Editorial

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Biographical notes: Mario Villalobos is a Professor of Environmental Bio-Geochemistry at UNAM in Mexico, he received his BSc Degree in Chemistry from UNAM, a MSc Degree in Soil Chemistry from Wageningen Agricultural University in the Netherlands and a PhD Degree in Civil and Environmental Engineering from Stanford University. He worked as a Postdoctoral Researcher at the University of California in Berkeley for two and a half years. His research area is environmental biogeochemistry of the soil-water system, including environmental molecular chemistry and surface chemistry of natural particles. He has published a total of 15 research papers in important journals in the field.

Anne M. Hansen holds a PhD in Chemical Oceanography from the Mexican National Autonomous University (UNAM). Currently she is Senior Scientist at the Mexican Institute for Water Technology (IMTA) and Lecturer at different schools at UNAM and the Mexican National Polytechnic Institute. Her research interests include the deposition, natural attenuation, and biodegradation of chemical pollutants in water, sediments and soil. Her research focuses on the prevention of pollution and rehabilitation of natural resources. She is author of several research papers, participates in the editorial boards of scientific journals and is Coeditor of a book on watershed management.

Jaime Vite-Torres holds a PhD (cum laude) in Natural Sciences with specialty in Chemistry from the Marthin-Luther Von Halle-Wittemberg University, in Germany, where he performed a thesis on electrodeposition of bismuth. His areas of research are on corrosion and corrosion protection of materials, and on the manufacture of light and ceramic materials from hazardous industrial residues. He is the author of 15 peer-reviewed international research papers, and eight national ones, and is a creator of five patents. He is recognised in the International Biographical Center, Cambridge and has directed a total of 20 Bachelor's, five Master's, and two Doctoral dissertations in Mexico.

Rafael Villalobos-Pietrini is Professor of Genetics at the Sciences School of the Mexican National Autonomous University (UNAM). He has published more than 100 papers on the genetic effects of pollutants, mainly of organic matter in airborne particles. He founded and has been the Editor-in-Chief of the Mexican journal *Revista Internacional de Contaminación Ambiental* since 1985. He received the UNAM Natural Sciences Teaching award in 1995. He has founded four research and teaching centres of biological and environmental sciences, and his name is used for the Mexican Academy of Environmental Sciences Award for best graduate work presented at their conferences.

This special issue of the *International Journal of Environment and Pollution* represents a showcase of recent environmental research carried out in Mexico on aspects covering air, water, and soil contamination, and ranging from characterisations of contaminated environments to descriptions of environmental processes, and novel technologies for industrial processing with minimisation of hazardous waste generation. Other topics include new aspects of environmental analytical chemistry, gas measurement systems, detection and correlation of contaminants to metabolism effects in biological systems; as well as studies of environmental processes such as photochemical smog formation mechanisms, arsenic dispersion from mine tailings, and health risk assessment.

The volume includes nine papers on water and sediment pollution and geochemistry in different areas of Mexico. Six of these papers describe aspects on pollution in coastal lagoons and near-coastal areas from the Gulf of California, Pacific Ocean, and Gulf of Mexico. Spatial variability and distribution of contaminants between water and sediment phases are among the main objectives of these papers as well as the estimation of ecological risks. Attempts have also been made to attribute specific sources of some contaminants to the observed pollution in the different study areas. One paper determines mercury concentrations and distribution in waters and sediments of a freshwater dam using neutron activation analysis techniques. Another describes the biomarkers and pollutants in different biological species from four lakes in the southern part of Mexico. The physicochemical characterisations of rainwater in an urban and a rural area is the subject of another paper, while groundwater and springs in a volcanic area used for domestic, agricultural and industrial activities were characterised in yet another one, including bacteriological and radioisotopic parameters.

Contaminants treated in these papers include metals, organochlorine pesticides, and hydrocarbons and these are related to biological effects as well as hydrogeochemical parameters that may explain their accumulation in the sediments of the different study areas. The latter includes organic carbon and clay mineral concentrations, among others.

Water pollution is among the prime environmental concerns in Mexico. It is caused by point as well as non-point sources including pollutants transported through air over long distances and captured by rain and out-falling aerosols and dust. It is therefore not a simple task to use monitoring information to develop control strategies for use and emissions of these substances. Information as that presented in the papers in this special volume may help establish the knowledge required for this purpose.

Six papers in this issue are devoted to different aspects of soil pollution and solid wastes. Soils have typically been the natural repositories of many kinds of wastes, including industrial wastes. This is due to their purifying properties through interfacial reactions of their constituting mineral solids, particularly the finer fractions, in the case of inorganic pollutants, or through their degrading capabilities for organic contaminants, where micro-organisms play a crucial role. However, land development and population growth continues to saturate the buffering capacities of soils. Optimisation of soil performance, thus, requires accurate understanding of the behaviour and fate of potentially toxic species, as related to fundamental parameters and chemical conditions of this medium. Regulatory efforts to limit waste disposal to soils are faced by the challenge of a clear scientific understanding of the important factors that dictate (bio) availability of pollutants in this important resource.

One of the papers presented in this special issue studies the distribution of arsenic species in mine tailings impounded near a residential area in rural central Mexico. Mining has traditionally been one of the most important industrial activities in Mexico since Spanish colonial times, Mexico being an important producer of silver, iron, zinc, copper, lead and some gold. Oxidation processes convert immobile reduced arsenic species to more mobile forms, challenging its original unavailability to living forms. Studying the geochemical processes that control and influence these transformations is crucial to understanding the potential toxicity of arsenic and to recommend control and treatment strategies to render this element unavailable.

Regarding environmentally benign processes for metal ore recovery, a study is presented that uses micro-organisms to concentrate a copper mineral to highly efficient levels, comparable to those of traditional flotation processes, while leaving behind a relatively inert solid waste. This ‘microbiological leaching’ may prove to be a new promising approach that substitutes the highly contaminating chemically based practices commonly used for metal recovery.

On a more theoretical approach, development of an electrochemical method is presented in two papers by the same authors to measure free metal activities in aqueous solution. This is an important step for chemical speciation of toxic metals in aqueous environments such as soils, where other methods are plagued with interferences when applied to ‘dirty’ systems. The novel application of this methodology provides interference-free determinations and promises high selectivity and sensitivity for aqueous determinations of divalent metals such as cadmium, copper and lead cations.

Another paper describes a technique to measure microbial respiration rates in laboratory test systems. The set up of the technique requires standard laboratory equipment allowing this methodology to be implemented in most environmental research laboratories. The paper describes the testing of the system, proving its accuracy and applicability as a research tool in laboratories dedicated to study the environmental fate of organic compounds such as soil, water and sediment pollution.

Finally, a health risk assessment of soils polluted with petroleum hydrocarbons is presented exemplifying the kinds of assumptions and methodologies performed in these types of assessments, the results of which serve to recommend priority treatment zones.

The special issue contains additionally three papers devoted to air pollution in the Mexico city metropolitan area. This city, being one of the largest and most populated megacities in the world, poses important challenges and provides fertile ground for investigations on air pollution processes. In one of the papers, a linear multivariate model is utilised to explain the PM10 increase over several years in the central Mexican valley in relation to wind speed and direction, which was attributed to extensive forest fires occurring in the first year of the modelled period. The other two papers deal with photochemical smog. One reports indoor and outdoor carbonyl concentration measurements, and the other is a model simulation of smog formation from natural gas, which has begun its use as motorcar fuel. High reactivity is predicted in the latter study in the form of ozone formation when carbonyl compounds are simultaneously present.

The information presented in the series of papers is the result of individual studies on pollution by heavy metals and persistent or reactive organic pollutants and their effects on the natural environment. This information is particularly important because no long-term monitoring efforts exist on the behaviour of many types of contaminants in natural environments in Mexico. Therefore, case studies as those presented are the only evidence of contamination by substances such as the 'dirty dozen' included in the Stockholm Convention and the pollutants attended by the Sound Management of Chemicals Program of the North American Commission of Environmental Cooperation within NAFTA (the North American Free Trade Agreement). The cases presented may help evaluate the extent of pollution, the environment risk, and the trend of contaminants in time and space. This, in turn, may provide evidence for the need to control the use of specific pollutants, their discharge and transport in aquatic environments, their effect on biota, and ecological risks as well as to humans.

The papers compiled here are presented in no particular thematic order but represent current research efforts by leading environmental specialists in Mexico. The scope of the information presented is necessary to formulate national and international environmental protection policy and confront legal aspects of pollution. It also allows assessing risks from water, soil, and air pollution and establishing the basis for effective and viable remedies. The protection of these resources depends on such information as well as waste disposal strategies and ecological impact of pollutants, and evaluation and management of environmental risk and safety.