

Particulate Transport as a Mediator of Climate Change Effects in the Asia-Pacific Environment

Ross Sadler¹, Des Connell², Glen Shaw³, Albert Gabric⁴ and Emily Shaw⁵

¹ Queensland Health Forensic and Scientific Services,

² School of Australian Environmental Studies, Griffith University,

³ School of Public Health, Griffith University,

⁴ School of Australian Environmental Studies, Griffith University

⁵ School of Australian Environmental Studies, Griffith University

E-mail: Ross_Sadler@health.qld.gov.au

Abstract:

The scientific approach to climate change is to say the least patchy. A moderate amount of effort is being directed towards documentation of effects, but little effort has been directed towards the implications of climate change as regards pollutant behaviour. In no region of the earth are these deficiencies more manifest than in the Asia-Pacific region. Our research to date suggests that the most important agent in terms of mediating climate change effects will be particulate species.

The climate change processes that will affect pollutant behaviour are: Increased levels of greenhouse gases; changes in land, water and air temperatures; increased prevalence of extreme weather events; melting of icecaps and alpine regions and rises in sea levels

Particulates are a vital component of environmental processes such as environmental transport of heavy metals, nutrients and hydrophobic organic pollutants. As such, they are involved in processes that range from global distillation to dispersal of toxins produced by red tides. A consequence of climate change will be increases in the levels of particulates, arising from process such as extreme weather events, dust storms (as a result of desertification) and evolution from forest fires. Therefore, Particulate transport can be expected to play a dominant role in mediating the environmental effects of climate change. This paper discusses the use of modelling approaches can be used to describe particulate transport resulting from climate change. Particle bound pollutants will also undergo a changed global and regional distribution as a result of perturbations in atmospheric and ocean currents.

Through effects on particulates, climate change has the potential to affect environmental processes including short and long-range pollutant transport, activity of nitrogen metabolism in water bodies, eutrophication, and the proliferation of harmful algal blooms and distribution of the resulting toxins. The paper will discuss the underlying mechanisms and also the relative significance of climate change induced short vs. long-term perturbations in environmental parameters in terms of modifying pollutant behaviour.

EG-02(Keynote)

Design of Humic-Based "Green" Chemicals and Biomaterials with Tailored Properties

Perminova I.V.

Department of Chemistry, Lomonosov Moscow State University, Moscow 119991, Russia,

E-mail: iperm@org.chem.msu.ru

Abstract:

Facing the growing needs in world consumption of mineral oil along with deterioration of its reserves, of particular importance gains development of new principles and technologies of fuel and chemicals production based on a use of alternative and renewable resources. Alternative biogenic resources are presented by fossil and technogenic materials. The former consist of oxygenated organic rocks such as leonardite, peat, sapropel, etc.; the latter include organic industrial and agricultural wastes (spent pulp liquors, activated sludge, composts, etc.). Main organic components of these resources are humic or humic-like compounds, whose inherent properties are: non-toxicity, biocompatibility, resistance to biodegradation. Despite immense reserves of inexpensive humic materials and unique

biological properties; they do not find a broad practical application. Fundamental reason is large polydispersity and structural heterogeneity of humic substances, which translates into properties that are difficult to control. To overcome this problem, chemical modification and surface chemistry are proposed as promising tools for acquiring humic materials with desired properties.

The goals of this study were to obtain functional and hybrid humic-based materials using chemical modification and surface chemistry. Polycondensation reactions were used to enhance redox properties of humics. This approach allows for incorporation of the desired phenolic- fragment with the known redox properties into the humic backbone. The obtained humic derivatives possessed much higher reducing capacity and were capable of reducing Np(V) and Pu(V) . To evoke mineral adhesive properties, new surface-active function was incorporated into native humic materials – alkoxy-silyl- groups. This yielded humic derivatives capable of covalent binding with hydroxyl-carrying surfaces (e.g. silica gel). The obtained derivatives were water soluble and could be immobilized onto mineral supports under mild ambient conditions from aqueous solutions. The test for sequestration of radionuclides and bacterial endotoxin has shown that the produced coatings completely sequestered Pu(V) and possessed substantial affinity for bacterial endotoxin. Of importance is that all humic derivatives synthesized did not acquire toxicity as a result of modification that allows for considering them and derived materials as “green” chemicals and biomaterials.

Humic materials were shown to be promising biogenic resources for producing “green chemicals” and biomaterials with tailored properties. This opens broad opportunities for commercial applications of HS.

The research was supported by ISTC (KR-964), DOE (RUC2-2006), RFBR (06-04-49017).

EG-03 (Invited)

Studies of Arsenic Mobilization with Iron, Manganese and Copper and their Mobilization in the River Padma

M. Sarifuzzaman¹, M. N. A. Siddique¹, Farhana Khanam Ferdousi¹, Etmna Ahmed¹,

A. M. Shafiqul Alam¹ and Shah Mohammad Ullah²

Department of Chemistry¹ & Department of Soil, Water and Environment²,

University of Dhaka, Dhaka-1000, Bangladesh

E-mail: amsalam2004@yahoo.com

Abstract:

Arsenic is harming the developing countries like India and Bangladesh more vehemently owing to obvious reason. It has been reported that arsenic comes from the Himalayas through the rivers. The rivers such as the Ganges originating from the apexes of the Himalayas enters Bangladesh as the Padma river at Chaipai-Nawabgonj and the river water carries soils and sediments containing the minerals which then spreads or by leaching to the wide regions of neighboring districts. In this context, a comparative study was conducted in this current experiment to correlate As, Fe, Cu and Mn by determining their concentration in sediments at different depth in the river Padma³. Six locations were selected as sampling sites from entering point (upstream) and end point (downstream) of the river Padma. Sampling was performed by borehole technique at several depths ranging from 1 meter to 5 meters. The samples were digested with (HClO_4 - HNO_3) acid mixture of ratio 3:2 in an acid digestion bomb and As was determined by HVG-AAS technique and Fe, Mn and Cu were determined by flame-AAS technique. The standard deviation values of arsenic from 1 to 5m were high and varied in six locations. Among the six locations of the Padma River, high amount of (As 84.65 mg Kg^{-1}) was found at Padma River near Mowyaghat and low amount was found 2.57 mg Kg^{-1} at Manikgonj near Padma-Jumuna River. Here upstream Manikgonj near Padma-Jumuna belt and down stream Mowyaghat are two adjacent locations of the river Padma. Arsenic from upstream (Manikgonj) might be transported further distance and stored to downstream region. As a result, As concentration at the downstream (Mowyaghat) region is higher. Low amount of arsenic was found in 1 m depth compare to other depths because arsenic from upper surface leached to the deeper depth. Arsenic in upper soil and edge sediment were also considered. Compare to upper soil, edge sediments and borehole sediments, average higher arsenic concentration was found in borehole sediments rather than upper soil, edge sediments. This is because arsenic from upper soils that swift away to edge of the river and finally leached to the borehole sediment of different depths.

Fe contents were higher comparatively to Mn, Cu and As of all borehole sediments. The small correlation value in case of As, Fe and Mn indicate that only hydroxides of Fe and Mn interfere with arsenic and very low with Cu.

Keywords: arsenic, borehole, sediments, Padma, mobilization