectives 2005, 113(4), 494-498 (Eng)

Exposure of nursery school children and their parents and teachers to di-n-butylphthalate and butylbenzylphthalate

2005-09-01

Some phthalates, among them di-n-butylphthalate (DnBP) and butylbenzylphthalate (BBzP), are known reproductive and developmental toxicants in animals and suspected endocrine disruptors in humans. Children are probably the most susceptible to these effects. To obtain an estimate of internal exposure to DnBP and BBzP the authors compared the excretion of their metabolites in the urine of nursery school children with that of their teachers and parents. Within the children’s cohort the authors found elevated MnBP exposure to be caused by augmented use of skin-care products. Authors have shown that the internal exposure to MnBP and MBzP in children is approximately 2- to 4-times higher than in adults. Correlation of internal MnBP with MBzP exposure points to common sources of exposure for both phthalates. DnBP exposure seems, at least in part, to be connected with the use of body/skin care products and certain medications.

Authors: Koch, Holger M.; Preuss, Ralf; Drexler, Hans; Angerer, Juergen

Full source: International Archives of Occupational and Environmental Health 2005, 78(3), 223-229 (Eng)

Total Lung Deposition of Ultrafine Particles in Elderly Subjects During Controlled Breathing

2005-09-01

Ultrafine particulate matter (PM) in the air may be harmful to health, particularly in elderly subjects. From the dosimetry point of view, it is not known if the elderly subjects are more susceptible to exposure to ultrafine PM. The authors measured the total deposition fraction (TDF) of ultrafine PM in the lungs of healthy, elderly subjects and compared the results with those obtained from young adults in an earlier study. Apparently, healthy, elderly subjects are not subjected to a greater respiratory dose of ultrafine PM than young adults under the same exposure conditions.

Authors: Kim, Chong; Jaques, Peter

Full source: Inhalation Toxicology 2005, 17(7-8), 387-399 (Eng)

Cadmium and lead levels in deciduous teeth of children living in Mexico City

2005-09-01

Cd and Pb levels in 79 deciduous teeth from children between 5 and 13 years old-living in the Mexico City Metropolitan Zone were determined. Pb and Cd concentrations showed a positive skewed distribution and results were transformed into logarithms. The geometric mean concentrations (GM) in all
teeth were 0.22 ± 3.4 and 10.2 ± 2.2 mug g⁻¹ for Cd and Pb, respectively. No statistical differences were observed for Cd and Pb concentrations among tooth type, tooth position, gender, socioeconomic level, and use or no use of color crayons. Cd values decreased with children’s age and Pb levels did not show a clear tendency. Statistical differences were only observed for Cd according to age.

Authors: Baez, Armando; Belmont, Raul; Garcia, Rocio; Hernandez, Juan Carlos
Full source: Revista Internacional de Contaminacion Ambiental 2004, 20(3), 109-115 (Eng)

Chromium and manganese levels in the scalp hair of normals and patients with breast cancer
2005-09-01
The adverse health effects linked with chromium and manganese and the diverse cellular and molecular effects of chromium and manganese make the study of chromium and manganese carcinogenesis and toxicology very interesting and complex. Quantitative elemental analysis of scalp hair of breast cancer patients (stage III) and controls were used to find any correlation and possible changes between breast cancer and healthy controls. Comparison of mean elemental contents of the breast cancer patients with controls showed a significant enhancement of chromium but declining trends for manganase in breast cancer patients. Changes in element content in hair can serve as a guide to opening up new vistas in the treatment of breast cancer on the basis of an overall analysis of symptoms and signs.

Authors: Kilic, Eser; Saraymen, Recep; Demiroglu, Asuman; Ok, Engin
Full source: Biological Trace Element Research 2004, 102(1-3), 19-25 (Eng)

Evidence for increased internal exposure to lower chlorinated polychlorinated biphenyls (PCB) in pupils attending a contaminated school
2005-09-01
External and internal exposure to six WHO-indicator congeners of polychlorinated biphenyls (PCB 28, 52, 101, 138, 153, 180) as well as subjective health complaints of a group of 377 pupils attending a PCB-contaminated school were compared with a control group of 218 pupils attending a non-contaminated school. Indoor air of the contaminated school revealed total PCB concentrations ranging between 690 and 20800 ng/m3. The lower chlorinated congeners PCB 28, 52, 101 were the prevailing contaminants. It is concluded that exposure of pupils to PCB in indoor air of the contaminated school caused increased blood concentrations of lower chlorinated congeners. Compared to background levels the detected excess body burden was very low indicating no additional health risk. Exposure was not associated to any specific subjective complaints.

Authors: Liebl, Bernhard; Schettgen, Thomas; Kerscher, Guenther; Broding, Horst-Christoph; Otto, Andrea; Angerer, Juergen; Drexler, Hans
Full source: International Journal of Hygiene and Environmental Health 2004, 207(4), 315-324 (Eng)
Nicotine and surface of particulates as indicators of exposure to environmental tobacco smoke in public places in Austria
2005-09-01
As part of a Europe-wide project the amount of exposure to environmental tobacco smoke (ETS) in public places like schools, restaurants, and public transport facilities was investigated. Highest ETS concentrations were found in discos and intermediate concentrations in restaurants with no significant difference between smoking and non-smoking areas but on average higher values in restaurants with no separation between smoking and non-smoking areas. Concentrations usually below 10 μg/m³ were found in transport facilities and in schools. In hospitals “problem spots” were sought and so concentrations from very low to as high as 45.1 μg/m³ next to a smoking area with no physical barrier or separation and 47.7 μg/m³ inside a smoking room could be documented. The fine particle’s surface correlated well with the nicotine concentration. Only in one instance (in a pizza restaurant on a busy road with heavy duty diesel traffic and the sampling spot next to the pizza stove) high concentration of fine particles was detected without high nicotine. Tobacco smoke is a key source of indoor fine particles. Health policy must intervene to change the situation found at present in many public places in Austria.
Authors: Moshammer, Hanns; Neuberger, Manfred; Nebot, Manel
Full source: International Journal of Hygiene and Environmental Health 2004, 207(4), 337-343 (Eng)

Pesticide product use and risk of non-Hodgkin lymphoma in women
2005-09-01
A population-based, incidence case-control study was conducted among women in upstate New York to determine whether pesticide exposure is associated with an increase in risk of non-Hodgkin lymphoma (NHL) among women. Overall cumulative frequency of use of household pesticide products was positively associated with risk of NHL, which was most pronounced when they were applied by subjects themselves. When exposure was analyzed by type of products used, a significant association was observed for mothballs. The associations with both occupational and household pesticides were, particularly elevated if exposure started in 1950-1969 and for high-grade NHL. Although the results of this case-control study suggest that exposure to pesticide products may be associated with an increased risk of NHL among women, methodological limitations related to selection and recall bias suggest caution in inferring causation.
Authors: Kato, Ikuo; Watanabe-Meserve, Hiroko; Koenig, Karen L.; Baptiste, Mark S.; Lillquist, Patricia P.; Frizzera, Glauco; Burke, Jerome S.; Moseson, Miriam; Shore, Roy E.
Full source: Environmental Health Perspectives 2004, 112(13), 1275-1281 (Eng)

Comparison of 1-hydroxypyrene exposure in the US population with that in occupational exposure studies
2005-09-01
Urine samples collected in 1999 and 2000 as part of the National Health and Nutrition Examination Survey (NHANES) were analyzed for 14 monohydroxy polycyclic aromatic hydrocarbons (PAH); for the first time, reference range values were calculated for these metabolites in the US population. There were...
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no statistically significant differences among age, gender, or race/ethnicity groups. Adult smokers in the US have urinary 1-OHpyrene concentrations 3 times higher than those of non-smokers. This difference was statistically significant. The reference range of urinary 1-OHpyrene concentrations were compared with concentrations reported from various occupations by other researchers.

Authors: Huang, Wenlin; Grainger, James; Patterson, Donald G., Jr.; Turner, Wayman E.; Caudill, Samuel P.; Needham, Larry L.; Pirkle, James L.; Sampson, Eric J.
Full source: International Archives of Occupational and Environmental Health 2004, 77(7), 491-498 (Eng)

Air pollution and childhood asthma emergency hospital admissions: Estimating intra-city regional variations 2005-09-01
This study aims to assess associations of regional ambient air pollutants on emergency department childhood asthma presentations across 4 regions of the city of Melbourne, Australia. There was consistent association between childhood ED asthma presentations and regional concentration of PM10, with a strongest association in the central district of Melbourne. NO2 and ozone was associated with increased childhood asthma ED presentations in the Western districts. This study suggests that regional concentrations of PM10 may have a significant effect on childhood asthma morbidity. In addition, ozone may play a role however, its effect may vary by geographic region.

Authors: Erbas, Bircan; Kelly, Anne-Maree; Physick, Bill; Code, Colleen; Edwards, Mary

Environmental fate and bioavailability of Agent Orange and its associated dioxin during the Vietnam war 2005-09-01
Scientific literature related to the environmental fate of Agent Orange and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and how this affected potential exposure of ground troops to TCDD in Vietnam was reviewed. An evaluation of spray systems used to disseminate herbicides in Vietnam showed they were capable of highly precise application in terms of concentrations sprayed and area treated. Research on tropical forest canopies with leaf area indexes of 2-5, indicated the amount of herbicide and associated TCDD reaching the forest floor would have been 1-6% of the total aerial spray. Studies of plant cuticle layer surface wax properties suggested Agent Orange, including the TCDD, would have dried, i.e., be absorbed into the plant cuticle wax layer, within minutes after spraying and could not be physically dislodged. Agent Orange and associated TCDD leaf and soil surface studies demonstrated sunlight photolysis would have rapidly decreased the TCDD concentration; this process continued in shade. Dislodgeable foliar residues studies showed only 8% of DFR was present 1 h after application, decreasing to 1% of the total 24 h after application. Human volunteer studies confirmed that after 2 h of saturated contact with bare skin, only 0.15-0.46% of 2,4,5-T, a phenoxy acetic acid compound which was an active ingredient of Agent Orange, entered the body and was eliminated in urine.

The prospect of TCDD exposure from Agent Orange in ground troops in Vietnam seemed unlikely in light of TCDD environmental dissipation, little bioavailability, and herbicide properties and application circumstances.
Photochemical degradation of TCDD and limited bioavailability of residual TCDD in soil or on vegetation suggests dioxin concentrations in ground troops who served in Vietnam would have been small and indistinguishable from background concentrations even if they were in recently treated areas. Literature reported laboratory and field data provide compelling evidence on the environmental fate and dislodgeability of herbicide and TCDD. This evidence of the environmental fate and poor bioavailability of TCDD from Agent Orange was consistent with observed little or no exposure in veterans who served in Vietnam. Appreciable TCDD accumulation in veterans would have required repeated long-term direct skin contact of the type experienced by US Air Force RANCH HAND and US Army Chemical Corps personnel who handled or had direct contact with liquid herbicide, not from incidental exposure under field conditions where Agent Orange was sprayed.

Authors: Young, Alvin L.; Giesy, John P.; Jones, Paul D.; Newton, Michael
Full source: Environmental Science and Pollution Research International 2004, 11(6), 359-370 (Eng)

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**PCB contamination from polysulphide sealants in residential areas-exposure and risk assessment**

2005-09-01

From the late 1950s to the early 1970s elastic polysulfide sealants were used in outdoor seams between concrete blocks in prefabricated buildings. The sealants contained 5-30% polychlorinated biphenyls (PCBs). Due to the weathering of sealants in general and the replacement of seams with new PCB-free materials in the 1990s, PCBs have drifted to the soil adjacent to buildings. The objectives of this study were to survey PCB contamination in the surroundings of former PCB-containing buildings and to evaluate the risks to human health. The mean total PCB concentration was 6.83 mg/kg within 2 m of the buildings and 0.52 mg/kg within 3-10 m from the buildings. The deterministic risk assessment with conservative parameters resulted in lifetime cancer risk estimates on the order of 10^-6-10^-7. The lifetime average daily dose (LADD) for PCBs was less than 10% of the reference dose (RfD) 0.02 μg/kg day, which is based on immunosupression in monkeys. The LADD corresponding to the total site attributable exposure was less than 10% of the estimated average dietary PCB intake in Finland. Children can, however, in worst cases be exposed to daily doses near the level of the RfD. Low cost measures are recommended to reduce possible exposure of children.

Authors: Priha, Eero; Hellman, Sannamari; Sorvari, Jaana
Full source: Chemosphere 2005, 59(4), 537-543 (Eng)