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Zlatka Knezović, Marina Trgo, Davorka Sutlović. *Monitoring mercury environment pollution through bioaccumulation in meconium.* Pages 2-8.

In this study, bioaccumulation of mercury in humans was examined by performing analysis on 165 meconium samples of newborn children in Split and Dalmatian County. Total mercury determination was performed on the Advanced Mercury Analyser AMA 254 without previous sample preparation. Mercury was identified from all examined samples, where mean value of concentration for the whole studied group was 58.19 ng g⁻¹, median 35.69 ng g⁻¹ and concentration range from 3.04 to 394.69 ng g⁻¹, respectively. The analysis of the results showed correlation of mercury concentration in meconium with sociodemographic characteristics of the studied group such as living residence place, dietary habits and influence of amalgam fillings. The highest concentrations of mercury were observed in the group in which mothers consumed fish, particularly in the coastal living area. Slightly higher concentrations of mercury in samples were found in the urban living area compared to the rural residence. This was probably due to the strong effect of disposed mercury from the industrial plants into the environment of Split and Dalmatian County during last 50 years. The relation of sea food consumption and mercury content in meconium samples, confirms that food path is responsible for its bioaccumulation and biomagnification from the environment into the living organisms, particularly in humans.

- **Keywords:** Mercury pollution; Bioaccumulation; Environment; Meconium; Fish consumption; Human biomonitoring

Sorin Borza, Valentin Petrescu. *The Olt River pollution monitoring, using spatial analysis, analytic hierarchy process and technique for order preference by similarity methods.* Pages 9-18.

Environmental pollution is one of the most serious problems of the contemporary world. Chemical industry is one of the major sources of environmental pollutants. Human knowledge and experience is currently focused on the use of assessment methods and techniques before and during the onset of such activities. For instance, it is common to consider the integration of multiple constraining factors and also, taking into account their high complexity and the application of one of the various techniques of Multi-Criteria Decision Making. The purpose of this study is to determine the location of the least and most polluted areas from several sampling points on the Olt River, in Romania. In the investigations carried out, MCDM methods were used: AHP and TOPSIS and spatial analysis performed using GIS software. The first part of the paper presents a quantitative assessment of the pollution in each sampling using AHP method. In the second part, the

most polluted and least polluted sampling points among those under consideration were determined by using TOPSIS. At the end of the work performed, a spatial analysis allowed for the development of representative maps of the studied area.

- **Keywords:** AHP; TOPSIS; GIS; Spatial analysis; Databases; Environment

Laura Ferreira, Emilio Rosales, Anthony S. Danko, M. Angeles Sanromán, Marta M. Pazos. *Bacillus thuringiensis* a promising bacterium for degrading emerging pollutants. Pages 19-26.

In the last decades, a wide range of organic pollutants has been identified as emerging pollutants in the aquatic environment. However, limited work has been done examining the ability of microorganisms to degrade emerging pollutants, such as polycyclic aromatic hydrocarbons (PAHs) and pesticides. In this work, a novel PAH and pesticide degrading bacterium was isolated from polluted marine sediment. After morphological and genetic characterization, the novel strain showed the highest similarity to *Bacillus thuringiensis*. The ability of the isolated bacterium to degrade the target pollutants was evaluated in shake flasks and bioreactor assays, reaching high levels of degradation for the model pollutants studied, phenanthrene and imidacloprid. Furthermore, the plausible degradation pathways of both pollutants were established. Based on the reported results, it can be concluded that *B. thuringiensis* has an enormous potential to mineralize a wide spectrum of emerging pollutants, such as PAHs and pesticides.

- **Keywords:** Emerging pollutant; Phenanthrene; Bioremediation; Metabolic pathway; Imidacloprid; Mineralization

Bipasha Das, Santanu Sarkar, Ankur Sarkar, Sangita Bhattacharjee, Chiranjib Bhattacharjee. *Recovery of whey proteins and lactose from dairy waste: A step towards green waste management. Pages 27-33.*

Whey is produced as a by-product during cheese and casein manufacture containing some important components such as lactose and protein. In this study, ultrafiltration process was adopted to separate lactose and protein with high yield and purity from whey using hollow fiber module. Ultrafiltration in a diafiltration mode was used in order to improve the yield of protein in the retentate, which was then freeze-dried to get the end product in dried form. Nanofiltration of the permeate stream from ultrafiltration was done to concentrate the lactose part and was similarly freeze-dried. To assure that after freeze-drying the quality of both the protein and lactose was not affected, FTIR analysis was done. The performance of both ultrafiltration and nanofiltration was characterized in terms of permeate flux. The influence of transmembrane pressure on both ultrafiltration and nanofiltration membranes was studied. The effect of fouling was also studied on both ultrafiltration and nanofiltration membranes and it was observed that the fouling effect was less in case of both the membranes and as such the membranes could be re-used for several times for effective separation of those components. The quantitative measurements were done for lactose and protein and it was observed that up to 90% of lactose and 80% of protein recovery could be achieved using the advanced separation technology. Therefore, the present article represents a novel approach for separation whey proteins and lactose from dairy waste to meet the socio economic requirements as well as to mitigate waste disposal problem.

- **Keywords:** Whey; Hollow fiber membranes; Diafiltration; Milk proteins; Lactose; Freeze-drying

Elvira Bocos, Olaia Iglesias, Marta Pazos, Maria Ángeles Sanromán. *Nickel foam a suitable alternative to increase the generation of Fenton's reagents. Pages 34-44.*

One of the bottlenecks often faced in environmental processes is focused on the design of efficient technologies. Thus, the hunt of suitable alternatives is a must to be tackled in order to improve the conventional methods. In this study the applicability of nickel foam as cathode in electro-Fenton's treatment of Poly R-478, a recalcitrant dye, was demonstrated. Linear sweep voltammetry and initial studies show the ability of nickel foam to increase the H₂O₂ generation during the electro-Fenton treatment, enhancing the removal yields achieved in comparison with other carbonaceous materials. Furthermore, complete mineralization of the pollutant was reached when using Boron Doped Diamond (BDD) as anode. A heterogeneous electro-Fenton process using iron loaded polyacrylamide hydrogels enhance the efficiency of the process with respect to homogeneous electro-Fenton and anodic oxidation technologies. Furthermore, the evaluation of the generated hydroxyl radicals confirms the obtained results. Finally, the reusability of the designed process was evaluated by decolorization of Poly R-478 in successive batches. SEM study of the nickel foam along the successive experiments confirms that no structure changes were detected. Summing up, nickel foam seems to be a suitable cathode material for the electro-Fenton treatment of recalcitrant compounds in continuous mode.

- **Keywords:** Heterogeneous electro-Fenton; Nickel foam; Iron loaded polyacrylamide hydrogels; Poly R-478; Boron Doped Diamond (BDD); Decolorization

Priya Banerjee, Pinaki Das, Aisha Zaman, Papita Das. *Application of graphene oxide nanoplatelets for adsorption of Ibuprofen from aqueous solutions: Evaluation of process kinetics and thermodynamics. Pages 45-53.*

Ubiquitous occurrence of several pharmaceuticals in discharged sewage effluents has lead to considerable deterioration of life and quality of receiving water bodies. Ibuprofen, an acidic nonsteroid drug, is one such pharmaceutical being widely used for its analgesic, antipyretic and anti-inflammatory properties. The present work investigated the efficiency of graphene oxide nanoplatelets (GONPs) in adsorption of Ibuprofen from its aqueous solutions. The GONPs were characterized by electron microscopy and X-ray diffraction to analyze changes in structure and morphology occurring due to adsorption (if any). The impact of various process parameters on percentage removal (%) of Ibuprofen was determined by batch adsorption experiments. The data obtained were subjected to isotherm and kinetic analysis in order to describe the distribution of ibuprofen between the liquid and solid phases in the batch studies. The results obtained best fitted the Langmuir isotherm model and were determined to be guided by pseudo second-order kinetics. Thermodynamic parameters such as Gibb's free energy, Enthalpy and Entropy were also evaluated and the results revealed the endothermic and spontaneous nature of the process of adsorption of ibuprofen onto graphene oxide. Hence, graphene oxide may be considered as a suitable adsorbent for large scale efficient treatment of water contaminated with ibuprofen and similar other anti-inflammatory drugs.

- **Keywords:** Ibuprofen; Adsorption; GONPs; Kinetics; Thermodynamics; Isotherms

LiXia Wang, Yang Ou, DuiAn Lv, BaiXing Yan, LiMei Zhai, JiuNian Guan, Huai Li, Muhammad Irshad. *Effects of boron waste (BW) addition on the bioavailability of boron and magnesium during swine manure composting. Pages 54-60.*

The improper disposal of boron waste (BW) would bring much trouble for environment, at the same time, BW with a higher content of boron (B) and magnesium (Mg) could be used as a fertilizer in B and Mg deficient soils. Therefore this study recommended a novel

disposal method of BW by composting, and investigated the influence of BW additions (at rates of 2.5%, 5.0% and 7.5%, dry weight basis) on the bioavailability of B and Mg during aerobic swine manure composting. Results indicated that additions of BW increased the content of both B and Mg in different fractions. The proportion of B fractions in the final composted material supplemented with BW were: nonspecifically adsorbed B (NSA-B) > B occluded in Mn oxyhydroxides (MOH-B) > specifically adsorbed B (SPA-B) > residual B (RES-B) > B occluded in crystalline Fe and Al oxides (CRO-B) > B occluded in amorphous Fe and Al oxides (AMO-B). The addition of BW improved the bioavailability of B to plants and reduced the proportion of Mg in the exchangeable fraction. Spearman correlation showed that B and Mg bioavailability was associated with fulvic acid (FA; $P < 0.05$). This study suggested that the humification process changed bioavailable forms of B and Mg during co-composting.

- **Keywords:** Composting; Boron waste; B and Mg fractions; Bioavailability; Humification process; Chemical parameters

E. Rosales, J. Meijide, T. Tavares, M. Pazos, M.A. Sanromán. *Grapefruit peelings as a promising biosorbent for the removal of leather dyes and hexavalent chromium. Pages 61-71.*

The objective of this study was to find a suitable and versatile agroforestry waste as alternative low-cost biosorbents for the removal of inorganic and organic compounds present in the wastewater of tannery industry [leather dyes and Cr(VI)]. Grapefruit peelings, fern, eucalyptus barks, oak leaves and cane pruning of grapevines were evaluated as biosorbents. Among them, grapefruit peelings showed the best results reaching 45 and 55% for the mixture of dyes and Cr(VI), respectively. A significant improvement in the performance of this biosorbent was obtained when it was pretreated with H₂O₂ (1 M) attaining the highest removal capacity of 80% and 100%, respectively. This biosorbent was characterised showing an adsorption capacity of 1.1003 meq/g and pHZPC 3.48. The adsorption working parameters, kinetics and isotherms were deeply studied in order to scale up the process to a continuous treatment system. Adsorption isotherms data fitted well to the Langmuir model with a maximum uptake of 37.427 mg/g for dyes mixture and 39.0628 mg/g for Cr(VI). Finally, the dynamic behaviour of the system, operating at different flow rates, was evaluated using a Homogeneous Surface Diffusion Model. Pretreated grapefruit peelings demonstrated to be a suitable low-cost biosorbent in the treatment of wastewater of tannery industry.

- **Keywords:** Grapefruit peelings; Adsorption; Tannery effluent; H₂O₂; Pretreatment

A.M. Díez, O. Iglesias, E. Rosales, M.A. Sanromán, M. Pazos. *Optimization of two-chamber photo electro Fenton reactor for the treatment of winery wastewater. Pages 72-79.*

The treatment of winery wastewater is necessary since it constitutes an environmental problem due to its high organic content and chemical oxygen demand and its low pH. However, these characteristics hinder the use of conventional technologies commonly utilized for the treatment of effluents. Therefore, new technologies for the management of this type of wastewater are required. In this sense, the photo electro Fenton process (PEF) was proposed as a good alternative because of the synergetic effect among Fenton, electrolysis and photolysis processes. In this study, the development of a new double chamber cubic reactor for the treatment of winery wastewater using PEF was performed. Surface response methodology was applied based on Box–Behnken design to define the best operational conditions. The selected key variables were voltage, distance between electrodes and the organic load of the effluent. Among the parameters optimized, distance between electrodes and voltage were identified as significant in the model. Under the optimized conditions the treatment of real winery wastewater was efficiently

carried out. Finally, it can be concluded that the configuration of this reactor is suitable for the remediation of this type of effluents.

- **Keywords:** Winery wastewater; Degradation; Two chamber reactor; Photo electro Fenton; Response surface methodology

Zhaohui Li, Nicole M. Fitzgerald, Wei-Teh Jiang, Guocheng Lv. *Palygorskite for the uptake and removal of pharmaceuticals for wastewater treatment. Pages 80-87.*

In this study, ranitidine (RT), a cationic drug was tested for its removal by palygorskite (PA) under different physico-chemical conditions, such as initial RT concentrations, contact time, equilibrium solution pH, ionic strength, and temperature. FTIR, SEM, and XRD analyses were conducted to determine the mechanisms of RT uptake on PA. The results showed that cation exchange or electrostatic interactions between the negatively charged PA surfaces and positively charge dimethylamine of RT was the major mechanism of RT uptake when solution pH was less than the pKa value of RT. Under high pH conditions, the 2,5-disubstituted furan group interacted with the PA surface via a delocalized π -bond, suggesting that the RT molecules were parallel to PA surface. The larger values for the RT distribution coefficient between PA and solution via electrostatic or cation exchange interactions and delocalized π -bonds in a multi-regression analysis confirmed these mechanisms. The XRD results showed no expansion of the (1 1 0) reflection of PA while the SEM observation showed no changes in crystal size and morphology, indicating that the sites for RT uptake were limited to the external surfaces of PA.

- **Keywords:** Cation exchange; Pharmaceutical removal; Palygorskite; Ranitidine; Sorption; Wastewater

O.A. Galblaub, I.G. Shaykhiev, S.V. Stepanova, G.R. Timirbaeva. *Oil spill cleanup of water surface by plant-based sorbents: Russian practices. Pages 88-92.*

The paper analyses the best practices of Russian researchers, including the authors of the article, in the field of crude oil and refined products cleanup of water surfaces by alternative sorbents. Sorption methods and using low-cost plant based sorbents are emphasized. Various modification methods (heat treatment, chemical modification, etc.) of the above mentioned sorbents are discussed, which are aimed at increasing oil sorption capacity and developing hydrophobic properties. It is evident from the review that these sorbents have considerable potential for the oil spill cleanup.

- **Keywords:** Oil spills; Cleanup; Plant waste; Plant-based sorbents; Alternative sorbents; Modification

Ravishankar Sathyamurthy, D.G. Harris Samuel, P.K. Nagarajan. *Theoretical analysis of inclined solar still with baffle plates for improving the fresh water yield. Pages 93-107.*

This work presents the theoretical analysis on the effect of mass flow, feed water temperature, internal heat transfer coefficient and the absorber plate temperature of an improved inclined solar still for producing fresh water. The solar intensity and other environmental parameters are considered for simulating the solar still in order to examine the effect of mass flow; feed water temperature; internal heat and mass transfer parameters; basin temperature on yield and effect of air gap distance between plates. The results show that, at a minimum mass flow rate, yield was increased by 57.14% and the maximum average water temperature for the flow rates of 0.0833,

0.1666, 0.3222 and 0.4166 kg/min are found to be 62, 45, 40 and 38 °C respectively. The average temperature of hot water collected in the lower storage was 47.9 °C. The effect of inlet feed water temperature shows that, there is an increase in yield by 65% with a flow rate of 0.0833 kg/min and the inlet temperature 60 °C respectively. Also, introducing baffle plates in the basin absorbs some of the intensities which will heat up the flowing water for achieving higher brine temperature. The present RHN (Ravi-Harris-Nagarajan) model can be applied to stepped and weir cascaded solar still for determining the average water temperature in the solar still.

- **Keywords:** Inclined solar still; Baffle plates; Flow rate; Inlet temperature; Fresh water yield; Ravi-Harris-Nagarajan model

Renato Benintendi. *Modelling and experimental investigation of activated sludge VOCs adsorption and degradation.* Pages 108-116.

This article deals with role and importance of adsorption in the activated sludge substrate degradation. This process is typically described according to the Monod-Michaelis-Menten (M-MM) kinetics, which is based on the assumption that the substrate has been pre-adsorbed on flocs in order for the biochemical reaction to take place. However, the simple and generalised use of M-MM equation in wastewater treatment modelling could be misleading in describing some specific scenarios, where substrate in the liquid phase is not in equilibrium with substrate inside the flocs and, in general, when adsorption and kinetic rates are not comparable. This can occur in numerous process configurations, during plant start-up, when substrate peaks or significant fluctuations are met, in batch processes. An experimental test has been carried out with the aim to investigate the characteristics of the adsorption mechanism and its relationship with the stored mass degradation. Direct application of M-MM kinetics failed in fitting the experimental data. External transport and Glueckauf and Coates particle-phase diffusion relations have been adopted to study substrate transfer to active sites. Andrews and Busby model has then been applied and an excellent accordance with the experimental data has been found. As a final aim of the work, transition from adsorption-to-kinetics has been modelled, which has shown to be very effective for a full understanding of phenomena.

- **Keywords:** Activated sludge; Adsorption; VOC; Monod-Michaelis-Menten; Andrews and Busby; Languimur-Hinshelwood

Junjie Bian, Qi Zhang, Xin Min, Shu Zhang, Lijuan Feng, Chunhu Li. *Modified clinoptilolite catalysts for seawater flue gas desulfurization application: Preparation, characterization and kinetic evaluation.* Pages 117-123.

Seawater flue gas desulfurization (FGD) process has been adopted by a number of coastal power plants for its lower operation cost. Natural clinoptilolite (clin) was modified by Fe²⁺ ion exchange, drying, and calcination to prepare a catalytic packing for improving desulfurization efficiency of the adsorption tower. Compared with natural clin, the most active 350-Fe-clin (Fe²⁺ exchanged clin, calcined at 350 °C) catalyst kept 6–12% higher SO₂ removal efficiency at the operation temperature regime 45–85 °C. The acidic effluent of the adsorption tower was below pH 3.0, and S(IV) oxidation efficiency was above 80%. This confirmed that the modified clin catalytic packing played a crucial role on seawater FGD process. Mechanistic and kinetic studies were carried out on the seawater SO₂ removal over prepared catalytic packings. XRD, SEM and temperature programmed desorption (TPD) were employed to characterize the catalysts. Kinetic and TPD experiments showed that SO₂ desorption energy on 350-Fe-clin was 19.85 kJ/mol, apparent reaction activation energy of seawater FGD on 350-Fe-clin in the scrubber was 20.27 kJ/mol, and liquid phase S(IV) oxidation rate constant in liquid phase was much higher than that of overall reaction. It could be deduced that the reaction rate determining step existed in gas phase reactions.

- **Keywords:** Flue gas desulfurization; Seawater; Catalytic packing; Kinetics; Clinoptilolite; SO₂ desorption

M.M. Ballari, J. Carballada, R.I. Minen, F. Salvadores, H.J.H. Brouwers, O.M. Alfano, A.E. Cassano. *Visible light TiO₂ photocatalysts assessment for air decontamination. Pages 124-133.*

Different visible light responses of commercial TiO₂ photocatalysts are assessed for their application in air decontamination. To do that the modified TiO₂ catalysts were immobilized on borosilicate glass plates according to a dip coating method. Then, the photocatalytic performance of these plates was evaluated in a continuous gas flat plate photoreactor irradiated with visible light lamps using two representative air pollutants: nitrogen oxide and acetaldehyde. Working under visible light, the modified TiO₂ catalysts were compared by means of efficiency parameters: the true quantum efficiency, which relates the moles of degraded pollutant with the moles of the absorbed photons, and the apparent photonic efficiency, which relates the moles of degraded pollutant with the moles of incident photons. Also, the photocatalytic pollutants degradation by immobilized modified TiO₂ could be related with their optical properties, finding a clear correlation between them. These results are useful to decide which TiO₂ will be more efficient for a full scale air decontamination process under visible light illumination.

- **Keywords:** Visible light; Photocatalysis; Air purification; Nitrogen oxide; Acetaldehyde; Efficiency

Leandro F. Nascimento, Osvaldo A. Serra. *Washcoating of cordierite honeycomb with ceria-copper mixed oxides for catalytic diesel soot combustion. Pages 134-143.*

Cordierite honeycomb monoliths coated with ceria-copper catalyst were synthesized, characterized, and used in catalytic soot oxidation. First, Ce_{0.6}Cu_{0.4}O₂ was obtained by the sol-gel method and deposited on cordierite. The resulting material was employed to capture and oxidize soot. The coating process generated highly dispersed active species and enriched the coating surface with ceria and copper. XRD, H₂-TPR, OSC, Raman spectroscopy, and SEM and TEM microscopies helped to confirm the structural and morphological properties of the material and formation of the mixed oxides. Compared with the uncatalyzed reaction, thermogravimetry analysis (TGA/DTA) of the soot oxidation in the presence of the catalysts showed that the soot oxidation temperature decreased. Raman spectroscopy studies revealed an increased number of oxygen vacancies in the Ce_{0.6}Cu_{0.4}O₂ deposited on cordierite as compared with pure CeO₂ deposited on cordierite. The coated monolithic catalyst exhibited desirable catalytic performance the soot removal rate exceeded 73% according to dynamic tests conducted in a stationary engine.

- **Keywords:** Diesel soot oxidation; Mixed oxides; Ceria; Cordierite coating; Automotive catalysis; Diesel particulate filter

C. Gutiérrez, J.F. Rodríguez, I. Gracia, A. de Lucas, M.T. García. *Reduction of the carbon footprint through polystyrene recycling: Economical evaluation. Pages 144-151.*

The incorporation of CO₂ into new processes is one of the most important strategies for gas emissions mitigation that also would help to decrease the Carbon footprint. Recycling of wastes is also considered as a route to prevent greenhouse emissions as well as a source of interesting raw material. The process of recycling of polystyrene (PS) wastes using high-pressure CO₂ as antisolvent and blowing agent in order to produce microcellular foams with enhanced properties was proposed, because the process could

combine the benefits of both strategies for CO₂ mitigation while high value-added materials were achieved. The technical, environmental and economical advantages of the recycling of polystyrene wastes were evaluated in an industrial and pilot-scale plant considering that CO₂ could be recirculated during the process in several cycles in order to minimise its consumption while the economical profit is maximised.

- **Keywords:** Carbon footprint; Recycling; Polystyrene; Economical profit; CO₂; Supercritical

Santiago Fernández-Rodríguez, Pablo Durán-Barroso, Inmaculada Silva-Palacios, Rafael Tormo-Molina, José María Maya-Manzano, Ángela Gonzalo-Garijo. *Quercus long-term pollen season trends in the southwest of the Iberian Peninsula. Pages 152-159.*

It is widely accepted the influence of meteorology to airborne pollen distribution, this concern is clearly affected by the issue of climate change. In the SW of Iberian Peninsula pollen from *Quercus* species is often the most abundant in the air and their flowering phenology show changes in seasonal pollination affected by meteorological parameters. This study aims to investigate airborne pollen data of *Quercus* from a city on the SW Iberian Peninsula over a 20 year period and to analyse the trends in these data and their relationship with meteorological parameters using time series analysis and propose a predictable model to forecast their concentration. Aerobiological sampling was conducted from 1994 to 2013 in Badajoz (SW Spain) using a 7-day Burkard spore trap. The main pollen season for *Quercus* pollen lasted, on average, 59 days, ranging from 31 to 80 days, from 28th March to 27th May. The model proposed to forecast the airborne pollen concentration is described by Eq. (1). This expression is composed of two terms: the first term represents the resilience of the pollen concentration trend in the air according to the average concentration of the previous 10 days; the second term is obtained from considerations of the actual pollen concentration value, which is calculated based on the most representative climatic variables multiplied by a fitting coefficient. In order to obtain the best fit the model was developed in four partial time series of 5 years, each of one with a high level of accuracy, although a general model was calculated.

- **Keywords:** *Quercus* pollen; Air pollution; Climate change; Long time series; Forecasting; Temporal modelling

Aditee Potdar, Anju Singh, Seema Unnikrishnan, Neelima Naik, Mayuri Naik, Indrayani Nimkar. *Innovation in solid waste management through Clean Development Mechanism in India and other countries. Pages 160-169.*

This paper focuses on the potential of Clean Development Mechanism (CDM) for Municipal Solid Waste (MSW) management in India. About 350 MSW projects are implemented through CDM across 56 countries. The maximum MSW management CDM projects are implemented in China (102) followed by Brazil (45) and Mexico (28). Fourteen countries registered two projects individually and twenty-three countries registered a single project individually. About 22 CDM projects for MSW management are registered in India. The annual estimated emission reduction from these 22 projects is 1,467,371 ton CO₂e/annum. Approved large-scale methodology (AM0025) and approved small-scale methodology (AMS III.F) are the most widely used methodologies. The highest numbers of projects are registered in the state of Delhi. These CDM projects use technologies viz. refuse-derived fuel pelletization, landfill capture, biogas generation, and composting. These technologies assist in reducing pollutants and landfill space, and generating energy and useful by-products. Policy and barriers for MSW management in India are highlighted and plans for implementation of more CDM projects are proposed. Though physical, operational, regulatory, and socio-economic challenges exist for MSW

management, India should make the best use of the opportunity that CDM offers and develop projects to benefit in terms of finance, technology and sustainable development.

- **Keywords:** Municipal Solid Waste; Innovation; CDM; Land-filling; RDF; Composting