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A STUDY OF BENZENE AND 1,3-BUTADIENE CONCENTRATIONS IN THE URBAN ATMOSPHERE OF TOKYO

Volatile organic compounds (VOCs) are of great importance in air quality measurement. They are present in especially high concentrations in urban areas, causing adverse health effects.

In a recent study conducted in Japan, benzene and 1,3-butadiene concentration profiles in the urban ambient air were generated to investigate their levels at two specified sampling locations, roadside and residential, in Tokyo. Air monitoring data for benzene and 1,3-butadiene were obtained from the Air Quality Monitoring Information of the Tokyo Metropolitan Government. Air samples were continuously obtained and analyzed every hour for VOCs using an automated GC-MS system. The diurnal variations in benzene and 1,3-butadiene concentrations showed bi-modal patterns, which were considered to be related to the increasing and decreasing trends of vehicle emissions and vertical mixing depths in a day. The frequencies of occurrence of various benzene and 1,3-butadiene concentrations were examined. The results of each concentration showed log-normal forms with almost straight lines. The frequency distributions of both pollutants were confirmed to have a log-normal, rather than a simple normal, form. The relationship between benzene and 1,3-butadiene concentrations at both the roadside and residential site were examined. Separate observations of day and night trends revealed that photochemical decomposition showed a greater influence on the data in the residential site than that in the roadside site.

Although many investigations have studied these compounds in urban areas, detailed information on their behavior is still limited. Extensive data are now available to characterize these important ambient toxics (Bureau of Environment, Tokyo Metropolitan Government, 2005). However, only few well-organized interpretations of these data have been published because of the variations in factors such as meteorological conditions, relative position of subject and source, and vehicle traffic volume.

The present study creates a compilation of benzene and 1,3-butadiene concentration profiles to interpret their measurement levels at two specified sampling locations; roadside and residential. The data includes diurnal variation in concentration, as well as frequency distribution and day and night trends. Separate observations of air pollutant concentrations in day and night offer great insights into the relative importance of various sources, and the atmospheric reactions of benzene and 1,3-butadiene. They are also useful for formulating proper strategies to control air quality.

Source: Atmospheric Environment, Vol. 43, Issue 12, April 2009.

Human Plasma Concentrations of Persistent Organic Pollutants and Intake of Marine Food

Locally caught marine food is important for people in rural communities along the Norwegian coastline. Women living along the northern and western coast of Norway have a mean intake of 63 g fish per day. This corresponds to approximately two fish dinners a week and is almost twice as much as what the Swedish and Danish women consume. Lean fish constitutes two thirds of the Norwegian dietary fish intake and the remaining one third is fatty fish. The most common fish consumed are cod, coley, salmon and mackerel. Several traditional marine dishes are also ingested throughout the year depending on season; during winter months a dish consisting of boiled cod liver and fresh cod liver oil is frequently served as dinner in some parts of the country. Seagull eggs are harvested and consumed during spring, but to a much lesser extent than cod liver. During the summer and early fall, freshly caught coley and coley liver is boiled and served as dinner, mostly along the northern coast of Norway. These traditional dishes have often a high cultural value in addition to contain many essential nutrients, *e.g.,* unsaturated fatty acids and vitamin D which have been shown to have beneficial effects on human health. The production of vitamin D in skin among humans is dependent on UV radiation from the sun. During winter in northern Norway the sun is under the horizon for two months and the cutaneous production of vitamin D is negligible. Consumption of cod liver has then historically been the most important source of vitamin D for coastal populations during the dark winter months.

Despite the beneficial effects, concerns have been raised about consumption of fatty fish, fish liver and seagull eggs due to their content of persistent organic pollutants (POPs). Even though there are only a few local sources, POPs are found in the Arctic due to their susceptibility to undergo long-range transport. Most POPs are lipophilic and persistent in the environment; therefore, they may bioaccumulate in organisms and biomagnify in the food chain. The marine food web is especially vulnerable to contamination due to many factors, *e.g.,* long food chains with high content of lipids that favour biomagnification of POPs. Therefore, species harvesting from the top of the marine food chain, *e.g.,* humans, may be exposed to high concentrations of POPs.

The Norwegian Food Safety Authority currently recommends people to eat more fish and vary the types of fish consumed due to the expected beneficial effects of a fish rich diet. They also recommend people in general to minimize their intake of fish liver and seagull eggs and argue that eating one gull egg a year will increase your total contaminant body burden by 10%. Pregnant women, women of childbearing age and children should avoid eating fish liver and seagull eggs due to the content of POPs. Greenlandic halibut above 3 kg should also be avoided due to the content of mercury.

Now a study has been conducted to investigate the concentrations of POPs in human blood in relation to consumption of fatty fish, fish liver, fresh fish liver oil, halibut and seagull eggs. This cross sectional study was performed in the municipality of Andenes at 69 degrees north in Norway, where many inhabitants have a marine based diet.

The study concluded that there was no significant association between consumption of fatty fish and concentration of POPs. The mean intake of fatty fish in the high consumption group was 810 g/month. This equals approximately four dinners of fatty fish per month. Salmon is the most common fatty fish consumed. It has been argued that one should eat less than 1 meal of farmed salmon per month based on potential cancer risks due to POP concentration in farmed salmon. In Norway, mostly farmed salmon is consumed due to availability in grocery stores. Since researchers found no association between POP concentration and intake of fatty fish, this consumption advice seems excessive. Eating as much as one meal of fatty fish per week did not increase the body burden of the measured POPs significantly in this study group.

Furthermore, consumption of halibut did not influence the POP concentration in plasma. The Norwegian Food Safety Authority claim that a high intake of Greenlandic halibut above 3 kg over a long period of time may lead to elevated concentrations of mercury; therefore pregnant women and children are advised against consumption of Greenlandic halibut. However, they also state that there are not many people in Norway that actually consume Greenlandic halibut today. Hence, there should be no concerns for people in general. It is not common to find Greenlandic halibut in grocery stores, but in contrast, halibut is frequently found in Norwegian shops. This may lead to confusion. Taken together, one could raise the question if it is wise to advise against consumption of Greenlandic halibut or if one should be more concerned about the possible implications of an equivocal message about healthy/non-healthy effects of fish consumption. However, there should be no concerns about a moderate intake of halibut and POP concentrations.

Marine food does contain healthy fatty acids and many important vitamins. There are several studies showing the healthy effects of a modest marine based diet. Seasonal variations of vitamin D have been measured in this study population throughout a year. When adjusting for possible confounders, no seasonal variation was found even though the solar induced cutaneous production of vitamin D is negligible during several months per year in this area. This phenomenon was explained by a high dietary intake of vitamin D, mainly from fatty fish, fish liver and fresh fish liver oil. Also, the Norwegian Women and Cancer study investigated the association between fish liver consumption and cancer risk in 64,285 women. No association was found between intake of fish liver and increased risk for cancer in breast, uterus or colon. In contrast, they found a decreased risk for total cancer. In addition, temporal trends of PCBs and some other chlorinated pesticides in fish and air samples from northern Europe show a declining trend of concentrations from the 1970s until now. Concentrations of these legacy POPs can be expected to further decrease in the future at least in some parts of the world. Consequently, it seems that the favorable effects of eating fish liver and fatty fish, *e.g.,* stable vitamin D status and decreased risk of cardiovascular disease, outweigh the concerns about increased body burdens of POPs, especially for people living north of the Arctic Circle.

Source: Journal of Environmental Monitoring, Vol. 11, Issue 2, February 2009.

A STUDY OF THE ENVIRONMENTAL BURDEN OF LEAD IN CHILDREN IN A CONTAMINATED URBAN AREA

Metals are the most ancient toxic elements known to man. Anthropic intervention has changed their potential effects on health, particularly by means of transportation among several parts of the world through air, water, soil and food. Lead is an important, highly toxic and harmful metal. A recent study focuses on the chronic incorporation of lead in children from poor families living in a small and allegedly contaminated area in the city of Sao Paulo, in Brazil. The study uses a biokinetics code which is based on an accepted International Commission on Radiological Protection (ICRP) biokinetics model for lead, in order to extrapolate the results from teeth to other organs.

Gasoline in Brazil has been unleaded since 1992. However, lack of rigorous control on the disposal to the environment of domestic and industrial waste, associated with the low recycling rate of batteries, makes lead an ever present contaminant and at non-negligible amounts. Additionally, lead is used in more than 200 distinct industrial processes.

Epidemiological and toxicological studies undertaken in individuals exhibiting lead concentration in blood, near or below the maximum recommended by the World Health Organization (10 µg/dl), surprisingly revealed that toxic effects are more intense in individuals belonging to low socioeconomic classes. In particular, learning difficulties, lack of concentration and memorization, and aggressive behavior have been reported. The most vulnerable individuals are children, particularly from the neonatal period until prepuberty. These findings upgrade the importance of studying chronic contamination scenarios with low, non-critical lead quantities. In Brazil, as in many others countries, the great majority of studies refer to regions where acute and occupational contamination has been verified.

The south region of Sao Paulo city has been subject to intense and irregular populational occupation for more than 20 years, associated with lack of basic infrastructure. This region hosts the Guarapiranga dam, which belongs to a huge hydrographical basin located south of Sao Paulo city, covering an area of 643 km^2 encompassing Sao Paulo city itself plus six neighboring villages. About 36% of the basin area (229 km^2) with the dam inside is in Sao Paulo city. The Guarapiranga dam is responsible for water supply to 25% of Sao Paulo population, nearly 3.7 millions of inhabitants. The fringe surrounding the dam is irregularly occupied by a population of 60,000.

Measurements undertaken on sediment and particulate materials in the dam revealed concentrations of lead, copper, zinc and cadmium above internationally accepted limits. For lead in particular, although its content in water is within normal limits, the concentration in sediment is very high.

Human exposure to metals is commonly monitored through the analysis of urine, blood, hair and saliva. These bioindicators are easy to sample, and existing measuring techniques and methodologies are well established. However, blood and urine data provide information on recent exposures, that is, those occurring at times close to the sampling date. Furthermore, appreciable amounts of the contaminant could be gradually incorporated from a steady source, without an alarming increase of its level in blood. Hair and fingernail are considered medium-range bioindicators, associated with exposure times from a few months to years and providing, in the case of hair, more precise information on acute exposures.

According to the goals of the present study, i.e. chronic incorporation, the use of indicators working as contaminant dumps through long periods of time (bioindicators for long-range exposures) is necessary. In this regard, teeth fulfill nearly all of the investigation needs since: (1) they are easily obtainable from children; (2) present the same structure of bone and, therefore, they have the same metal affinity, and (3) their remodeling is slow; as a consequence, the contaminants clearance is much smaller *vis-à-vis* other organs. Therefore, teeth allow for both an exposure longstanding record and inferences on the contaminant content of the skeleton.

In the study, a total of 74 human teeth were collected and analyzed, 50 from children living in the region of the Guanapiranga dam and 24 from children in the control area of Osasco, a developed village west of the city of Sao Paulo, where the population uses only treated water from authorized supplies.

The average concentration of lead in teeth of children 5 to 10 years old was determined by means of a high-resolution inductively coupled plasma mass spectrometer (ICP-MS). For standardization of the measurements, an animal bone certified material (H-Animal Bone), from the International Atomic Energy Agency, was analyzed. The amount of lead in children living in the surroundings of the dam was approximately 40% higher than in those from the control region, and the average lead concentration was equal to 1.3 g/g approximately. Grouping the results in terms of gender, tooth type and condition, it was concluded that a carious molar of boys is a much more efficient contamination pathway for lead, resulting in concentrations 70% higher than in the control region.

Source: Environment International, Vol. 35, Issue 3, April 2009.

Non-Cancerous Chronic Lung Disease Resulting from in utero and Early Postnatal Exposures to Arsenic

Growth and development requires the temporal and spatial coordinated expression of genes and gene products. During this critical time, *in utero* and early postnatal exposure to toxicants has the potential to affect gene expression, altering organ structure and physiological function which can be manifested as adult disease. While the potential adverse health outcomes that result from exposures during these sensitive developmental times are recognized, only limited attention has been paid to the effects of environmentally relevant exposures to toxicants during these critical periods of development. Inorganic arsenic is a ubiquitous environmental toxicant, found in high concentrations throughout the world. Chronic environmental arsenic exposure through consumption of geologically contaminated drinking water has been correlated with increased incidence of and mortality due to internal cancers of the lung, skin, kidney, urinary bladder and liver. In addition, reports from human studies in Chile, Bangladesh and the West Bengal region of India show that chronic exposure to arsenic via drinking water is correlated with increased incidence of chronic cough, chronic bronchitis, shortness of breath and obstructive or restrictive lung disease. Taken together, these studies argue unequivocally that the lung is targeted by arsenic, producing both carcinogenic and non-carcinogenic endpoints.

It has been reported that high exposures to arsenic in drinking water (800 ppb) during sensitive developmental times can lead to adverse health outcomes and increased mortality. Drinking water exposures to high levels of arsenic either *in utero* or during early childhood development led to an increased risk of dying from lung cancers and chronic lung disease in young adults. Exposures in early childhood led to a standardized mortality ratio (SMR) for lung cancer of 7.0 and a SMR for bronchiectasis of 12.4. For those exposed both during *in utero* and early childhood, the SMRs were 6.1 for lung cancer and 46.2 for bronchiectasis. These findings suggest that exposure to arsenic in drinking water during early childhood or *in utero* has pronounced pulmonary effects, greatly increasing subsequent mortality in young adults from both malignant and nonmalignant lung disease. The effects and the molecular targets for alterations after exposure to environmentally relevant levels (0 to 100 ppb) of arsenic, levels that would be seen in some regions of the United States, are not known.

In addition to the effects reported on the lung, early developmental exposures have also been associated with other adverse outcomes in humans. Arsenic is able to cross the placenta. In Chilean populations with well defined arsenic exposures, an association between arsenic exposure in the drinking water and adverse reproductive outcomes (increased infant mortality and decreased birth weight) were suggested. Autopsy tissues from five children living in the Antofagasta area of Chile (high arsenic exposure region) revealed increased arterial intimal thickening. No reports exist concerning the relationship of arsenic exposures and lung function in children. Animal and *in vitro* models have been used in attempts to determine the sites and the mechanisms of developmental toxicity of inorganic arsenicals.

In a recent study using a mouse model, *in utero* and early postnatal exposures to arsenic (100 ppb or less in drinking water) were found to alter reactivity to methacholine challenge in 28 day old pups.

Removal of mice from arsenic exposure 28 days after birth did not reverse the alterations in sensitivity to methacholine. In addition, adult mice exposed to similar levels of arsenic in drinking water did not show alterations. Therefore, alterations in airway reactivity were irreversible and specific to exposures during lung development. These functional changes correlated with protein and gene expression changes as well as morphological structural changes around the airways. Arsenic increased the whole lung levels of smooth muscle actin in a dose dependent manner. The level of smooth muscle mass around airways was increased with arsenic exposure, especially around airways smaller than 100 m in diameter. This increase in smooth muscle was associated with alterations in extracellular matrix (collagen, elastin) expression. This model system demonstrates that *in utero* and postnatal exposure to environmentally relevant levels of arsenic can irreversibly alter pulmonary structure and function in the adults.

Source: Toxicology and Applied Pharmacology, Vol. 235, Issue 1, February 2009.

Biosorptive Removal of Arsenic from Drinking Water

Arsenic is highly toxic and has historically been used as a poison. Acute poisoning has a mortality rate of 50-75%, and death usually occurs within 48 h. Arsenic contamination has been acknowledged as a “major public health issue”. Arsenic is classified as a group A and category 1 human carcinogen by the US Environmental Protection Agency (US EPA, 1997) and the International Association For Research on Cancer (IARC, 2004), respectively. The WHO provisional guideline of 10 ppb (0.01 mg/l) has been adopted as the drinking water standard. However, many countries including Bangladesh and China have retained the earlier WHO guideline of 50 ppb (0.05 mg/l) as their standard or as an interim target. In 2001, US EPA published a new 10 ppb (0.01 mg/l) standard for arsenic in drinking

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EVIDENCE ON THE ASSOCIATION BETWEEN DIOXIN EXPOSURE AND CARDIOVASCULAR DISEASE MORTALITY IN HUMANS

The term "dioxin" refers to a diverse group of structurally related, environmentally persistent chemicals that exert toxic effects through a common pathway mediated by the aryl hydrocarbon receptor. Dioxins include several types of polyhalogenated aromatic hydrocarbons: polychlorinated dibenzofurans (PCDFs); some types of polychlorinated biphenyls (PCBs); and polychlorinated dibenzo-p-dioxins (PCDDs), including 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD), the most potent member of this class of chemicals.

Although studies have demonstrated that the fetal mammalian heart is a sensitive target of TCDD-induced teratogenicity, only in the past few years have toxicologic studies demonstrated cardiovascular effects after exposure to dioxins in adult rats and mice. These effects did not seem to occur as a result of overt toxicity. Chronic exposure of rats to either TCDD or PCB-126, the most potent of the dioxin-like PCBs, led to a dose-dependent increased incidence of degenerative cardiovascular lesions, including cardiomyopathy and chronic active arteritis. PCB-126 also increased heart weight, serum cholesterol levels, and blood pressure in rats. Adult mice exposed subchronically to TCDD developed increased blood pressure and heart weight, as well as elevated markers of oxidative stress. Increased blood pressure and triglyceride levels were also observed after an acute high dose of TCDD in mice. *ApoE-/-* mice exposed to subchronic doses of TCDD also developed earlier and more severe atherosclerotic lesions. Some of these changes may be due to altered gene expression, inflammation, and oxidative stress, whereas others may relate to direct effects on cardiomyocytes involving dioxin perturbation of key calcium signaling pathways leading to abnormal depolarization. Recent evidence that TCDD causes mitochondrial dysfunction in cell culture may suggest an additional mechanism for the effect of dioxin on the cardiovascular system. Such molecular, physiologic, and morphologic effects in rodent models all provide biological plausibility to the association observed in epidemiologic studies between exposure to dioxins and cardiovascular disease (CVD) mortality.

To evaluate the evidence for this, a systematic review was carried out of epidemiologic studies and their citations published in English regarding CVD mortality. Cohorts that were either primarily exposed to PCBs or from the leather and perfume industries were excluded, since these include other cardiotoxic coexposures.

Results from 12 cohorts were included in the review. Ten cohorts were occupationally exposed. Analyses were divided according to two well-recognized criteria of epidemiologic study quality: the accuracy of exposure assessment, and whether the exposed population was compared with an internal or an external (e.g. general population) reference group.

Analyses using internal comparisons with accurate exposure assessments are the highest quality because they minimize both exposure misclassification and confounding due to workers being healthier than the general population ("healthy worker effect"). The studies in the highest-quality group found consistent and significant dose-related increases in ischemic heart disease (IHD) mortality and more modest associations with all-CVD mortality. Their primary limitation was a lack of adjustment for potential confounding by the major risk factors for CVD.

The results of this systematic review suggest that dioxin exposure is associated with increased risk of mortality from both IHD and all CVD, although more strongly with the former. Although biological plausibility is provided by animal studies, uncontrolled confounding by other risk factors for CVD cannot be ruled out as a contributor to the association. The authors of the study hope the results will stimulate further evaluation of CVD incidence and mortality in dioxin-exposed cohorts, especially using internal comparisons with detailed exposure assessments, and careful control for confounding. Future studies in both animals and humans should assess whether cardiovascular effects are present at environmentally relevant doses. Of additional interest would be analysis of whether the association between dioxin exposure and all CVD persists when IHD cases are excluded, as well as a pooled or meta-analysis of the internal comparison results in order to obtain a dose-response curve for dioxin and CVD.

Source: Environmental Health Perspectives, Vol. 116, No. 11, November 2008.

Toxicity of Atmospheric Aerosols on Marine Phytoplankton

Laboratory experiments, field observations, and numerical simulations all link atmospheric deposition events to increases in ocean chlorophyll concentrations and phytoplankton biomass, suggesting that atmospheric deposition of nutrients and trace metals can stimulate phytoplankton growth. Indeed, enrichment experiments with iron (a required nutrient scarce in seawater and enriched in dust) show that in high-nutrient low-chlorophyll areas (representing 20-40% of the ocean), iron addition can increase primary production, export production, and carbon sequestration. In areas where phosphorus and nitrogen concentrations are low, aerosol deposition can supply both iron and phosphate, nutrients that stimulate nitrogen fixation. It has been suggested that increases in dust deposition during glacial periods have been responsible for lowering atmospheric carbon dioxide concentrations thus impacting climate.

Aerosol particles consist of many natural and anthropogenic components, including mineral dust, soot, organic molecules, sea salt crystals, spores, bacteria, and other microscopic particles, and can supply many elements and compounds to seawater. Little research has been done to elucidate what specific component(s) in aerosols affect phytoplankton at the level of community or individual species or how certain taxa within the community respond to distinct aerosol deposition events and to aerosols of different composition.

Now in a new study using aerosol samples from different back trajectories in incubation experiments with natural communities, researchers have demonstrated that the response of phytoplankton growth to aerosol additions depends on specific components in aerosols and differs across phytoplankton species.

Aerosol additions enhanced growth by releasing nitrogen and phosphorus, but not all aerosols stimulated growth.

The unique response of different phytoplankton to aerosols of different origin and chemical composition and the results of the model used in this study collectively illustrate the variable and globally significant impacts of aerosols on marine phytoplankton. Specifically, the researchers report a negative effect of aerosols in the open ocean in contrast to multiple examples of negative effects on land. Many climate models, however, assume that aerosol deposition is equivalent to iron and/or phosphorus enrichment, which, in turn, uniformly stimulates phytoplankton growth across all taxonomic groups. This new study demonstrated that this is an incorrect oversimplification of the effects of aerosols, and more detailed and specific aerosol composition should be considered. Moreover, the selective response of different taxa to aerosol additions demonstrates that aerosol deposition results in changes in phytoplankton community composition. On a local scale, these phytoplankton community shifts may affect grazing by higher trophic levels, thereby potentially impacting marine fisheries in coastal communities. Such changes may also directly affect the amount of export production, because species-dependent cell size, density, and aggregation potentially affect sinking rates. Predicted changes in dust deposition globally, from the present to the end of the century, range from a 300% increase to a 60% decrease. The complex mutual interactions between phytoplankton, atmospheric chemistry, and climate are important in view of predicted changes in aerosols deposition rates and distribution and the possible increase in future anthropogenic copper emissions. Accordingly, to predict the impacts of expected future changes in aerosol deposition, global climate change models should incorporate the variable effects of aerosol on the marine ecosystem (including negative toxic effects) and the complex interactions between aerosols and marine phytoplankton of different taxa.

Source: Proceedings of the National Academy of Sciences, Vol. 106, No. 12, March 2009.

RISE IN CARBON-FUELLED OCEAN ACIDITY THREATENS SHELLFISH

Increasing global concentrations of atmospheric CO_2 are predicted to decrease ocean pH, with potentially severe impacts on marine food webs, but empirical data documenting ocean pH over time are limited. In a high-resolution dataset spanning 8 years, pH at a north-temperate coastal site declined with increasing atmospheric CO_2 levels and varied substantially in response to biological processes and physical conditions that fluctuate over multiple time scales.

Changing pH levels potentially have vast consequences for marine ecosystems because of the critical role pH plays in mediating physiological reactions. Furthermore, many important groups of marine organisms have a skeleton of calcium-carbonate, which dissolves when it reacts with free hydrogen ions. Hence, declining pH could interfere with critical processes such as reef building, carbon sequestration via phytoplankton sedimentation, and consumer-resource interactions. Recent calculations indicate that increasing CO_2 concentrations may deplete the buffering capacity, in at least some parts of the ocean, and that ocean pH may drop 0.2 units over the next century. Many sources now state that ocean pH has already changed 0.1 units over the past century. The basis for these statements is model simulations that include only physical processes in the control of pH and that are calibrated from a single year of data rather than those that use direct empirical measurements of ocean pH through time. Little published empirical information exists on the dynamics of directly measured ocean pH, and none is available at

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Biosorptive Removal of Arsenic from Drinking Water

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water, requiring public water supplies to reduce arsenic from 50 ppb (0.05 mg/l).

The majority of arsenic in natural water is a mixture of arsenate and arsenite, with arsenate usually predominating. High concentration of arsenic in groundwater has been reported from the Bengal Delta Plains in West Bengal and Bangladesh. Arsenic is the twentieth most abundant element in the earth. Symptoms of arsenicosis are primarily manifested in the forms of different types of skin disorders such as skin lesions, hyperkeratosis, and melanosis.

Many scientists have been trying to remove arsenic from the drinking water as well as industrial effluents using adsorptive removal technique. Existing methods of arsenic removal include oxidation, ion-exchange, precipitation, adsorption, and ultrafiltration.

The process of adsorption is a good alternative because it can remove the disadvantages of the classical chemical destabilization. Numerous biological materials have been tested for the removal of toxic metal ion from aqueous solution over the last two decades. However, only a limited number of studies have been investigated on the use of adsorbents derived from biological sources, e.g. chitosan, orange waste, fungal biomass, activated carbon (AC) produced from oat hulls, coconut husk carbon (CHC), a low-cost ferruginous manganese ore (FMO), *Garcinia cambogia,* alkaganeite, oxisol, shirasu-zeolite, synthetic hydrotalcite, lignite, peat chars, bonechar, to remove arsenic from aqueous solution.

Now a new study reports that a biomass derived from the plant *Momordica charantia* has been found to be very efficient in arsenic(III) adsorption. An attempt was made to use this biomass for arsenic(III) removal under different conditions. The parameters optimized were contact time (5-150 min), pH (2-11), concentration of adsorbent (1-50 g/l), concentration of adsorbate (0.1-100 mg/l), etc. It was observed that the pH had a strong effect on biosorption capacity. The optimum pH obtained for arsenic adsorption was 9. The influence of common ions such as Ca^{2+}, Mg^{2+}, Cd^{2+}, Se^{4+}, Cl^{-}, SO_4^{2-}, and HCO_3^{-}, at concentrations varying from 5 to 1000 mg/l was investigated. To establish the most appropriate correlation for the equilibrium curves, isotherm studies were performed for As(III) ion using Freundlich and Langmuir adsorption isotherms. The pattern of adsorption fitted well with both models. The biomass of *M. charantia* was found to be effective for the removal of As(III) with 88% sorption efficiency at a concentration of 0.5 mg/l of As(III) solution, and thus uptake capacity is 0.88 mg As(III)/gm of biomass. It appears that this biomass should be used as a palliative food item. Further it also appears that the dietary habits may play a role in the toxic effects of ingested arsenic.

Source: Bioresource Technology, Vol. 100, Issue 2, January 2009.

RISE IN CARBON-FUELLED OCEAN ACIDITY THREATENS SHELLFISH

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temperate latitudes, which harbor the world's most productive fisheries. In addition to understanding the dynamics of ocean pH, a key unanswered question is how marine ecosystems will respond to the anticipated declines in ocean pH. From basic principles of biology and chemistry, calcifying organisms are expected to be impacted most negatively by decreasing pH. Laboratory experiments demonstrate that declining pH can negatively impact calcification in corals, mollusks, coralline algae, and phytoplankton, but such experiments can be difficult to extrapolate to ecosystem responses because pH may affect other aspects of species biology besides calcification, and because the web of species interactions can enhance or counteract effects of environmental impacts.

Now a new study applying a method to link environmental changes to species dynamics via multispecies Markov chain models reveals strong links between *in situ* benthic species dynamics and variation in ocean pH, with calcareous species generally performing more poorly than non-calcareous species in years with low pH.

The new data demonstrate that coastal ocean pH is unexpectedly dynamic given the historical perspective that oceans are highly buffered, and show that pH is declining in association with increases in atmospheric CO_2. The results also provide clear links between pH and biological activity, which may be essential to incorporate when developing quantitative predictions of ocean pH in response to anthropogenic change. Qualitatively, however, the results support the broad predictions of physical models suggesting that ocean pH decline is an ongoing process. The data also indicate that these changes are ecologically meaningful and merit further efforts to understand their causes and consequences by placing ocean pH change in a predictive framework for complex marine ecosystems. Collecting the intensive data needed to document high-resolution, long-term pH dynamics and their ecological impacts in the field necessarily limits the spatial extent of the present study. For example, the study probes coastal surface waters, and, hence, may not reflect subsurface pH dynamics in the open ocean. The low pH values revealed in a recent spatial survey along the Pacific coast of North America suggest, however, that the dynamics reported are broadly applicable. Although coastal and surface waters make up only a small portion of the world's oceans, they are focal points for ocean production and human activity; therefore, understanding pH changes in these areas is crucial. The results highlight the urgent need for more spatially distributed and temporally intensive studies of ocean pH dynamics and their underlying causal mechanisms and consequences.

Source: Proceedings of the National Academy of Sciences, Vol. 105, No. 48, December 2008.

Effect of Extremely Low Frequency Magnetic Field on Antioxidant Activity in Plasma and Red Blood Cells in Spot Welders

Exposure to extremely low frequency magnetic field (ELF-MF) has become worldwide, while its biological effects have not been clearly demonstrated. Although the increased risk of cancer or pregnancy outcome has not been confirmed in epidemiological studies, recently experimental and cellular studies have demonstrated that ELF-MF exposure can lead to chromosomal damage and gene destruction resulting in induction or promotion of cancer. Some investigators suggest that the DNA damage mechanism is an oxidative stress induced by ELF-MF. On the other hand, some other studies showed increased activity of the antioxidant system after exposure to magnetic field and suggested that this increase may represent a compensatory reaction against oxidative stress.

Free radicals have a major role in inducing oxidative stress. The antioxidant system is a body defense mechanism that can safely interact with free radicals and terminate the chain reaction before vital molecules such as DNA are damaged. When free radical production exceeds antioxidant activity, oxidative stress occurs. Recurrent or long-term exposure to ELF-MF can lead to excessive free radical production and induces oxidative stress. Spot welding is one of the electrical welding processes that induces high strength magnetic field. The amount of current and induced ELF-MF is related to material thickness, type, cross-sectional area and contact surfaces.

In vitro, the oxidative effect of ELF-MF has been demonstrated by some experimental studies, but there is limited evidence for this effect in human. The present study was therefore carried out to investigate the potential effects of ELF-MF on human antioxidant activity.

A chronological cohort study was performed on all spot welders who worked in a car manufacturing factory and met the inclusion criteria.

Forty-six male spot welders were selected and compared with a control group that consisted of 45 male workers in the same factory. Similar conditions, including exclusion criteria, physical workload, working time and physical properties of work-site, were applied in both groups. Both groups were also matched according to their age and employment period.

Exclusion criteria were as follows:

1. History of liver, heart, respiratory, renal and endocrine diseases
2. Abnormal findings on physical examination suggesting internal diseases or inflammatory processes
3. History of alcohol consumption, drug and medication usage
4. History of cigarette smoking
5. Previous contact with toxic substances
6. Work shift
7. Dyslipidemia, impaired fasting glucose or diabetes mellitus

ELF-MF dosimetry was performed by Holaday HI-3604.

The total serum antioxidant status (TAS), red blood cells (RBCs) glutathione peroxidase (GPX) and superoxide dismutase (SOD) were measured in 46 spot welders who were occupationally exposed to ELF-MF (magnetic field strength = 8.8-84 microTesla (T), frequency = 50 Hertz (Hz) and electric field strength = 20-133 V/m). The results were compared with a nonexposed ELF-MF control group. The correlation between magnetic field strength and antioxidant activity in RBCs and plasma was then assessed.

No significant differences in TAS levels were observed. However, in RBCs of the exposed group, a significant decrease in SOD and GPX activities was observed. This decrease was measured as 22 and 12.3%, respectively. Furthermore, a significant negative correlation between SOD/GPX activities and magnetic field intensity was observed.

The results of this study indicate that ELF-MF could influence the RBC antioxidant activity and might act as an oxidative stressor. Intracellular antioxidant enzymes such as SOD and GPX were found to be the most important markers involved in this process. The influence of magnetic field on the antioxidant activity of RBCs might occur even at the recommended levels of exposure.

The data propound the necessity for more investigations on the effect of ELF-MF on human antioxidant system and activation-adaptation systems. There are still some unresolved issues such as the minimum intensity of magnetic field that causes oxidative stress and the role of exposure duration on activation of antioxidant systems.

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