



Green environmental technologies and waste utilization

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This special issue covers important research themes related to green environmental technologies and waste utilization such as plastic waste management, waste as resource recovery, air quality pollution and control, innovation of water and wastewater treatment. Environmental pollution is unwarranted disposal of mass or energy into natural resources such as water, land or air that attracts the attention of human beings for its severe long-term consequences. Nowadays, environmental pollution changes from simple to multi-substance pollution (visible way) to potential pollution (blind-optic machine visible); therefore, green, advance and innovation of environmental technologies and monitoring need to respond to that change. For example, air pollution is an important risk factor for global disease burdens. It has a major impact on human health, particularly among the poor and vulnerable such as elderly and children. PM_{2.5}, which is fine particulate matter with an aerodynamic diameter of less than 2.5 µm, is the most health damaging and accounts for large attributable health burdens. Fine particles are directly emitted during the combustion of fossil fuels and biomass including forest and peat fires, and from industrial processes; these particles include fly ash, various metals, salts and carbonaceous species including black and organic carbon. Particle emissions also originate from natural sources such as soil dust and sea salt. The number of people, economic activities and energy demand in the world's growing cities means that poor air quality is often regarded as an urban problem. Due to their small size and thermodynamic properties, PM_{2.5} particles remain in the atmosphere

for several days and are typically transported over several hundreds of kilometres (Seibert et al. 2020). Thus, as a consequence, a significant share of particles found at any specific location originates from distant sources, which are often outside the immediate jurisdiction and control of the local authorities.

Heavy metals are a sort of metals and metalloids which have relatively high density and are toxic even at ppb levels including some types such as As, Cd, Cr, Cu, Pb, Hg, Se and Zn... that originated mostly from wastewater sources in the industry, agriculture, as well as in nature (Kurniawan et al. 2006). The growing development of industries in the twenty-first century has occurred as an inevitable consequence in the development of society. However, it is accompanied by the appearance of waste streams that are discharged into the environment with a lack of control or treatment. Alongside surface water flow from the waste canals of craft villages, industrial parks, urban waste channels etc., a part of heavy metals in this waste stream is accumulated in sediments in water bodies. This accumulation has a heavy impact on the entire ecosystem. If an organism (benthos, aquatic plants ...) is exposed, and there is an accumulation of heavy metals in their biomass, the entire food chain will be affected as a result. Humans, as the last organism of the food chain, are at risk of accumulating heavy metals through food consumption, due to increased concentrations of pollutants along the food chain.

Moreover, waste is a potential resource and energy recovery. In developing countries, waste-to-product approach in research is getting more attention from different stakeholders because of their potential to reduce landfilling and greenhouse gas emission. Plastic waste, which is a major obstacle for waste disposal management all over the world, may be considered as a technically feasible material for water treatment since it is used with large quantities and low-cost. Nowadays, throw-away culture with single-use food packaging causes the pollution problem that now presents in every country in the world. The large amount of expanded polystyrene (EPS)–takeaway food single-use package is disposed mainly for the purpose of high consumption, while its life cycle is relatively short (Geyer et al. 2017). Plastic recycling can be done by using it as a secondary material or by recovering and reprocessing waste plastic into a new (secondary)

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material not only helps to prevent environmental pollution but also restricts the ability to exploit natural resources.

The collection of papers presented in this special issue covers the impact of air pollution (such as $PM_{2.5}$, CH_4 and SO_2) on human health and ecosystem; generation and trace of heavy metals from industries and their impacts to water environment; modelling the toxicology loads; appropriate technologies that consider local conditions and promote green technology, waste utilization and circular economy in the region. This special issue will provide valuable networking opportunity and set the stage for further cooperation among professionals from many Asian countries. The guest editors of this IFGTM-2020 special issue are thankful to the Editor-in-Chief of Environmental Science and Pollution Research (ESPR), Prof. Philippe Garrigues, for providing an opportunity to publish selected peer-reviewed papers that were presented at the following International Forum on Green Technology and Management Conference (IFGTM-2020) — Green Collaboration for Healthy Environment and Sustainability, an annual international event initiated by the Consortium for Green Technology Management and Research (CGTMR), Vietnam. Our special thanks to Ms. Fanny Creusot and Ms. Florence Delavaud, Editorial Assistants of ESPR, and the entire production team at Springer for their valuable support in bringing out this issue successfully. The guest editors firmly believe that the special issue papers will be a useful reading document to your research group, and we wish you all the very best.

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include advanced biological wastewater/waste treatment technologies (e.g. membrane bioreactor, specific attached and/or suspended growth bioreactors, anaerobic digesters, wetland and bio-sorption). His expertise spans green bioprocessing technologies, resource recovery, renewable resources, water management, environmental impact assessment, biogas/biohydrogen production, greenhouse gas emission control/climate change mitigation and solid waste management.