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Editorial

Environmental Sustainability of Current Waste Management Practices

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The Special Issue on '*Environmental Sustainability of Current Waste Management Practices*' was a part of the section '*Environmental Sustainability and Applications*' of the journal '***Sustainability***'. It was focused on recent developments in the field of 'Waste Management', including solid and liquid wastes and their collection, segregation, disposal and processing in a cost-effective and environmentally sustainable manner. Reports on different types of wastes included municipal, industrial, medical, construction, demolition, agricultural, electronic, hazardous, sewage sludge, etc. The focus was on mitigating various environmental issues and on the steps taken to enhance the sustainability of current waste management practices around the globe.

This 'Special Issue book' has six full articles with contributing authors from Australia, Chile, India, Israel, Kazakhstan, Nigeria, the Russian federation and Saudi Arabia. Global authorship in this book reflects multifaceted interest and activity in this field worldwide, with breakthroughs occurring in several research areas. Brief summaries and key features of various articles are given next.

The first article by Artyukhov et al. on 'Harvesting waste thermal energy using a surface-modified carbon fiber based thermo-electrochemical cell' focussed on the conversion of waste heat into electrical energy using thermo-electrochemical (TEC) cells. The utilization of energy from primary energy sources to their final use is accompanied by several losses in the form of waste heats; nearly 72% of the primary energy consumed can be lost as waste heat. This article presents new results on enhancing the efficiency of TEC cells based on carbon fiber electrodes and potassium ferri-/ferrocyanide redox electrolyte. Electrode surfaces were modified using magnetron deposition of silver and titanium and/or infiltration implantation of nanoscale titanium oxide. Surface modification of electrodes were found to change the internal resistance of TEC cells by three orders of magnitudes. Maximum power achieved with modified electrodes was determined to be 25 mW/m^2 and an efficiency of 1.37%.

The second article by Alharbi et al. on 'Toward sustainable environmental management of healthcare waste: A holistic perspective' presents a case study on healthcare waste-management practices in Saudi Arabia. A multi-faceted approach involving policy analysis, observations, semi-structured interviews and focus groups were used to elucidate the basics of healthcare waste management. It was estimated that Saudi government hospitals across the country discarded several waste items such as paper (27,000 tons), plastics (15,000 tons), food (10,000 tons), glass (8000 tons), and metal (7000 tons) in landfills every year with negligible levels of recycling. The lack of legal frameworks, waste-management training, coordination among stakeholders, and the lack of social responsibility were identified as some of the key challenges facing the system.

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The third article by Cayumil et al., 'An overview on solid waste generation and management: Current status in Chile', presented an overview on municipal solid wastes (MSW) and industrial waste from the iron/steelmaking and aluminium industries. Key waste issues such as sources, compositions, volumes, factors affecting waste generation and waste processing were first discussed, followed by further discussion on recycling, resource recovery, disposal and environmental impacts. Waste generation and management in Chile was presented in greater detail as a special case study. For Chile, being the world's largest producer of copper, with significant efforts for mining waste management, its infrastructure and procedures were presented to reduce the environmental impact of the mining sector and associated waste generation. Government initiatives, legislation for integrated solid waste management and measures were presented including regulations on waste management frameworks concerning transboundary movements of hazardous wastes, persistent organic pollutants, the closure of mining activities and installations, restrictions on plastics disposal, etc.

The fourth article by Ibikunle et al. on the 'Development of a software system for selecting steam power plant to convert municipal solid waste to energy' has reported on a thermodynamic-based software for the combustion of MSW into energy in a steam power plant with specific focus on the amounts of waste converted, heating values and capacities of power plants. Using 584 tons of MSW and a heating value of 20 MJ/kg as the input, an algorithm (Jawa script) computed saturated and superheated steam tables along with the requisite thermodynamic behaviour of the power plant operation. The software predicted a 3245 MWh energy potential for the quantity of waste investigated, with an electrical power potential of 41 MW. Plant capacities included 100 MW of boiler power, 41 MW of turbine power, and 60 MW of condenser power. This technique is expected to be a valuable tool in the waste-to-energy sector for processing MSW and power generation.

The fifth article by Dosmukhamedov et al. on 'Processing dross from hot-dip galvanizing by chlorination roasting' reports on recovering pure zinc ingots and zinc oxide from waste dross from hot-dip galvanizing towards utilization as mineral additives in animal and poultry feeds. The influence of chlorinating reagents $CaCl_2$ and NH_4Cl on the roasting temperature and degree of sublimation of Pb, Fe, Ni, Cu and Cd was investigated. The best results were obtained by using blends of $CaCl_2$ (6%) and NH_4Cl (15%) in proportion to the weight of the feed material. Optimal roasting parameters were identified as: 1000 °C, 60 min, and 0.1 L/min air flow. Impurity levels in pure zinc were determined to be: 0.05 Pb, 0.15 Fe, 0.06 Ni, 0.003 Cu and 0.001 Cd. The degree of sublimation achieved for copper, nickel and iron chlorides was ~75%, with lead and cadmium removal reaching 90–98% of their initial amount in the dross.

The sixth article by Khanna et al. on 'Red mud as a secondary resource of low-grade iron: A global perspective' assessed the suitability of red mud (RM) as a low-grade iron resource. Managing RM, a solid waste byproduct of the alumina recovery process, is a serious ecological and environmental issue. With ~150 million tonnes/year of RM being generated globally, nearly 4.6 billion tonnes of RM are presently stored in vast waste reserves. RM can be a valuable resource of metals, minor elements and rare earth elements. The utilization of RM as a material resource in several commercial and industrial operations was briefly reviewed along with key features of iron recovery techniques. RMs from different parts of the globe including India, China, Greece, Italy, France, Russia were examined for their iron recovery potential. The composition range of RMs examined were: Fe_2O_3: 28.3–63.2 wt.%; Al_2O_3: 6.9–26.53 wt.%; SiO_2: 2.3–22.0 wt.%; Na_2O: 0.27–13.44 wt.%; CaO: 0.26–23.8 wt.%; Al_2O_3/SiO_2: 0.3–4.6. Even with a high alumina content and high Al_2O_3/SiO_2 ratios, it was possible to recover metallic iron in all cases, showing the significant potential of RM as a secondary resource of low-grade iron.

This book covers extensive areas of interest on waste processing, recycling, material recovery, and the environmental impact of sustainable waste management, along with recent developments in the field. This book has a global perspective and wide coverage of topics for academics, professionals, regional and international organizations.

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