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EDITORIAL

Coastal and marine pollution and ecotoxicology

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Our planet is under increasing stress from human activities of exploitation of natural resources and biogeochemical processes as well as industrial refinery and production. This is evident by the observations of hypoxia in coastal ocean and also by decrease in biodiversity. As industrialization and urbanization in the developing countries including China, India and Brazil intensify further, more serious deterioration and pollution of the natural ecosystems can be more strongly pronounced than before for air, soil, water and also the biodiversity (Cao et al. 2012, 2013; Han and Gu 2015) . Relevant results from different directions of research focus are reported before on chemical pollutants and ecotoxicological data (Ford and Cheng 2009; Ford et al. 2012; Gu and Wang 2012, 2013a; Zhao et al. 2013), continuous investigations with new research tools available are also necessary to further document the changes for better understanding, and also forecasting the changes and trends in the future to better serve our society for regulation and legislative action. Oceans and coastal ecosystems are both important to humans, and protection and conservation will allow future sustainable development and also the human long-term survival (Mitchell and Gu 2010; Shen et al. 2010; Gu and Wang 2012, 2013a). The changes documented and reported in China today can be very useful information and mirror images for the changes to be observed in other developing countries, if not now but in the near future.

Pollution as a phenomenon closely associated with human society has distinctive phases over time of the history and it includes sewage, toxic chemicals of metals and metalloids and also persistent organic compounds, harmful organisms from toxic algae including dinoflagellates, bacteria and viruses, and more recently the emerging new chemicals of pharmaceuticals and personal care products (Gu and Wang 2013b; Mitchell and Gu 2010; Jiang et al. 2015). This changing trend of different chemicals over time illustrates not only the technological advances in our society and analytical chemistry driving the environmental understanding and study, but also the consumer attitude and habits of our society altering the pollutant types. Synthetic plastics and composite materials are more important than traditional metals and steel, industries associated with manufacturing of them become the major contributors to the new sources of pollutants and types. Because of this, research and technological innovation has also been conducted in a similar pattern over time in developed countries first and then developing ones. It is apparent that chemical analysis yields specific information on the individual chemicals, their forms, bioavailability, but (eco)toxicology combines the information of chemicals and organisms to make the connection between toxic effects and implications on humans (Han et al. 2011; Li et al. 2011a, b). From this, our capability in analysis has been advanced far better than toxicology and further enhancement on organism-based analysis of chemical exposure is still needed.

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Chemical analysis has an important role in our understanding of the environment because it can quantify the concentrations of specific contaminants at the time and locations of sampling. This serves as basic information on the extent of contamination, but this approach also has its own limitations due to the entities of the sampled, matrices involved and the analytical methods used. Such data are only relevant to the specific compartments of the ecological niche under the specific conditions at the time of sampling and the methods used, no historical information could be recovered from the samples. Actually, environmental data that can yield any historical events are impossible using routine chemical analysis alone except for a few situations, e.g., lead isotopic ratio for the sources of the contamination in sediment cores and nitrogen isotope ratio for the sources of pollution. As such, alternative approaches in understanding the environmental impact from pollution and toxic chemicals can be ecological based by using indicators that can stand the test of time to reflect the historical events of the past or pollution (Han and Gu 2015). In general, ecological investigations have not been given the deserved importance and uniqueness as they should be mainly because the high variability and also the long duration of the study for collection of meaningful data to reach a more convincing conclusion (Shen et al. 2010). However, it is undeniable that ecological analysis coupling with chemical data can provide more meaningful insights to the environmental status of the ecosystems and the changes that have been taking place. In a similar but different approach, microbial community structure composition of selective biochemical process can be used as reliable environmental quality indicators, anammox bacteria as one has been proposed as selective species of this group are only detected in contaminated environments while others are only in pristine ecosystems (Cao et al. 2012, 2013; Li et al. 2011a, b; Han and Gu 2015).

It is our belief that the research field of ecotoxicology can be best advanced by more in-depth research and fundamental investigations of environmental chemistry, ecotoxicology and environmental/pollution toxicology, applied biology and molecular biology through interdisciplinary approaches to provide the essential basic information and necessary data for a better understanding of the environmental issues and also protection of the environment. It is indisputable that many scientists in China have actively engaged in research on pollution sources, types of the pollutants, toxic effects of chemicals on target and non-target organisms at a wide range of response levels including molecular, enzymatic, and organismic levels, especially many studies carried out in laboratory under simulated and controlled conditions (Wu et al. 2009; Zhao et al. 2009, 2013; Luo et al. 2013; Shao et al. 2013; Xu et al. 2009; Yu and Gu 2006; Yu et al. 2008). The information from such hypothetical studies must serve the needs for problem solving in the real world, which is community and ecosystem based. Here an integration of studies focused on coastal and marine ecosystem and ecotoxicology has been collected from selective papers of talks presented at the International Symposium on Marine Pollution and Ecotoxicology held on March 1–3, 2014 in Daya Bay, Guangdong, PR China to make these results in a permanent record form accessible to the scientific community worldwide.

It was our primary purposes initially in organizing this series of symposia to further gather scientific data from scientists to discuss their on-going research projects, foster active communication on their latest research results and effectively disseminate such information at each symposium so that future research projects could be formulated and carried out coherently and logically for a better, systematic and coherent understanding of the magnitude of environmental problems, basic mechanisms involved and possible mitigation strategies. By doing so, research projects in the planning phase by graduate students and postdocs can benefit greatly from such information exchanges to advance the better understanding of the scientific research questions involved. At the same time, both legislatures and governing bodies of the government can use such information and to implement science-based policy with the scientific data available as a basis. It is very important that multi-disciplinary interactions are necessary and essential not only to better our understanding and effective planning of research projects in pollution control and ecotoxicology, but also to implement any remedial measures to deal with the environmental problems facing not only China but particularly the developing countries and emerging ones in the world in the near future (Ford et al. 2011; Gu and Wang 2012, 2013a; Zhao et al. 2013; Shao et al. 2013). Elucidation of the processes and mechanisms involved is the primary responsibility of scientists so that administrative and management plans can be formulated to deal with such problems most effectively.

In this collection of 40 papers, topics cover from Toxic Cyanobacteria and Dinoflagellates to Toxicants and Risk. Mangrove and Pollution alone has more than 10 papers in particular to show the focus of this symposium specifically. At the same time, Microbial Ecology and Ecotoxicology is also presented here as a separate section with widely different research presented from freshwater cyanobacteria and coral associated bacteria to bacterial laccase-like genes in mangrove and microbial response to anthropogenic impacts and polyaromatic hydrocarbons. Others include Gene Markers and Responses to Pollutants as ecotoxicological focus also highlights the recent advances in these areas of research. Most importantly, many papers in this

collection are not restricted to the these section topics and can be under more than one topic titles, such as those under Mangrove and Pollution. This collection of papers keeps up the tradition of this symposium series emphasizing on the ecological and microbial ecotoxicology with a much wider view on the ecosystem under stress. It is clear that environmental contamination and cleaning up should be dealt with in case-by-case manner and different techniques can be utilized selectively based on the specific pollutant and conditions of the ecosystem to formulate the science-based approach. It is also clear that nano-materials and abiotic process also have their role to play in affecting the geochemical processes and solving the environmental problems (Xu et al. 2009; Luo et al. 2013; Han et al. 2011). Similarly, phytoremediation is a specific subject where scientific investigation should be focused on removal of metals and metalloid or organics from the polluted niches (Yu and Gu 2006; Yu et al. 2008; Mitchell and Gu 2010) and alleochemicals may also facilitate the inhibition of pollution-induce bloom of algae (Shao et al. 2013). The problems we are facing are the anthropogenic sources of pollutants, high population and growth, and related activities (Cao et al. 2012, 2013; Li et al. 2011a; Han and Gu 2015).

Environmental studies have been moving constantly from much wide education in curriculum in all countries to finely defined research in laboratories, but our society is still facing a much big challenge between development and protection and conservation. Though we do not know how fragile is our ecosystem, but we do know they are altered through our activities, especially in more recent time than in the past, reactive nitrogen is a very good example. Because of our thirst for energy, petroleum is widely and increasing consumed as the major energy source, but pollution and oil spills are notable widely. Similarly, wastewater is also part of life style, it contaminates the rivers and streams and also coastal ecosystems, resulting in serious eutrophication and harmful algal bloom, killing fishes and other organisms (Cao et al. 2013; Jiang et al. 2015). Drinking water quality is a much wide issue of common interest and contamination of food and beverages by plasticizers are still facing the public and the developing countries (Gu and Wang 2013b). In addition to the environmental pollutants of metals and polyaromatic hydrocarbons, pesticides and herbicides, endocrine-disrupting chemicals and pharmaceutical and personal care products are becoming more and more research focus for the current investigations. It is recognized that environmental problems are not a pure scientific question to human society there are fundamental socioeconomics basis for them to occur again and again in different countries and cultures. We shall embrace new technologies for CO_2 capture and elimination of pollutants, (Liu et al. 2015) but at the same time, society needs to implement environmental ethical education to allow our citizens to contribute to the further conservation and protection of our planet to better our living conditions. It must be true that both education and scientific research plus exchange of information to overcome some of the obstacles in communication so that our society can move forward in a concrete step each time in dealing with the environmental pollution problems and protect our living planet for future generations.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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