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## Evaluation of Fenton and Ozone Treatment Processes for the Degradation of Psychiatric Drugs Carbamazepine (CBZ) and Oxcarbazepine (oxCBZ) in Simulated Wastewater (SWW)

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The current research focuses on the evaluation of two advanced oxidation processes (AOPs) viz. Fenton and ozone treatment for the degradation of recalcitrant antipsychiatric carbamazepine (CBZ) and oxcarbazepine (oxCBZ) in simulated wastewater. The parameters for Fenton reactions viz. pH, Fenton dosage, contact time and  $\text{Fe}^{2+}/\text{H}_2\text{O}_2$  were optimized using Response Surface Methodology. The optimum conditions obtained were (pH 2.0, Fenton dosage 1.61 g/dm<sup>3</sup>,  $\text{Fe}^{2+}/\text{H}_2\text{O}_2$  0.427 and contact time of 25 minutes) which yields a COD destruction of 92.49%. A pseudo-first order rate constant of 0.6185 min<sup>-1</sup> and 0.0676 min<sup>-1</sup> was observed for the ozonation of CBZ and oxCBZ respectively.

**Key words :** *Ozone, Fenton, advanced oxidation processes, carbamazepine, oxcarbazepine, kinetics*

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## Statistical Analysis and Process Optimization of Pretreatment Using Wetox for Complex Waste from Pharmaceutical Industry

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AND R.A. PANDEY<sup>+</sup>

Pharmaceutical wastewaters are complex and low in biodegradability index (BI: BOD/COD ratio) and hence difficult to treat biologically. Wet air oxidation (wetox), a green and eco-friendly process is used for the pretreatment of wastewater produced from a pharmaceutical industry manufacturing sulfa drugs, to enhance its biodegradability index from 0.27 to  $\geq 0.40$  to make it amenable for further biological treatment. Box Behnken design was used to perform the wetox experiments for three operating parameters viz. temperature (125-175° C), pressure (5-20 bar) and treatment period (15-45 min). The polynomial equation thus generated had  $R^2$  value of 0.9535 and was further subjected to optimization. The optimization was carried out with the aim to increase BI to 0.45. The optimal values for the three parameters were found to be temperature 185°C, pressure 20 bar and time 30 min. The results showed successful enhancement in the BI index of the complex waste making it further useful for biological treatment.

**Key words :** *Pharmaceutical waste, wetox pretreatment, box-behnken design, optimization*

## Performance Evaluation of Common Effluent Treatment Plant for Efficiency of Pollutant Removal and Relation to Design Adequacy

ASHWINI V. PADALKAR, SATINDER KAUR AND RAKESH KUMAR\*

Performance and efficiency of a Common Effluent Treatment Plant (CETP) in an industrial area of Maharashtra state of India was investigated with the aim of evaluating treatment effectiveness of each unit and also the CETP as a whole. The original designs of individual units of CETP were scrutinized for their design adequacy. The effluent was analyzed for the basic parameters of pH, BOD, COD, TDS, TSS and NH<sub>3</sub>-Nitrogen. Composite samples were collected from collection tank, primary clari-flocculators, secondary clarifier, aeration tank and final treated water tank. The performance efficiency of each unit in treating the pollutants was calculated. Results indicate that most of the parameters showed inconsistent reduction. The outlet discharge values were above the permissible limits of standards for industrial discharge. CETP showed removal efficiencies of 48, 56, 13 and 55% for BOD, COD, TDS and O&G respectively, whereas TSS increased by 36%. The study revealed that CETP needs revamp based on the characteristics of influent wastewater in order to meet the prescribed standard limits for CETP. The performance results have been used to make suggestions for improvement based on design principles and working of CETP.

**Key words :** *Performance efficiency, CETP, design adequacy, wastewater, design, reduction, pollutants*

## Source Identification and Quantification of PM<sub>2.5</sub> Aerosol in Mumbai Using Receptor Techniques

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Ambient levels of fine particles in the environment cause adverse human health effects and climate change. The estimation of PM<sub>2.5</sub> concentration, chemical characterization and source apportionment for different land use pattern in Mumbai was the objective. In the present study, factor analysis was performed followed by application of Chemical Mass Balance (CMB) model using source profiles developed for India and organic marker profiles developed in the United States of America. The average outdoor PM<sub>2.5</sub> mass concentrations at Control, Kerb, and Residential and Industrial site were 69±20.97, 84±31.99, 89±33.52, 95±36.01 µg/m<sup>3</sup>, respectively. Advantages of using speciation data viz. OC, EC, major ions and metals (with molecular marker) was helpful in identifying local sources like refineries, generators and kerosene combustion. Fine Particle Source Apportionment using Organic Marker indicated that major contributors to PM<sub>2.5</sub> mass were diesel exhaust, biomass burning, gasoline emissions secondary inorganic aerosol and road dust. The vehicular contribution (gasoline and diesel) was around 20-40%. The gasoline contribution is mainly attributed to vehicles but the diesel emissions may also be from vehicles, industries, stationary generators, forklifts for material lifting, bakeries etc. The secondary inorganic aerosol formation contributes to 11-28% indicating as one of the major sources followed by vehicles. Biomass combustion was about 6-24%, could be due to area sources like bakeries, crematoria, open burning, garden waste, domestic etc. Moderate road dust contribution was observed except at control site. The fossil fuel (diesel, gasoline and coal) contributions (27% to 38%) exceeded biomass contribution (6-24%) in Mumbai city.

**Key words :** PM<sub>2.5</sub> aerosol, source apportionment, organic marker, Mumbai

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## Seasonal Appraisal of Dissolved Carbon Distribution in a Tropical River, Kerala, India

PRINCE GEORGE<sup>1†</sup>, SABU JOSEPH<sup>2</sup> AND S CHIDAMBARAM<sup>3</sup>

This study on carbon distribution carried out in Meenachil River, Kerala during pre monsoon (PRM), monsoon (MON) and post monsoon (POM) typify remarkable seasonal variability in dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC) concentrations. Seasonal observation reveals that DOC is high during PRM compared to POM and MON. The study divulge that DOC, DIC and TC have similar trend for all seasons i.e. PRM>POM>MON, while ANOVA concludes significant variation among different seasons ( $P < 0.05$ ). Reduced DIC/DOC value at river mouth station especially during PRM indicates the ecohydrological changes in the river-estuary interface region. The total sediment carbon in river bed varied from 0.13 to 5.59 wt%. Strong correlations exist between dissolved carbon species of water and sediment during different seasons.

**Key words:** *Dissolved inorganic, carbon, Meenachil River, Kerala*

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## **Biomonitoring to Assess the Pollution Impact on Harbour Coastal Ecosystems – A Case Study**

JAYAPRADA CHUNDURI

Coastal ecosystems are under constant stress due to anthropogenic activities resulting in change within the communities' composition and distribution with respect to ambient water quality. The stress conditions lead to evolution of resistant organisms such as Chinese mitten crab and *Mytilopsis sallei* which are invasive and capable of propagating themselves across nations. Harbors are eco-centres that are under constant stress due to location, trade, and inflow of effluents. Poor water circulation, uneven mixing of effluents discharged in large quantities, and built structures affect the water quality conditions and communities of the harbours. Basic approach to understand harbours – with respect to their ecosystems, structural integrity, stress conditions, and to develop a conceptual model of stress assessment and its cost to its restoration, assessment of water quality and identification of biotic communities will show way forward to classify stress conditions and measure to restore water conditions. Holistic study of Eco-centres may open doors to innovative and risk based design for improvement of safety factor. Response of benthic microalgae to stress conditions in Visakhapatnam harbour as observed in this case study may be developed as conceptual model for environmental monitoring of harbour coastal ecosystem.

**Key words :** *Eco-centres, pollution, stress, ballast water management*

## Impact of Open Cast Coal Mining on Groundwater Quality Around Jharia Coal Field Area, India

AVANTIKA CHANDRA<sup>1</sup>, VIPIN KUMAR<sup>2</sup> AND MANISH KUMAR JAIN<sup>3</sup>

Assessment of the groundwater quality can enhance understanding of the hydrochemical system and effective management of water resources. An attempt has been made to evaluate the groundwater quality around opencast coal mining area during pre-monsoon (March), monsoon (July) and post monsoon (November) periods. Impact of mining on groundwater resources has been assessed by conducting geophysical and hydrological investigations. Groundwaters were collected from different locations and analyzed for physico-chemical parameters. The higher concentration of hardness, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Na<sup>+</sup>, Fe, Mn and Co was observed in all the seasons, which would make them unsafe for drinking purpose. The concentration of all the studied ions in groundwater was noticed higher in summer season followed by winter and monsoon. The groundwater quality index (WQI) was also calculated based on the parameters estimated and result indicated the deteriorated water quality. It was noticed that some of the groundwater locations are unfit for drinking as per Indian Standard. The presence of Mn, Fe, and Co in toxic amounts in groundwater samples is also a matter of concern. The study provides an insight into the likely impact of mining on water regime and will be helpful in taking proper precautionary measures.

**Key words:** *Coal mining, groundwater, impact of mining, water quality index*

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## Ozone Treatment of Sulfamethoxazole in Aqueous Matrix and Toxicity of its Degradation Products on *Pseudomonas aeruginosa* and *Enterobacter xiangfangensis* Species

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Sulfamethoxazole (SMX) is extensively used antibiotic and residue of SMX has been found in surface and drinking water in ng/L concentration. The advance oxidation process such as ozonation has been proposed for removal of SMX into its possible readily biodegradable intermediates and also limits its impact on the environment. About 20 g/h of ozone dosage used for treatment of sulfamethoxazole (four different concentrations of SMX 10 ppm, 20 ppm, 30 ppm and 40 ppm) resulted in 99 % removal within 60 minutes of ozonation with the leftover of its degradation products. However, the toxicity of degradation products of SMX formed after ozone treatment on soil microorganism (*Pseudomonas aeruginosa* and *Enterobacter xiangfangensis*) has not been reported. In the current study toxicity of degradation products using MTT assay has been reported. The study revealed that degradation product of SMX not showing any significant cytotoxic effect on the soil micro-organism compared to pure SMX.

**Key words :** *Sulfamethoxazole, cytotoxicity, MTT assay, ozonation, pharmaceuticals*

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## **Community Based Kitchen Waste Management : A Mass Balance Approach to Assess Potential of Anaerobic Digestion**

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ATYA KAPLEY AND R.A. PANDEY\*

Solid waste generation is a continuously increasing problem in India and requires effective management initiatives with attractive incentives to propagate the strategy being adopted. Anaerobic digestion of the organic-rich fraction of MSW is a potential solution to the management of wastes with possibility of energy recovery. Kitchen waste generated in significant quantities from community kitchens on a daily basis has the potential to generate biogas which in turn can be used to substitute fuel for cooking. The kitchen waste collected from NEERI campus contained up to 21 %  $\pm$  7.6 TS and 94 %  $\pm$  4.35 VS of total solids. Elemental profiling provided the average stoichiometric composition of waste. Buswell's model was applied to estimate the potential of the collected waste to generate biogas and be used as an alternate cooking fuel. With an estimated 14.9 tons of kitchen waste a total savings of around up to \$ 1180 per year is envisaged in fuel savings.

**Key words:** *Waste management, anaerobic digestion, mass balance, kitchen waste, biogas, Buswell's model*

## **The Role of Rotifers in Biological Treatment of Wastewater An Overlooked Aspect in Bioremediation**

RUPAROY<sup>1</sup>, MUNMUN SINHA<sup>2</sup> AND SUNITA SHASTRY<sup>3\*</sup>

Escalating human population leads to intensification of agriculture and manufacturing industries which results in the accumulation of wide range of xenobiotic compounds in the environment. Bioremediation is a promising, attractive and unswerving technique in cleaning of tainted environment and is widely applicable for soil and wastewater. The development of good quality activated sludge is a good example of biological process for treating wastewater. Rotifers form a vital component in this biological treatment system and have a momentous role in the diminution of pollution. This paper provides an account of the role of rotifer in wastewater treatment and emphasizes on the need of further research on the potential of rotifers for the bio-remediation of wastewater.

**Key words :** *Xenobiotic, activated sludge, rotifers, wastewater, bioremediation*

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