

In addition to classic Fenton’s reagent, which is catalyzed by ferrous iron (Fe²⁺), modified Fenton’s reagent relying on iron, extracted from locally available laterite soil as the catalyst has been widely investigated for its ability to degrade the hazardous 4-Aminopyridine (4-APy) in aqueous solutions. The focus of the study was on compound disappearance and mineralization. Mineralization was monitored in terms of Chemical oxygen demand (COD). 4-APy degradation was measured by spectrophotometric analysis using UV-Vis double beam spectrophotometer. Fenton’s oxidation process was carried out in lab scale using 2L Erlenmeyer flasks as reactors placed over magnetic stirrer to provide the necessary mixing of the reagents involved. Parameters like effect of pH, dosage of iron and hydrogen peroxide (Fenton’s reagent) are optimized to achieve maximum 4-APy degradation and subsequent mineralization. Effect of hydrogen peroxide addition in steps is also studied. Fenton treated samples were suitably analyzed by High performance liquid chromatography (HPLC). At optimized treatment conditions, 100-91% degradation of 4-APy at 10-80mg/L initial concentration was observed. Iron extracted from laterite soil shows a slight synergy with the classic ferrous sulfate when used in Fenton’s oxidation and thus can be a suitable alternative to ferrous sulfate to treat polluted water bodies containing 4-APy.

SURFACE WATER MANAGEMENT IN DISTRICT FARIDABAD, HARYANA: PRESENT AND FUTURE CHALLENGES

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Keywords : Faridabad, Industries, Effluents, Yamuna, Surface water pollution, Management.

Faridabad is the 9th biggest industrial city in the world and where river Yamuna is only a disposal medium for industrial and domestic effluents into it. Rapid industrialization and urban development leads to heavy pollution load on river, negatively affecting its quality as well its ecosystem. Due to present growth of population, it is very difficult to find and utilize new sources of clean water essential to satisfy rising water demand. To mitigate this kind of water related crisis should be a first priority to target all people and, especially, to those who are dealing with water management in city. Expansion of urban city brings considerable changes in physical properties of land surface growing integrated susceptibility of residents, agricultural ground and rural ecological life supporting systems. Many author’s findings from hydrological studies of river Yamuna on the basis of collection of hydrological data, analysis and modeling comprises a necessary base for significant surface water management in entire Yamuna river stretch in Faridabad. Potential challenges in urban surface water management consists development of new scientific and technical solutions as well as managerial and organizational methods in order to spin current problems into future opportunities. This paper summarizes following current and emerging challenges: supply of clean drinking water, recycling of wastewater, irrigation of wastewater, urban farming and agriculture, sharing of effective opinion, ideas and knowledge about new modern water management tools, techniques and models in the field of water resources for the better planning and management of a surface water of river Yamuna.

Apatites based Nanoceramics: Cobalt based waste water treatment

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Keywords : Hydroxyapatite; Cobalt; Isotherm; Adsorption isotherm, Waste Water Recycling

Cobalt radionuclide is one of the prime threats for humans due to its discharge through Heavy Water Reactors. To address this problem, nanoceramic Hydroxyapatite (HAp) biomaterials are synthesized in our lab by typical modified processes and utilized for removal of cobalt dispersed in water at its low ppm concentration. These HAp nanomaterials are synthesized and characterized by means of Atomic Force Microscopy, Scanning Electron Microscopy, X-Ray Diffraction, TGA/DTA, FTIR etc, for its structural and elemental identification. The cobalt(Co) contaminated water is treated with such nanomaterials with varying % of solute and solvent. Various experiments are performed in batches to assess the effect of adsorption by varying solute-solvent concentration. While performing adsorption equilibrium of Co on HAp, it is seen that Co adsorption in HAp is fast, reaching the equilibrium within 30 min., exhibiting maximum adsorption capacity of 1.21 mg/g. The adsorption isotherm data found to have well-fit with the linearized Freundlich model. The results are encouraging for the removal of cobalt traces from the waste water discharge through nuclear reactors. The results are attributed to nanosize of the synthesized HAp which remarkably higher surface to volume ratio useful for rapid and effective adsorption.

Effect of Contact Time on removal of dye from water using agriculture based biosorbent

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Keywords : Biosorption, coconut coir, contact time, dye, sugarcane bagasse, efficiency.

Biosorption, the property by which contaminants form a bond with biological material is an assuring technology directed towards the removal of numerous pollutants. The removal heavy metal and dye is a critical concern due to their extreme toxicity, cancerous properties and non-biodegradability. The use of conventional methods employing activated carbon is not effective due to its large capital cost. The disposal of these waste leads to large environmental concerns due to their non-eco-friendly nature. Biosorption is a method which has a high potential and its use in the removal of heavy metal and dye is promising, as it possesses the property to separate coloured complexes and dissolved metals from very dilute complex

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solutions. Agriculture based biosorbents are low cost, easy to manufacture and alternatives to the banal water treatment methods. It has a high efficiency. Dye is removed from water using agriculture biosorbents as such. Activated forms of these materials yield better results. Many factors such as pH, temperature, dosage, contact time etc. affect the efficiency of the process. Biosorbents such as sugarcane bagasse and coconut coir was tested with varying contact times with water contaminated with dye. This paper briefly summarises the influence of contact time of dye and agriculture waste on biosorption and removal of dye from water.

Qualitative Evaluation of Full Scale Municipal Wastewater Treatment Plants in North India

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Over recent decades, environmental regulations on wastewater treatment plants (WWTP) are meant for stringent organic and nutrient removal for the protection of local waterways. This paper is focused on performance evaluation of seventeen full-scale wastewater treatment plants with different processes of wastewater treatment. These STPs are based on Conventional Activated Sludge Process (ASP), Biofilm Based Process (MBBR), Biological Nutrient Removal Process (MBR, A/O, and SBR), Chemical Process (DENSADeg), Natural Process (WSP) & Anaerobic Process (UASB). The organic removal in different process of bioreactors was 0.55-3.84 kgCODm⁻³d⁻¹ in Activated sludge process based; 0.29-1.31 kgCODm⁻³d⁻¹ in Biological Nutrient Removal based; 6.29 kgCODm⁻³d⁻¹ in Biofilm based; 0.62-0.46 kgCODm⁻³d⁻¹ in Anaerobic process based; 9.24 kg CODm⁻³d⁻¹ in Chemical treatment based and 0.05 kgCODm⁻³d⁻¹ in Natural based process. Results suggest that among activated sludge based carbon removal technologies, high rate activated sludge reactor was best performer (3.84 kgCODm⁻³d⁻¹). Among BNR processes, the maximum organic and nitrogen removal was in A-O process (1.31kgCODm⁻³d⁻¹ and 0.15 kgTNm⁻³d⁻¹) followed by sequencing batch reactors (0.7 kgCODm⁻³d⁻¹ and 0.05 kgTNm⁻³d⁻¹).

Challenges To Meet New Guidelines on Water Consumption & Emission Discharge Limits for Thermal Power Plant

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Ministry of Environment, Forest & Climate Change, Government of India, has recently issued notification on 7th December 2015, with reference of S.O.3305 (E), Section 6 & 25 of Environment (Protection) Act, 1986, regarding maximum water intake consumption & achieving zero wastewater discharge for newly installed Thermal Power Plants (TPP). This notification also makes flue gas emission parameters more stringent, especially Sulphur dioxide (SO₂) less than 100 mg/Nm³ irrespective of power plant capacity, which mandates additional technology such as flue gas desulphurization to meet this requirement, which requires additional make up water. The maximum new water consumption limit is set at 2.5 m³/MWH. Presently coal based TPP, consumes water in the range of 3 - 3.5 m³/MWH without considering flue gas

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desulphurization. This paper discusses the various challenges as well as possible optimization to meet this new water consumption limit, including additional water requirement for SO₂ reduction and to ensure zero wastewater discharge from plant.

Water Conservation and Climate Change Training Program for Rural Rajasthan

Conference Theme: Community participation in water and waste water management

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Keywords : Gender, Water Conservation, Climate Change, Women Elected Representatives Rajasthan and Capacity building.

“A UN women study reveals that women led councils (panchayats) in India has 62% higher number of Water related projects than the councils led by men. Increase in women’s representation in the local governance has definitely had a huge impact in Rajasthan.”

The social constructions of gender define the roles of “male” and “female” in society. Looking after the household chores is one of the major gender roles assigned to a woman. It has been observed that maximum household work requires the usage of water and women play an important role in the provision, management and safeguarding of water. CSR recognises the importance of women’s active participation in governance structures and in the management of natural resources, particularly given the increasing impact of climate change. In order to address this issue we partnered with Hanns Seidel Foundation in 2012 to develop a Training Programme for the Elected Women Representatives and To-Be Elected Women Representatives of Rajasthan to achieve the following objectives :

- Increase understanding of the connection between water issues and gender inequality.
- Increase knowledge amongst Elected Women Representatives of tools and schemes for water conservation and water management.
- Increase capacity of Elected Women Representatives to lead water conservation initiatives at village level.

The program has adopted gender lens for contributing towards spreading awareness on water conservation and climate change. It focuses on building capacity of more than 100 elected women representatives to encourage them to take up lead role in water conservation within their community. The enumeration of the direct and indirect beneficiaries from this training program in rural Rajasthan is ongoing as CSR and HSF in collaboration is expanding the program in other parts of Rajasthan.

Domestic wastewater treatment using hybrid constructed wetland

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Keywords : Hybrid constructed wetland, Horizontal subsurface flow, vertical flow constructed wetland.

Hybrid constructed wetlands are emerging techniques of wastewater treatment. The present study investigates the potential of hybrid constructed wetland (HCW) to treat domestic wastewater. HCW system consists of vertical flow (VF) constructed wetland planted with *Typha angustata*, followed by two horizontal subsurface flow (HF-SSF) constructed wetlands planted with *Typha angustata* and *Phragmites karka* respectively. HCW system was assessed to remove carbonaceous organic matter (COD and BOD₅) for organic loading of 5-9 gm COD/m²/d and hydraulic retention time of 2 day. The Average removal efficiencies observed were COD (65±11%), BOD₅ (81±5%) and total solids (50±5 %). Also growth of plants was observed during monitoring period. Average height of plants was found to be 130 cm, with plant density 11 plants/m² and 20 cm as depth of root penetration. Based on the results obtained it can be concluded that the hybrid constructed wetland system can be effectively used as secondary treatment for onsite and decentralized wastewater treatment.

Performance of Community Based Ecological Surface Water Treatment

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In the EU-Indian collaboration project ECO-India (Energy-efficient, community based water- and wastewater-treatment systems for deployment in India) an ecological surface water treatment plant was developed. The plant design aims at elaborating a sustainable solution for the provision of safe drinking water to communities not having access to safe water sources. The solution makes use of traditionally widely available ponds. The multilayer treatment approach consists of catchment area management, pre-treatment (silt trap and sedimentation in the pond), a filter unit (two parallel rows of Horizontal Roughing Filter (HRF), Slow Sand Filter (SSF) and Activated Carbon Filter (ACF)) and finally disinfection with chlorine. The development of the treatment plant as well as the monitoring programme was setup in a participatory approach by the project team in close cooperation with the village water committee and various local stakeholders. Adelphi Research supports Jadavpur University in the conceptualisation, design, implementation monitoring and evaluation of the treatment plant.

The main part of the performance monitoring is based on the achieved water quality. After commissioning

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the treatment plant daily samples were taken in the first 30 days for examination in the field laboratory, thereafter weekly sampling is conducted for the next 5 months followed by monthly sampling. Offline water quality parameters which are monitored in the field laboratory are: e.coli, total coliform, turbidity, pH, TDS, ammonia, chloride, free chlorine, iron, nitrate, alkalinity, hardness, arsenic, dissolved oxygen, nitrite, phosphate, temperature, oxidation reduction potential and conductivity. Sampling spots for the offline measurement are Raw Water (RW), HRF treatment, SSF/ACF treatment and the final Clear Water (CW) tank. The online monitoring system documents every 10 minutes. It can monitor pump activity, turbidity, flow, temperature, pH, FAC and DO.

Important for the operation process are backwash periods of the HRF, scrapping intervals for the SSF and the time till the adsorption capacity of the activated carbon is exhausted. HRF backwash is conducted when more than 10cm headloss is reached, depending on the RW quality this has to be conducted every 1 to 3 weeks. Initial scrapping intervals for the SSF are 1 to 2 months also depending on the RW quality. The exhaustion of the activated carbon is assumed to be reached only after 1 to 2 years and thus was not yet checked.

The most important water quality parameters for the surface water treatment are turbidity and bacteria. Preliminary results of the treatment process showed that raw water of turbidities between 30 and 170 NTU could be treated to 1 to 5 NTU which satisfies the permissible limits according to the IS 10500. Although bacteria levels could be reduced in the treatment process, challenges were faced in reducing bacteria levels to acceptable limits which led to testing of various disinfection methods. Finally disinfection with Sodium Hypochlorite was evaluated to work best.

In further optimization steps desired water quality as per IS10500 is being aimed at by modifying flow rates, further uniforming roughing filter media, shading and closing further chambers of the filter and recirculating parts of process water.

Studies on Arsenic Pollution in Water, Soil and Crop Plant Samples, West Bengal, India

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Keywords : Arsenic Pollution, Ground Water, Microalgae, Physiochemical Parameters, Soil, Rice Plants.

In this present study water, soil, rice plants and microalgal samples were collected from arsenic polluted areas of West Bengal, India. Samples were collected at different seasons like winter, summer and spring. All the collected water samples were analyzed for physio-chemical parameters by multiparameter analysis field portable kit (Yellow Spring Instruments (YSI), USA). Arsenic concentrations from the collected water, soil and rice plant samples were analyzed and the results were recorded. In the present studies, arsenic tolerant genera of microalgae in the sampling sites were also recorded. *Chlorella vulgaris* was recorded as the dominant species in the study areas. *Chlorella vulgaris* was treated with different arsenic concentration for the detoxification of arsenic and to understand the effect of growth of microalgae with arsenic. Maximum arsenic concentration was found as 3 ppm at Baruipur, Chinsurah, Alipur and Dhakshineswar and minimum arsenic concentration found was 0.05 ppm. Maximum arsenic concentration (13.78 mg/kg) in collected soil

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samples was found at Bhogpur (East Medinipur district) and minimum concentration (5.87 mg/kg) was found at Hajigarh (Hoogly District). Maximum arsenic concentration in rice plants (15.06 mg/kg) was found in the root of the plant collected from Madhusudanpur (Hoogly district).

Isolation of indigenous Microalgal strains for textile dye industrial effluents treatment and Bioprospecting

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Keywords : Microalgae, Bioprospecting, IR, FTIR and GC-MS.

Many industrial areas in the world, shows increase in generating of wastewater nowadays. Industrialization is considered as the key factor to development of countries in economic terms. The recognition that environmental pollution is a worldwide threat to public health has given rise to new initiatives for environmental restoration for both economic and ecological reasons.

Among the various industrial sectors, the textile and paper industries are especially problematic since they generate significant quantities of wastewater that may have detrimental impacts when released into the environment without any treatment. The environmental problems associated with textile activities are caused mainly by the extensive use of synthetic dyes. Water usage statistics are mind-boggling: According to some estimates, 60 million metric tons of textiles are dyed each year at the rate of 100 liters of water per kilogram of material. Another way, it is equivalent to 219 days supply of drinking water for the entire world population.

The best methods for treating the textile dye industrial waste - water are biodegradation or removal of the pollutants by microorganisms. Microalgae have gained a great deal of attention as they are able to remove contaminants from wastewater and further the produced biomass, potentially could be the source of biodiesel or bio - fertilizer. We collected the effluents from the textile dye industries from Tirupur district, Tamilnadu, India. Isolation and identification of selected microalgal strains around the textile dye industries for the effluent treatment. We recorded the physico chemical parameters of the effluents after and before treatment. Biodiesel and economically important pigments, molecules, high value products like plant growth promoting agents, vaccines, Insecticides, bio fertilizers and other active molecules production by the transesterification of the lipids from treated microalgae from effluents could have an environmental impact. The bioprospecting from the biomass through solvent extractions and the fractions were analyzed for biodiesel by, IR, FTIR spectroscopy and GC-MS.

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Phycoremediation and Carbon dioxide (CO₂) Sequestration by Potent Microalgal Strains isolated from Thermal Power Stations in India

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Keywords : Thermal Power stations; Microalgae; Phycoremediation; CO₂ sequestration.

The elevating level of carbon dioxide concentration in the atmosphere is the main cause of global warming and climate change. The emissions of carbon dioxide (CO₂) from different sources are mostly from the combustion of fossil fuels used in power generation, transport and industries. The climate change is largely driven by increasing of CO₂ emissions due to the combustion of fossil fuels and also the thermal power plants are also releasing the polluted water to the nearby fresh water resources and creating ground water and land pollution. The flue gas released from thermal industries consists of high CO₂ concentration which can be utilized for the cultivation of microalgae because atmospheric CO₂ is the sole source of carbon for photoautotrophs. It is more important to apply a suitable strain of microalgae for the fixation of carbon dioxide emitted from various industrial sources and waste water treatment. The use of microalgae to fix CO₂ released from power plants via the exhaust gas and thereby mitigate the amount of carbon released into the atmosphere is an attractive idea. Therefore, the major task is to identify potent microalgal strains that can cope with very high CO₂ concentrations and Phycoremediation. The microalgae have several merits such as the CO₂ sequestration and thereby production of useful by-products.

In this study, the waste water samples from Thermal Power Stations in India were collected and Physiochemical parameters were analyzed. The dominant and potent micro algal strains such as *Chlorella* sp. and *Scenedesmus* sp. were isolated from the collected water samples from Thermal Power Stations (Kolaghat Thermal Power Station at West Bengal, Khaperkhed, Thermal Power Station at Maharashtra and Vallur Thermal Power Station, Tamil Nadu, India) because these microalgae can able to survive CO₂ stress tolerant in high CO₂ conditions. These microalgae strains were experimentally proved to the treat the waste water released from the Thermal power stations with NaHCO₃ as carbon source at different concentrations. The physio-chemical analyses were determined before and after the treatment of phycoremediation using microalgae. The results confirmed the reduction of toxic compounds from the waste water and reducing the CO₂ level in atmosphere. The CO₂ fixation rate from both microalgal strains *Chlorella* sp. and *Scenedesmus* sp. were determined after phycoremediation treatment. The overall study confirmed that *Chlorella* sp. and *Scenedesmus* sp. were concluded to be the best microalgal strains to sequester high concentration of CO₂ released from the flue gas and waste water treatment from thermal power stations in India. The yielding microalgae are high commercial value in the production of by products such as Biodiesel, Biofertilizers and Aquafeed etc.

Treatment of Sugar refinery effluent by Solar Photocatalysis using Ag/TiO₂ coated Prototype Reactors

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Keywords : Ceramic tiles; silver impregnated TiO₂; solar photocatalysis; sugar refinery effluent treatment; TiO₂ immobilization.

The present work illustrates the application of photocatalytic reactors for the treatment of effluent obtained from the secondary treatment plant of a sugar refinery. Silver impregnated TiO₂ was prepared by simple chemical reduction technique and are immobilized on to the surface of ceramic tiles which acts as prototype photocatalytic reactors. The prepared Ag-TiO₂ particles were characterized by using SEM, TEM, EDAX, XRD, and UV-Visible spectrophotometer. The XRD result reveals that silver are distributed over the surface of TiO₂ in silver oxide form. From SEM analysis its observed that the particles are more or less spherical in shape and agglomerated with each other. The EDAX pattern confirms that silver ions are doped over TiO₂ by showing its corresponding Ag peaks. The DRS study reveals, increase in wavelength response from UV region to visible region due to LSPR activity of nano silver coated TiO₂. On eight hours of solar irradiation, percentage reduction of COD by Ag/TiO₂, pure TiO₂ and control (without catalyst) reactors are about 95 %, 86 % and 22 % respectively. This results show that Ag/TiO₂ reactors can be effectively used for tertiary treatment of sugar refinery effluent and this treated water can be further reused for industrial processes.

Removal of Organic Pollutants from Coffee Wastewater: A Review

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Keywords : Coffee Processing Wastewater, Organic pollutants, Treatment technologies.

Coffee is one of the most commercialized commodities worldwide. India stands in seventh position in the global coffee production. Though India contributes only 4% share in the world's coffee contribution, Indian coffee is considered to be one of the most stimulating coffee in the world. Coffee is produced in both large plantations and small farms as well. The two well-known species of coffee, grown in India are the Arabica and Robusta. Increasing competition and a drive for increased output are impacting the environment in negative ways. The waste from coffee processing is the main source for environmental degradation. Coffee is processed either by wet method or dry method. Wet method produces parchment coffee having good quality but at a cost of releasing large amount of coffee pulp and effluent which is termed as coffee processing wastewater. Parchment coffee or plantation coffee can be prepared by pulping, cleanly washed with water and dried under sun. Preparation of such coffee requires pulping equipments and adequate supply of clean water. Hence the coffee industry uses large quantities of water during the various stages of the production process. In India, traditional wet method is adopted which consumes around 14-17 m³ of water per tonne of cherry to be

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processed. Consequently, the amount of wastewater generated is high that contains high concentrations of organic matter, nutrients, suspended matter and highly acidic with pH around 3.5-4.5. The chemical oxygen demand (COD) and biological oxygen demand (BOD) values can reach as high as 22,000 mg/L and 12,000 mg/L respectively. In addition, the presence of certain toxic chemicals such as alkaloids, tannins, and polyphenolics have the potential to make the environment for biological degradation of organic material in the wastewater more difficult. Thus the wastewater requires systematic treatment prior to the disposal. Central Pollution Control Board (CPCB), Government of India has imposed certain laws and guidelines for handling coffee effluents. Despite of this, due to economic constraints, effluents are discharged unwisely into nearby natural water bodies which flow into rivers and/or infiltrate into ground water. Hence there is a need to curb this problem through innovative and eco-friendly techniques. Understanding the coffee processing and nature of the coffee processing wastewater is fundamental for the design and operation of appropriate and effective treatment technologies. This review briefly explains the various treatment techniques adopted involving the biological treatment system such as anaerobic-aerobic settling ponds, artificial aeration, biogas reactors, land application by irrigation, wetlands. Various researches conducted in order to provide technical solutions on the removal of organic pollutants from coffee processing wastewater in a pilot scale are presented. Wastewater collected in the bins can undergo further treatments for methane gas production and is been proved to be economically viable for the conversion of waste to energy in order to obtain income from the generated waste. Thus the scope of biogas production in addition to the degradation of organic pollutants is been investigated with appropriate case studies.

Integrated Urban Water Management of Nanded City, Maharashtra, India - Need to Recharge the Failed Bore-wells

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Recent drought conditions in Nanded has posed severe problems to the water-table, therefore, the present study is carried out to suggest practicable and result yielding integrated Urban Water Management plan for Nanded city. Nanded city is dependent more on bore-well water as there is limited supply of water from Godavari River. Efforts are made to find out the density of the bore-wells and failed bore-wells. Three sampling sites, with varying rate of failed bores, are selected. It is observed that in Ganesh nagar there are 90 bore-wells of which 10 bores are failed. In Chikhalwadi area there are 20 bore-wells of which 5 bores are failed. While, in Ashtavinayak nagar there are 80 bore wells of which 70 bores are failed. Resistivity survey suggests that the minimum rate of failed bores in Nanded is not more than 20%. The statistical data from corporation suggests that there are 105254 houses in the city & there are about 30000 bore-wells in the city (In Taroda region itself there are 22012 houses, with atleast one bore-well in almost every house). Due to drought, in last four months 2500 bore-wells are drilled, of which 1500 bores failed. We suggest to use these failed bore-wells as 'Recharge-Pits', where in roof-water will be released. There are two advantages of this i) most of the bores are located in amygduloidal basalt which has got the capacity to absorb the water, though the absorption is slow & ii) these failed bores have more depth (30 m) than the roof water harvesting ditch (3 m). Thus deeper pits are available for recharge. But as absorption of water is slow in amygduloidal basalt generally the shallow aquifers are saturated during even moderate rains and can't absorb collected roof water. Under such circumstances collected rain water on roof can be stored temporarily and released in the recharge pits later on, once the water from amygduloidal basalt percolates to deeper level.

We identified few probable recharge pits (failed bore-wells) as a part of preliminary study. We suggest that all the bore-wells in the city should be registered (including failed bores), which will help delineate zones of contd...

recharge-pits in the city which is the integral part of the 'Integrated Watershed Development Plan for artificial recharge of groundwater. The Water Management Bill 2009 suggested that all the state authority shall ensure the registration of all the owners of wells. District Watershed Management Committee needs to ensure that this task is achieved. It may be further ensured that the construction of appropriate rainwater harvesting structures in the zones of recharge is done on priority basis. Such type of mapping of 'recharge-pits' (failed bores) should be done in all other cities across the state of Maharashtra.

Comparative study of nutrient removal of *Chlorella vulgaris* in different types of secondary treated wastewater and biochemical characterization of grown algal biomass

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Keywords : *Chlorella vulgaris*, nutrient removal, phycoremediation, value-added products, wastewater.

Aim of the work: The present work is a novel attempt to mitigate the nutrients especially nitrogen and phosphorus present in secondary treated sewage, soak liquor and composite tannery effluent through phycoremediation. *Chlorella vulgaris* was selected for the study and batch experiments were carried out to investigate the nutrient removal performance in different effluents. In addition, carbohydrate, protein and lipid content of residual algal biomass were determined.

Results: *Chlorella vulgaris* removed nitrate nitrogen by 74%, ammonical nitrogen by 68.6%, PO₄-P by 71.5% and total COD by 90.2% respectively from secondary treated domestic wastewater. In case of secondary treated soak liquor removal of nitrate nitrogen by 62.6%, ammonical nitrogen by 66.7%, PO₄-P by 61.5% and total COD by 93.8% respectively. For secondary treated tannery wastewater, removal efficiency of nitrate nitrogen, ammonical nitrogen, PO₄-P and total COD was found to be 85.6%, 55%, 60.5% and 43.4% respectively. Experimental results indicated that removal efficiency of both NH₄-N and PO₄-P was higher in secondary treated domestic wastewater compared to other two wastewaters while secondary treated tannery wastewater showed highest NO₃-N removal efficiency compared to other wastewater. Biochemical characterization revealed the possibility of biofuel production as the total lipid content was comparatively higher than carbohydrate and total protein.

Conclusion: In phycoremediation, Nitrogen and Phosphorus in the wastewaters can be used as cheap nutrient sources for algae biomass production and it can be utilized for the production of value-added products like bio-manure, biogas, fine chemicals production and feed to animals on large scale operation. Thus phycoremediation offer multifaceted benefits of eliminating the nutrients and production of valuable products.

TREATMENT OF SOAK LIQUOR USING MEMBRANE APPLICATIONS AND RECOVERY OF WATER AND SALINE LIQUOR

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Keywords : Membrane bioreactor, reverse osmosis, soak liquor, tannery, water recovery.

Tannery sector is a major contributor for the development of Indian economy, exports and also provides large scale employment. This tannery sector, effluent contains high amount of inorganic salts which can cause severe water pollution. Soak liquor, the hyper-saline effluent produced by soaking of salt-laden hides and skins, is abundant in TDS and organic matter. The segregation and disposal of soak liquor in Solar Evaporation Pans (SEP) is commonly practiced in tanneries for the recovery of salt. However, SEP requires large land area and the recovered salt is highly impure due to the presence of large amount of suspended and organic impurities. This study focuses mainly on the treatment of tannery soak liquor by adopting membrane process (MBR/RO integration) for the removal of organics, recovery of water and concentrated saline liquor. About 95% of the organics from the soak liquor was removed by MBR, hence the resulting permeate contains only saline liquor (NaCl). Further two stages RO is used for the recovery of concentrated saline liquor, which is utilised in the pickling process of leather manufacturing instead of SEP. The overall process will be beneficial to both industries and environment as it recovers the water and RO reject which can be directly used in pickling process without additional use of water and salt.

Synthesis and application of Clay-Alginate and Zinc embedded pebbles for adsorption of Congo Red from industrial effluent

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Keywords : Adsorption, Congo red, Electrostatic Interaction, inter diffusion Packed bed column, Pore diffusion.

Synthesis and application of Clay Alginate (CA) -Zinc embedded pebbles for adsorption of Congo Red (CR) anionic dye from aqueous solution using adsorption reactor was studied. Zinc Nano particles (ZnNps) were embedded on the concrete pebbles by the technique of inter diffusion of ions and it was characterized by SEM, FESEM, EDAX and FTIR. Packed bed column was constructed for adsorption using alternate layers of CA and ZnNps. The effects of volumetric flow rate, bed height and dye concentration were investigated. The adsorption capacity was mainly occurred through pore diffusion and electrostatic interaction and shown 98 % of removal efficiency at an optimum pH of 6.5. The newly developed ecofriendly composite materials have an excellent adsorption capacity of Congo red and has wide potential application for water and wastewater treatment technology.

"A PERSPECTIVE ON PRESENT WATER DISINFECTION TECHNIQUES AND RURAL WATER SUPPLIES WITHIN MAHARASHTRA"

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Keywords : Water crisis, Water disinfection, Household, Chlorination, Rural water supplies,

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Water touches every aspect of life and the future's crying need is for water, according to World Health Organization [WHO], about 750 million people around the world have no or lack of access to safe water. In India uncertainty over access to and the availability of water may be reaching catastrophe levels. The World Health Organization [WHO] estimates that 97 million Indians lack access to safe water today, second only to China and the World Bank estimates that 21% of infectious diseases in India are related to unsafe water. The solar energy for water disinfection process will be useful to minimize the total consumption of energy in the process at individual and community level which call for the conversion and development of the solar radiation into electrical, mechanical, or thermal energy. This paper reviews for comparisons of various disinfection techniques along with economical and effective solution towards the disinfection process within rural water supplies in Maharashtra. This study concludes with there is still a scope to plan and develop more reliable and simple methods of water disinfection technique in combination with solar energy system.

NATURAL WASTEWATER TREATMENT AND REUSE SYSTEM FOR COEP HOSTEL CAMPUS: A CASE STUDY UNDER THE NAWATECH PROJECT

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Keywords : Anaerobic Baffled Reactor, Anaerobic Filter, Anaerobic Settler, Hydraulic Retention Time and Vertical Flow Constructed Wetlands

This article describes the work at hostel campus of College of Engineering, Pune where 2000 persons are staying. The basic aim was to treat the sewage cost effectively for reuse. Three treatment systems are implemented here; viz. System A: 40 m³/day for black water, System B: 40 m³/day for grey water and System C: 100 m³/day for mixed water (sewage). Treatment units such as Anaerobic Settler, Anaerobic Baffled Reactor, Anaerobic Filter and Vertical Flow Constructed Wetlands are implemented at the site. The average Hydraulic Retention Time for Anaerobic Treatment System (ATS) is 2 days and for Vertical Flow Constructed Wetland (VFCW) it is 1 day. Black water (40 m³/day) is treated only by ATS (AS+ABR+AF). Grey water (40 m³/day) is treated by VFCW. Mixed water is treated by ATS and VFCW. The expected treatment efficiency from ATS for basic parameters like BOD, COD & TSS is more than 75 %, whereas from VFCW it is expected to be more than 90 %. The outlet from VFCW is disinfected by UV disinfection unit and the final treated water is used for toilet flushing and land applications. This will minimise the total consumption of fresh water for hostel campus and also reduce the pollution load on public sewerage system.

DECENTRALISED ONSITE INTEGRATED WASTE MANAGEMENT SYSTEM (DOSIWAM) : A SUSTAINABLE OPTION FOR WASTE MANAGEMENT

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In rural as well as urban areas, the existing waste management systems are lacking in the use of appropriate technologies and the percentage coverage of population is very low. The existing waste management systems are grossly inadequate while the arrangements in peri-urban and rural areas are either virtually nonexistent or hopelessly inadequate. Further, there is no coordination between the methodologies used for managing different kinds of wastes. Keeping in mind; the resource crunch and expected coverage of maximum possible percentage of population in low income urban, peri-urban and rural population, it is necessary to adopt methodologies appropriate to the situation, based on the following important parameters.

The suggested technologies should be non-conventional, appropriate, as low cost as possible technologies through which, as large a section of population as possible will have to be covered

Further, these technologies may be such that resource recovery is made possible by energy recovery, recycling and reuse.

The processes need to be decentralised and 'on site' as far as possible, so as to minimize waste carriage. Thus, these could be established even in isolated peri-urban areas and remote villages. In tropical countries, biological and biochemical process would be very suitable because of appropriate ambient conditions and low capital and maintenance costs.

Two such technologies that are used in various parts of Maharashtra and especially popularised by (Late) Dr. S. V. Mapuskar in Village Dehu of Pune district, are being studied and evaluated by us for sustainability criteria. The same are described in the paper. The comparative studies carried out clearly indicate that these systems are much more reliable than the prevailing mechanised systems available in the market.

A REVIEW ON MODERN TECHNIQUES FOR REMOVAL OF SYNTHETIC ORGANIC PESTICIDES FROM POLLUTED WATER

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Keywords : Advanced oxidation, Adsorption, Biological process, Nano-filtration.

A large number of synthetic organic pesticides have been registered and marketed for pest control purposes

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around the world. Occurrence of persistent organic pesticides in surface and ground waters sources can cause potential severe health effects on human and animal. Hence, drinking water production companies and end users are concern about the presence of pesticides in raw water. An ideal treatment technique for pesticide should be non-selective, suitable for small-scale wastes, and attain fast and complete mineralization. This article is an attempt made to review and update the recent advances made in the field of technological developments in synthetic organic pesticides removal technologies by using advanced Oxidation, Nano-filtration, Adsorption, Biological process, etc. to explore the potential of those advances to address the problem of synthetic organic pesticides contamination in water. Hence there is a need to evaluate the effectiveness of any proposed treatment to reduce pesticides concentration below the maximum permissible concentration.

Analysis of Latest Technological Solutions

The increase in urban populace has been a benefactor for the development of the country but it has been a malediction as umpteen number of the wastewater treatment facilities are then desired in metro cities. Therefore, such plants are desired which gives optimum output in terms of treatment capability, have minimum footprints and the treated wastewater is fit for recycle and reuse.

Emergence of Compact Technological Solutions

The traditional method of centralized wastewater treatment have superannuated as the output from such old fashioned technologies does the follow the laid down treatment standards as well as require more energy for the treatment and occupies considerable space. In addition the performance of such obsolete technologies in India is not very much appreciable.

Use of à la mode treatment technologies such as Membrane Bio Reactor, Sequencing Batch reactor and the Moving Bed Bio Reactor is now customary. They have helped the urban areas of India and benefitted the persons by the reuse/ recycle of the treated water as well as lowering the energy consumed by such plants.

Implementation of MBR, SBR and MBBR Technologies

The MBR, SBR and MBBR are the three current technologies which are of immense use in India. The system in each of these plants consists of units which uses the aerobic digestion for the treatment of sewage sludge into an end product having 'zero waste'.

MBR, Akshardham (Delhi) produces high quality effluent, good in removing organic and inorganic contaminants, capable to resist high organic loading and has lesser sludge generation. The SBR at Rishikesh (Uttarakhand) comprises of coarse and fine screens, screenings handling equipment, grit chambers, C-Tech basins, air blowers, centrifugal dewatering and chlorine disinfection system. In addition, studies was done on an STP based on MBBR Technology in the military cantonment area of Ordinance Factory Medhak (Dist Hyderabad) having a capacity of 1 MLD. The plant was using aerobic digestion with plastic discs as the media.

Low Cost Package Plants

Package Type plants enhance the efficiency of the septic tank systems by provisioning of anaerobic filter type system for the treatment of septic tank effluent. Studies on demonstration-scale packaged system at Roorkee (Uttarakhand) revealed that the system performs satisfactory and has low-maintenance since all parts of the system work without electrical energy.

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	Loc	Plant Capacity (MLD)	Area of the Plant (sqm)	Removal Efficiency				
				BOD	COD	TSS	TN	Faecal Coliform (log unit)
MBR	Delhi	4.5	2000	98%	96%	98%	84%	Upto 5<6
SBR	Uttrakhand	3	700	93%	88%	92%	71%	Upto 3<4
MBBR	Telangana	1	400	73%	66%	64%	59%	Upto 2<3
Package	Uttrakhand	0.0005	~10	66%	62%	62%	36%	Upto 1<2

Inferences

Comparison of the contemporary techniques with the low cost Package plants revealed that the effluent quality of the leading technologies satisfies the prescribed norms of discharge. If considering footprints and effluent quality, it is inferred that MBR occupies less space as compared to other treatment techniques, howbeit requires higher capital costs. The package plants on the other hand provide a cheaper solution for the rapid pollution control, however, the treatment is not very much laudable. The package plants are fit for usage in domestic household purposes.

Environmental Impact of Socio-Cultural Activities on River Ghats of Wai and Krishna river

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Keywords : Cities, Krishna, Pollution, River, RiverGhats, River management, River-front Development, Socio-Cultural activities

Abstract: Rivers have played vital roles in evolving human civilizations. The River edges were defined by developing concrete embankment, Ghats, which formed the cultural landscape of towns and cities. However, it is ironical to see the transformations of cities which treat the Rivers like sewage drains and show mere negligence in maintaining the River Ghats. This paper reviews the present environmental conditions of the River Ghats in Wai town, which is located at foothills of Panchgani in the state of Maharashtra, India. The aim of this study is to understand impact of socio-cultural activities on the Ghats and to design a feasible solution for Ghats development. The interview surveys revealed that the main cause of pollution of Wai Ghats was the left-over organic and non-biodegradable wastes after the festivals and daily cultural activities. We suggest implementing simple solutions like selling of biodegradable packaging items at River-banks, forming separate Kunds for washing utensils, and bathing, could enormously benefit these Ghats. Wai might lose its identity if the socio-cultural activities are hindered in the name of river development. This study has made efforts in identifying the ways in which pollution can be minimized without losing the identity of the River Ghats.

OXIDATIVE DEGRADATION OF RHODAMINE B USING NEEDLE LIKE MnO₂ NANO PARTICLES

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Wastewater effluents from textile industries contain different types of dyes, the discharge of which pose potential harmful effects on the ecosystem and human health. Rhodamine B, is a highly carcinogenic, neurotoxic dye that is used in textile, printing, and photographic industries extensively. In view of its potential harmful effects, it is essential to degrade such dyes in industrial effluents before they come in contact with the ecosystem and cause harm to humans and the natural environment. Manganese dioxide nanoparticles are found to be effective in the oxidative degradation of organic dyes. In this work, the application of needle like nanostructures of Manganese dioxide prepared via simple redox co-precipitation method for the oxidative degradation of Rhodamine B was investigated. The morphology of the material was characterized by Scanning Electron Microscopy (SEM); it was observed that Manganese dioxide nanoparticles have a needle like structure with width in nanometer range. The point of zero charge (pHPZC) of MnO₂ nanoparticles was found to be at pH 3.0, above and below which the material is expected to have a net positive charge and a net negative charge respectively. The porous nature and the oxidizing property of the MnO₂ nanoparticles has been exploited for the degradation of Rhodamine B in aqueous media under ambient conditions. The oxidative degradation characteristics of Manganese dioxide nanoparticles were evaluated as a function of system variables such as pH of the reaction mixture, dose of Manganese dioxide nanoparticles, initial concentration of Rhodamine B solution and speed of stirring the reaction mixture. The percentage decoloration was found to increase with increase in reaction time, dose of Manganese dioxide nanoparticles and speed of stirring during the process. It was also found to increase with increase in pH up to pH 7 and decrease in the alkaline pH range. The percentage decoloration decreased with increase in the initial concentration of CV. About 100% decoloration was achieved with Manganese dioxide nanoparticles at a dose of 0.5 g/L from 20 mg/L crystal violet solution with in 5 minutes.

DEVELOPMENT OF WISE WATER MANAGEMENT USING GREY WATER TREATMENT SYSTEM IN CSIR- NEERI, NAGPUR

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Keywords : Consumption, Grey water generation, GTP, Quantification, Reuses, Water management solution.

Many cities in developing countries are facing surface water and groundwater pollution problems. As global water resources decline, reuse of domestic grey water for the irrigation of home gardens, toilet contd...

flushing and washing is quickly becoming widespread in many parts of the world. Grey water treatment is an environmental friendly process as a minimization of water pollution. Wise water management is an important approach in order to address the several water related issues. The present research work carried out for the "Development of Wise Water Management System in CSIR-NEERI, Nagpur". Therefore, it is necessary to know about various sources of water supply, demand, wastewater generation, identification and quantification of various sources of water consumption for NEERI, Nagpur and hence a survey was done. Water consumption in different purposes such as bathing, cooking, drinking, ablution uses, washing of cloths, washing utensils, kitchen and wash basin, floor wash, irrigation, flushing of water closets, leakage in taps and urinals, vehicle washing, cooler, washing machines and pets in colony and institute such as in laboratories for various uses, canteen, etc. was from the estimated survey. The water consumption 71.13% per day and water losses 28.87% was found in survey and also estimated water consumption in Liter/Capita/Day 165 (Lpcd) in NEERI. The wise water management approach includes reuse of grey water for toilet flushing, floor washing, vehicle washing and irrigation in lawns and gardens, prevention of water losses, water management solutions and performance evaluation of grey water treatment systems. It was observed that such grey water generated from the colony can be reused after treatment for various non-potable purposes. The grey water generated in NEERI East or west colony or the total 79.00 m³/day/. We can save 10.78 % of municipal water supply per day by reusing treated grey water in NEERI campus. Thus it is realized that wise water management system is beneficial for fresh water conservation and would go a long way towards managing the problem of water scarcity in the country.

DECISION SUPPORT TOOL FOR WATER TREATMENT ALTERNATIVE SELECTION AT COMMUNITY & CITY SCALES

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Keywords : Decision support systems, many-objective optimisation, multi-criteriaanalysis, treatment train, water treatment alternatives, water-energy efficiency.

Freshwater scarcity has become one of the most challenging issues and it needs worldwide attention. Although a considerable progress has been made to develop sustainable water management strategies and fit for the purpose water treatment alternatives, their cost effective implementation and long run smooth operation still remains a challenge in developing countries. Since the selection of water treatment technologies is a complex process and requires consideration to several aspects to meet a range of objectives, an easy to use decision support tool (DST) for technology selection could help in identifying optimal solutions and facilitating improved provision of safe water supplies. Decision making for the selection of water treatment alternatives at both community and city scales requires consideration to economic, technical, social and

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environmental aspects. The decision making process also involves engagement with a range of stakeholders such as environmental regulators, policy makers and end users, with each having different priorities and perspectives. Here in this study, we present the development of a novel decision support tool: WETSUiT (WatEr Treatment decision SUpport software Tool). WETSUiT is a multi-device application in which both Many-Objective Optimization (MOO) and Multi-Criteria Analysis (MCA) are employed. WETSUiT helps to identify optimal treatment technologies combinations/configurations at community and city scales for various contexts in developing countries including India. The technology selection process takes into account a number of sustainability related selection criteria, constraints including availability of resources (e.g.land, trained manpower, energy etc.) and quality of raw water needing treatment. The tool comprises a technology library, a multi-objective optimisation engine, a user interface and a mechanism to perform multi-criteria analysis. The performance of the solutions proposed by the tool can be evaluated in terms of a range of sustainability indicators including removal of specific pollutants, carbon emissions, implications for resources and social aspects. The presented work emerges from an EU funded FP7 multi-disciplinary and multi-institutional project (Grant Agreement Number: 308496).

Method for improving biomethanation of domestic sewage in a UASB reactor at low to moderate temperature

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Domestic wastewater is now considered as huge resource of water, nutrients and energy. Up-flow anaerobic sludge blanket (UASB) reactor is one of the most economic anaerobic technologies that allow energy recovery by treating domestic sewage in the full scale sewage treatment plants (STPs). So far, UASB technology is implemented only in tropical countries like Brazil, Colombia and India. But ambient temperature not only varies with the change in season, but also varies within a day. Temperature of the sewage goes down as low as 15-20°C in winter in the cities like Delhi, Ghaziabad, Saharanpur, Kanpur where most of the UASB reactors are installed in the STPs. In the Indian climate, the diurnal temperature range varies from 11°C to 15°C. For practical reasons, full scale installations do not have temperature controlling gadgets and are exposed to seasonal changes in temperature. Biomethanation of domestic wastewater is challenging at lower temperature (<20°C). At temperature below 20°C, slow hydrolysis of complex and particulate organic matter and slow growth of microorganisms make anaerobic treatment practices very challenging. Many researchers working in this area tried to develop psychrophilic methanogenic population by seeding reactor with mesophilic methanogens and operating the reactor at fixed temperature (<20°C). They operated the reactors under this condition for long time thus allowing them to adapt in this condition. It is reported that methanogens isolated from cold ecosystems use methanol as their preferred substrate. Several studies have confirmed that hydrogenotrophic methanogens are adapted to low temperature. Some hydrogenotrophic methanogens can utilize methanol in addition to H₂ and CO₂. Encouraged by this finding, we aimed to develop temperature resilient methanogens. We hypothesized that methanol induces low temperature resilient methanogens and improves methane generation from domestic wastewater at low to moderate temperatures. We tested the hypothesis in a pilot-scale UASB reactor in field conditions to evaluate the impact of seasonal variations in temperature on methane production in the presence and absence of added methanol. Results show that methanol at a dose of 0.04% (v/v) improved methane yield in UASB up to 15 times. The effect of methanol

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was more prominent at 150C than at 250C and 350C. Microbial characterization using qPCR analysis showed that hydrogenotrophic methanogens were unaffected by temperature drop in winter. But the presence of methanol utilizing Methanobacteriales along with acetate utilizing Methanosetaeaceae in dominating numbers indicate that methanol induced the growth of both the groups through direct and indirect mechanism, respectively. Our study thus demonstrated that methanol can be used to impart resistance in methanogenic biomass to low temperature and improve performance of UASB reactor treating domestic wastewater.

Effect of Contact Time on removal of dye from water using agriculture based biosorbent

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Keywords : Biosorption, coconut coir, contact time, dye, sugarcane bagasse, efficiency.

Biosorption, the property by which contaminants form a bond with biological material is an assuring technology directed towards the removal of numerous pollutants. The removal heavy metal and dye is a critical concern due to their extreme toxicity, cancerous properties and non-biodegradability. The use of conventional methods employing activated carbon is not effective due to its large capital cost. The disposal of these waste leads to large environmental concerns due to their non-eco-friendly nature. Biosorption is a method which has a high potential and its use in the removal of heavy metal and dye is promising, as it possesses the property to separate coloured complexes and dissolved metals from very dilute complex solutions. Agriculture based biosorbents are low cost, easy to manufacture and alternatives to the banal water treatment methods. It has a high efficiency. Dye is removed from water using agriculture biosorbents as such. Activated forms of these materials yield better results. Many factors such as pH, temperature, dosage, contact time etc. affect the efficiency of the process. Biosorbents such as sugarcane bagasse and coconut coir was tested with varying contact times with water contaminated with dye. This paper briefly summarises the influence of contact time of dye and agriculture waste on biosorption and removal of dye from water.

Adequacy and Efficacy Assessment of Pilot Scale French Reed Bed System for Domestic Sewage Treatment under Indian Conditions

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Keywords : Constructed Wetland, French Reed Bed System, Nutrient Removal, Wastewater treatment
Abstract

Constructed Wetlands have emerged as potential treatment system for removal of contaminants present in sewage. French Reed Bed System is an alternative arrangement of intermittent loading on two stage Vertical Constructed Wetland Beds in the form of primary and secondary treatment processes.

The system was designed to treat an organic loading rate of 8 - 10 g BOD m⁻²d⁻¹ with hydraulic retention time of 20 hours. The system was operated at a particular hydraulic loading starting with a flow of 1.3 Ld⁻¹ (HLR = 0.01 md⁻¹ for Stage I and 0.008 md⁻¹ for Stage II). To account for the role of plants in treatment comparative study between FRB and unplanted system was conducted. FRBs were planted with locally available Typha and Canna Indica plant species.

It was found that, in FRB stage-I TSS, BOD, COD, TKN, TP the removal efficiencies were 53, 28, 47, 58, 63 % respectively. Whereas removal efficiency in unplanted first stage unit for TSS, BOD, COD, TKN and TP was 37, 29, 36, 58 and 64% respectively. In the second stage FRB unit, the removal efficiency of TSS, BOD, COD, TKN and TP were 62, 45, 50, 50 and 52% respectively. In unplanted stage II the removal efficiencies were TSS 48, BOD 32, COD 40, TKN 50, and TP 43 %.

The FRB system has been proved to be an effective system which utilizes the interaction of plant and media, in the removal of pollutants. It was found that TKN, TP was best removed in planted wetland than unplanted wetland.

PERFORMANCE OF ROTATING BIOLOGICAL CONTACTOR WITH SPECIALLY DESIGNED ROTATING ASSEMBLIES

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Keywords : Attached Growth System, RBC, Rotating media, Suspended growth system

Waste water treatment is predominantly overruled with aerobic treatment. Irrespective of the huge power requirement, aerobic treatments are most preferred because of the inherent advantages of aerobic treatment systems. Rotating Biological Contactors are considered to be the best option which encompasses the

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advantages of both suspended and attached growth system.

The lab scale model was developed to test the performance of model by providing specially designed rotating assemblies in place of conventional rotating discs. The model was operated at the rotational speed of 3 rpm and detention time of 24 hours. The efficiency of the model was tested for various iterations by changing the type of media in the rotating assemblies. Extensive study was carried out on the performance of RBC for various combinations of rotating media and operational parameters. The present paper discusses about various aspects associated with model fabrication, its working and performance evaluation with the introduction of modifications in the conventional RBC.

Operation-Maintenance Strategies for Sustainable Wastewater Treatment System at Ordnance Factory Ambajhari (OFAJ), Nagpur.

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Keyword : O&M; hazard; cause; risk, decentralized wastewater treatment systems.

Nowadays decentralized wastewater treatment plants are being implemented in India owing their ability to recycle wastewater locally and their low requirement of operation and maintenance O&M. Also research is being carried out by various research and academic institutions to improve and modify the treatment processes.

But it was observed that still not much attention is being paid towards O&M requirements of these systems. The main reason for this is, the word 'passive systems' is many times misinterpreted as no O&M is required. Literature has shown that on account of failure to carry proper O&M the decentralized systems have failed to provide long term service.

On this account the present work aims at finding out O&M requirements of decentralized system and to prepare an O&M plan for treatment system implemented at OFAJ, Nagpur. Here a risk based approach was adopted to find the hazards leading to failure of the system and the number of causes which are responsible for particular hazard and risk was evaluated for each cause. Based on the risk of failure O&M plan was prepared. The risk analysis also agreed with the general conception of low O&M requirements of decentralized wastewater treatment systems.

SPECIATION OF HEAVY METALS IN SEWAGE SLUDGE

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Keywords : Heavy Metals, Metal Speciation, Sequential Extraction, Sewage Sludge.

In India, like in many other countries, sewage sludge is mainly disposed of in agricultural land. To evaluate the potential of sewage sludge as a fertilizer, characterization of sewage sludge is required. Heavy metals are persistent pollutants in sewage sludge and are naturally bound with clayey particles, iron and manganese oxides and hydroxides, and organic substances. Total metal content does not indicate mobility, toxicity and bioavailability of a metal in different environmental conditions. Thus for agricultural application of sewage sludge speciation of heavy metals is required which will indicate the different forms of heavy metals present in the sludge. In this study, sequential extraction procedure was used for fractionation of eight heavy metals, namely, As, Cu, Cr, Cd, Ni, Pb, Hg and Zn in the raw and treated municipal sewage sludge collected from three treatment plants of Surat city of India where three different biological treatment processes of activated sludge process, membrane bioreactor and upflow anaerobic sludge blanket reactor are used. Sewage sludge was fractionated into four separate fractions namely, acid exchange, reducible, oxidisable and reducible fractions. Results of the study indicate high variation of metal content in sewage sludge from different treatment processes. This study also indicates that in sewage sludge Cu and Zn are present in high amounts; however, they are less mobile as they are present mostly in organic fraction.

Solar Driven Photocatalytic Disinfection of *Vibrio cholerae* and *Staphylococcus aureus*

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Keywords : Core-Shell, Colloidal route, Chick-Watson Disinfection Kinetics, Photocatalysis.

Disinfection of *Vibrio cholerae* and *Staphylococcus aureus*, in synthetic and natural water by solar light assisted photocatalysis employing Ag@ZnO core-shell structure nanocomposite (NC) particle was investigated. Such NC are stable in harsh environment, high surface area for photocatalytic reaction and allows no leaching of the noble metal from NC, thus their application in photocatalytic reaction is preferable as far as material structure integrity and health hazards are concerned.

The present study involves the synthesis of Ag@ZnO by colloidal route and characterization with UV-Visible Spectroscopy, X-Ray diffraction (XRD), Transmission electron Microscopy (TEM). Effect of photocatalyst loading and reaction temperature on the kinetics of disinfection was studied and validated using classical

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Chick-Watson disinfection model. In exposure to solar light, with catalyst loading of 15mg/L and initial bacteria count of 3×10^6 CFU (colony forming unit) /mL, substantial photocatalytic disinfection of *Vibrio cholerae* ($\geq 99\%$) and *Staphylococcus aureus* ($\approx 99\%$) at 75min and 105min respectively was observed, without reactivation till 24h post disinfection. Disinfection efficiency in both water samples were compared with that of pure-ZnO and TiO₂ (Degussa P25) at optimum catalyst concentration.

These findings may serve beneficial for optimization and designing a portable water purification system for advancement in public health.

Urban Wastewater Management in East Kolkata Wetland: A Case Study

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Keywords : East Kolkata Wetlands, Energy-efficient, resource recovery, Wastewater Management, Water Quality

In propensity of developmental activities like rapid industrialisation, mushrooming real estate business, urban sprawl and other activities promoting economic growth and youth employment has raised the issue of urban waste management all over the world. The megacities and metropolis are craving for low cost, energy efficient and effective technical solutions to deal with urban wastewater management issues. The study of East Kolkata Wetland - A Ramasar Site declared in 2002 demonstrates the vital role of naturally occurring wetlands for treating the sewage generated in the adjoining metropolitan city of Kolkata. This investigation highlights an aspect of low-cost, energyefficient resource recovery alternative through generation of employment among the local stakeholders. This study approves successful treatment of incoming wastewater from the Palmer Bridge pumping station through analysis of certain water quality parameters prior final discharge of the wastewater into the Kulti River. It has been discovered that the discharged water satisfies desirable standard of water quality parameter set as per Central Pollution Control Board of India. This study envisages various wastewater management measures to be undertaken for successful implementation of available wastewater treatment technologies and execute them effectively.

Domestic Sewage for Urban Vertical Agriculture

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Keywords : Domestic Sewage, , Sewage treatment, Terrace gardening, Vertical farming

In the conventional agricultural process, the total cost and carbon footprint due to packaging and transportation is high. Vertical farming and terrace gardening can thus be used for growing small fruits and vegetables like tomato, cabbage, so on. There is a common practice to irrigate the agricultural fields with raw domestic sewage, rich in essential nutrients. The objective of this paper is to use domestic sewage waste water for irrigating the vertical farms and terrace gardens installed in the buildings itself. The necessary pipelines and the treatment system that needs to be set up in the existing and the upcoming constructions is designed, also the cost analysis and carbon footprint involved is calculated. The benefits derived from this set up would be, reducing the load on the municipal sewage treatment plant and also to make the buildings self sufficient with regards to the grown crops. Other benefits include the reduction in carbon footprint and also the rate of the produce being such that tomato would cost Rs. 1/ kg while cabbage would cost Rs. 5/ kg.

Potential of Water Hyacinth for Phytoremediation of dairy effluent

Potential of Water Hyacinth for Phytoremediation of dairy effluent

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Keywords : COD, Dairy effluent, Phytoremediation, Water Hyacinth

Water hyacinth is an alien invasive species and also its rate of growth is high, doubling up in 7 to 10 days. The destruction of water hyacinth is a problem and in this project there is a methodology followed to use the water hyacinth to treat the effluent of the dairy industry for nutrient removal and COD (Chemical Oxygen Demand) reduction. Phytoremediation involves first acclimatization of the plants in the dairy effluent through a pilot study. After its acclimatization, the primary treated dairy effluent is taken and stored in two open containers. Water hyacinth is introduced in one of the containers while the other container is left as the blank sample. The analysis of the samples from both the containers is done on a daily basis in order to assess the gradual and progressive COD reduction of the effluent by the plants against the blank. The dairy effluent is rich in nitrogen and phosphorous which cannot be removed by the conventional treatment processes but show a significant reduction in the presence of the water hyacinth.

Thin film composite membranes with metal organic framework (MOF) for removal of pharmaceutical compounds from aqueous streams

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Keywords : Metal organic framework; Polyamide; Polysulfone; Thin film composite membrane; Filtration; Acetaminophen.

Pharmaceutical compounds which are hydrophilic and biologically persistent are being recognized as new unregulated contaminants in water. The hydrophilic characteristic deters their removal through biological processes and adsorption. However, electrostatic repulsion and size sieving in nanofiltration (NF) can be used for the removal of these compounds. Although both NF and reverse osmosis (RO) are options for removal of pharmaceutical compounds from aqueous feeds, the high pressure (and therefore high energy consumption) and membrane fouling remain serious concerns. Therefore development of improved membranes continues to be a key research area.

Metal organic frameworks (MOF) are a class of porous crystalline compounds which offer advantages of large surface area and controlled porosity. MOFs have been used as adsorbents. More recently, MOF membranes and MOF incorporated polymeric membranes have gained importance. In this work, MOF incorporated polymeric membrane was prepared and tested for removal of the common analgesic acetaminophen (or paracetamol, MW 151 g/mol). Thin film polyamide composite membranes were synthesized by interfacial polymerization with zeolitic imidazolate framework-8 (ZIF-8). Two different structures were prepared and characterized (i) polysulfone (PSF) support membranes with ZIF-8 and polyamide (PA) separation layer, and (ii) layer-by layer polyamide/ZIF-8 nanocomposite membrane on top of PSF support. The latter synthesis protocol produced defect free TFC membrane with 50% acetaminophen retention and permeance equivalent to conventional PA/PSF membrane.

Performance Evaluation and Microbial Community Dynamics of Vermifiltration Technology for Wastewater Treatment

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The choice of appropriate wastewater treatment technology that follow sustainable development approach, presents a challenge to national policy makers. Different technologies have been employed for wastewater treatment varying from simple 2-stage processes to physico-chemical and biological processes. One such technology is vermifiltration, which emerged as a popular option for wastewater treatment and has been recognized as appropriate alternative to conventional treatment systems. It is a novel technology for

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wastewater treatment, which adopts modern concept of ecological design and extends the existing chain of microbial metabolism by introducing earthworms. The microorganisms are responsible for the bio-chemical degradation of the organics, and earthworms further enhance the process by proliferating the growth of aerobic microflora through their burrowing activity. The present study was designed to determine the effect of earthworms and microbial community dynamics on the removal of pathogens and organic matter degradation during wastewater treatment by vermifiltration. The study was divided in different phases. The results of a lab scale study showed that vermifiltration resulted in an effluent with biochemical oxygen demand (BOD) < 20 mg/L, chemical oxygen demand (COD) < 100 mg/L, total suspended solids (TSS) < 30 mg/L, and pathogens < 103 MPN/100 mL, signifying high treatment efficacy. The decay rate constant (k) for indicator organisms and pathogens was observed to be within the range of 5.99–7.96 md⁻¹ and the population of total heterotrophic bacteria, total fungi and actinomycetes were reduced remarkably by 2–3 log, respectively.

The suitability of different filter media (riverbed gravel, mud balls, wooden coal and glass balls) was explored during vermifiltration and results indicated that naturally occurring riverbed material and mud balls were found to be better suited for the treatment with higher pathogen removal efficacy. The higher BOD, COD, and pathogen removal efficiency, higher microbial diversity in the filter bed, increase in earthworm's number and biomass, and no abrasions on the body walls of earthworms concluded that river bed material is a promising filter media.

The study further investigated the microbial community dynamics and antibacterial & enzymatic properties of microorganisms in a vermifiltration system. It included the isolation and identification of diverse microbial community from a vermifilter (VF) with earthworms and its comparison with a conventional geofilter (GF) without earthworms. The burrowing activity of earthworms promoted the aeration conditions in VF which led to the predominance of the aerobic microorganisms, accounting for complex microbial community diversity. In vitro antimicrobial assay also showed that the present microflora had strong inhibitory efficiency against pathogens *S. aureus*, *E. coli*, *P. aeruginosa* and *K. aerogenes*. The release of antimicrobial substances by earthworms and associated microflora was found to be responsible for the removal of pathogens. The enzymatic activity of microorganisms is responsible for the biodegradation and stabilization of organic matter. The kinetics evaluation showed the predominance of first order removal model during vermifiltration. Vermifiltration technology for wastewater treatment represents a techno-economically feasible and emerging solution for water pollution control, water conservation and reuse of water for non-potable purposes placing them in the suitable alternative for appropriate technology

AER powered Desalination system

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Keywords : AER, desalination, photovoltaic, reverse osmosis

In this communication, an emphasis has been made on alternative energy resources (AER), which could facilitate the technological advances in desalination and water purification systems, while lowering costs and increasing availability. The AER, when integrated to desalination systems, offers promising prospects for covering vast but fundamental needs of water in rural areas. In this paper, an AER technology has been discussed, which is integrated to the photovoltaic-reverse osmosis (PV-RO). A study on the energy intensity of desalination of water has been done. In addition, the economic analysis of the same has also been studied.

ECONOMIC EVALUATION OF WASTE WATER TREATMENT TECHNOLOGIES IN URBAN AREA

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Keywords : Circular-Loop, Cost-Benefit, Economics, Recycle, Reuse, Risk.

This paper aims bring about complete optimization of the waste water treatment technologies in three types of urban settings:

1. College of Engineering, Pune Hostel campus (Constructed wetland)
2. Amanora Satellite township (Conventional STP)
3. Thane - Belapur Industrial Zone (CETP)

The objective of this paper is to study current situation, carry out economic valuation of waste water and evaluate challenges faced in using waste water as a resource. The valuation process uses cost benefit approach that involves studying various costs (capital investment, operating costs etc.) and evaluates them against various benefits and cost savings from the treatment process. The goal is to bring about a circular loop to the waste water treatment process by recycling and reusing the treated water, residue and other by products of the process. This study is based on the frame work of Waste Water Management - UN Water analytical brief, 2015. Research methodology followed is primary data through expert interviews and secondary data from government websites. The paper concludes that recycling and reusing the treated water helps in reducing the fresh water bills, creates a source of water for various non potable uses, and reduces the environmental degradation risk by discharging only treated water into the public sewers.

Treatment of Textile industry wastewater Using Aeration-A case study

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Keywords : pH, solids, aeration, textile wastewater, COD, air diffusers.

In the present study the textile industry wastewater is treated with aeration and the parameters like pH, solids, colour and COD are monitored of a pilot plant at Polygenta Technologies Ltd. Nasik, Maharashtra, India. As the effluent from the industrial textile waste water is harmful to potable water as well as aquatic and human life. The treatment for industrial textile wastewater is also a high cost operation & maintenance, formation of bye products & slow processes. The result showed that average pH varies from 7.4 to 7.9 , average suspended solids varied from 9.5 mg/lit to 40 mg/lit, average total dissolved solids varies from 806 mg/lit to 1243 mg/lit, average COD 30 mg/lit to 45mg/lit . The aeration rate is 0.2 kg/cm² and 108 m³ of wastewater using air diffusers of 3.21m² area is treated . The characteristics of treated effluent compare with the MPCB norms and found within the permissible limit. The cost minimization and sludge reduction take place by aerobic methods.

Development of compact anaerobic system for wastewater treatment using high specific surface area synthetic filter media

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Keywords : Anaerobic filter, COD removal, Synthetic media, Wastewater Treatment

Wastewater treatment using anaerobic system is gaining attention nowadays because of its low footprint, low maintenance cost, ability to give good performance at high organic loading. This study involved development of laboratory-scale anaerobic filter to investigate effect of organic loading and hydraulic retention time on the treatment efficiency of reactor. A 7L up flow anaerobic filter supporting low cost synthetic, settleable, recycled HDPE material media of high specific surface area of about 165m²/m³ and void volume of 98% was employed. Synthetic wastewater prepared in the laboratory with COD of about 400mg/l was used as a substrate. A constant temperature of 35° C was maintained throughout the study. Monitoring parameters during AF operation were COD, BOD, pH, and alkalinity. Reactor performance was evaluated in terms of BOD and COD removal efficiency for different HRT of 20h, 16h, and 13h at flow rate of 8 Ld⁻¹, 10Ld⁻¹, 12Ld⁻¹ and corresponding to organic loading rate ranging between 0.55-0.7 kg COD/d/ m³. COD removal efficiency was observed to be between 60-70% and BOD removal efficiency between 65-75%. Amount of methane gas generated was between 0.0012-0.0014kg/d. About 65% of removed COD was converted to Methane.

It was inferred from study that media occupied negligible volume yet provided high specific surface area, thus helping in maintaining the required HRT. Hence study shows that this type of Anaerobic Filter can be used as good pretreatment system for removal of high organic matter. Also methane gas generated can be used as alternative source of energy.

Pilot scale thin film fixed bed reactor (TFFBR) for photocatalytic disinfection of fecal coliforms present in drinking water

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Keywords : Drinking water treatment; E. coli disinfection; solar photocatalysis; Pilot scale TFFBR.

Availability of safe drinking water is one of the major concern for the growing global population. Semiconductor oxides mediated photocatalysis is emerging as a promising technology for drinking water treatment. But the major constrain associated with TiO₂ photocatalysis that it requires UV spectrum region for activation and the post recovery of suspended TiO₂ is a cumbersome process. To overcome these drawbacks, the present study deals with the preparation of Ag doped TiO₂ by sol gel process (Ag 1% w/v) and its immobilization over ceramic tiles used in the thin film fixed bed reactor. The prepared particles were characterized by using XRD, UV-VIS Spectroscopy, BET analysis and photoluminescence spectroscopy. The characterization study

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shows that there is an increase in the absorbance of visible light region with increased production of reactive oxygen species (ROS). Drinking water spiked with fecal coliform bacteria (*Escherichia coli*) was used to study the efficiency of the reactor for disinfection, under solar irradiation. The reactors were operated in batch recycle mode using 30 liters of samples spiked with known concentration of *E. coli*. Within one-hour, complete inactivation of *E. coli* was observed under solar irradiation. These reactors were found to be simple, effective low-cost solution for the disinfection of drinking water in developing countries with plenty of sunlight.

Impregnation of metal based oxides within granular activated carbon for removal of inorganic contaminants from water

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Arsenic (As) and Fluoride (F^-) contamination in groundwater is a major concern in many parts of India. Acceptable limit of arsenic and fluoride in drinking water is $50\mu g/L$ and 1.5 mg/L , respectively, based on Indian standard. Iron based adsorbent is widely accepted for arsenic removal, where, alum is a traditionally used adsorbent for fluoride removal. Several recent studies have reported fluoride removal has improved significantly by application of layered double hydroxides (LDH) of metals and/ by emerging nanoparticles (NPs). Arsenic removal by different NPs is also reported widely. However, use of metal oxide powder or NPs based adsorbent might have some risk associated with their release in the treated water. On the other hand, granular activated carbon (GAC), which has very high SSA and good mechanical resistance, is commonly used as filtering media for water purification. Thus, the hypothesis of this study is to impregnate single or multiple metal based oxides/hydroxides within the pores of GAC, so that high SSA and mechanical resistance of GAC can be combined with adsorption active sites of metal oxides.

Based on this hypothesis, the objective of this study was to impregnate single and double metal oxides/hydroxides within the pore spaces of GAC for removing arsenic and fluoride from drinking water. Second objective was to evaluate the arsenic and fluoride removal behavior by single metal and double metal impregnated GAC composites, respectively. To achieve the objectives, first iron is impregnated within the pore spaces of GAC for removal of arsenic. Distribution pattern of arsenic within the composite was assessed. In a separate set of 2 experiments, oxides/hydroxides of aluminum and cerium were impregnated within the GAC pores under varying synthesis conditions. The fluoride removal by different composite was evaluated. Equilibrium sorption experiments and kinetic tests were performed to evaluate the sorption behavior of fluoride.

From the experimental results it can be said that arsenic removal behavior improved significantly by introducing small amount of iron inside GAC pores. Significant amount of arsenate (>98%) and arsenite (>60%) are removed from the water using the composite. However, the study suggests too much iron loading during synthesis can affect the performance of the composite due to pore blocking. Anchoring a small amount (0.05M) of aluminum and cerium can enhance fluoride removal significantly compared in GAC. However, impregnation of excess metal or formation of precipitate due to increasing pH of the synthesis condition resulted in reduction of the performance of the composite. Sorption kinetics of fluoride is explained well by pseudo first order kinetics model. Maximum fluoride sorption capacity by the AC-AlCe composite was estimated as 3.05 mg/g of sorbent from the Langmuir isotherm model fit.

SOLAR DRIVEN WATER DISINFECTION BY OZONIZATION USING PHYTOPLANKTON - AN OVERVIEW

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Keywords : Phytoplankton, Ultraviolet rays, Ozone, Bioabsorption.

An Integrated water processing methodology using sun as the primary energy source is proposed. A right combination of fresh water Phytoplankton, Ultraviolet rays, filtration bags and Coriander leaves can give an effective and efficient processed water reaching potable standards. The integrated approach begins with fresh water phytoplankton being used as oxygen generators. The phytoplankton produces complex organic compounds and oxygen through photosynthesis using nutrients and CO2 dissolved in water in presence of sunlight. Using prism, the sunlight’s spectrum is split to produce UV light. The oxygen harvested from photosynthesis is treated with UV to synthesize ozone. The water to be treated is fetched and processed in batches. In a given batch, microfiltration is carried out to remove impurities. Coriander leaves are dried, powdered and packed in permeable bags. The bags are then suspended in the filtered water to remove dissolved heavy metals through bioabsorption. The water is then ozonized with the synthesized ozone to kill the waterborne pathogens. Ozone also deodorizes the water leaving it more potable. The described process can be integrated in a given fresh water body with sun being the primary enabler in all steps. The batch processing enables phytoplankton to be effectively managed diurnally.

Low Cost Multistage Water Purification System for Large Communities Powered by Dye Sensitized Solar Cells (DSSC)

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Keywords : water purification, bio sand filtration, dye-sensitized systems, solar panel

People are dying because there is no low cost solution for highly portable drinking water. Most of the current technologies available to combat this problem are expensive and consume too much power to be effective. The solutions that do not consume an excess of power generally require expensive and time-consuming filter maintenance. With the idea of low cost and sustainability in mind, we planned to develop a water filtration system that has taken advantage of cost friendly and user friendly processes along with natural energy in order to run a highly efficient water purification system. By using all our techniques, our goal is to get the outlet water quality, which is well under the limits of Indian Standard Specifications for Drinking Water (IS: 10500). We have used self-made dye sensitized solar cells (DSSC) to power the electric components of the system. The graphical representation shows the experimental set up used to treat the water of different location in Gujarat. We have analysed the efficiency of DSSC for energy production and also verified the outlet characteristics of water using the IS and ASTM standard methods. We have also compared the design and cost effectiveness with other available water purifier in the market.

Grey water treatment using pilot scale solar photocatalytic reactors.

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Keywords : Ag impregnated TiO₂, Pilot scale slurry reactor, Solar photocatalysis, Waste water treatment.

The reuse of grey water for non-potable water applications is a potential solution for water-deprived regions. In this present study, the grey water collected from the student's hostels of Pondicherry University was treated with pilot scale photocatalytic reactor with Ag impregnated TiO₂ under sunlight. The effects of various operational parameters such as, catalysts load, pH and addition of oxidizing agent- H₂O₂ were optimized for the degradation of organic contaminants. The results show that, reactors, operated with 200 mg/l catalyst load shows 78% of COD reduction (with initial COD value 1440 mg/l) within 3 hrs of solar irradiation. Better COD reduction was observed at an optimum pH 2. Addition of oxidizing agent, H₂O₂ significantly increases the rate of COD reduction. Within 1hr, 99% of COD reduction was observed when the reactor was operated with optimum operational parameters like catalyst load of 200 mg/l, pH 2, addition of 250 ppm of H₂O₂ and a flow rate of 15 L Hr⁻¹. The results clearly reveal that pilot scale solar photocatalytic reactors could be used for the treatment of grey water and the resulting clean water could be reused for various purposes.

Performance Evaluation of Moving Bed Biofilm Reactor

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Keywords : Domestic wastewater, MBBR, Biofilm, COD, HRT

Moving Bed Biofilm Reactor (MBBR) is a wastewater treatment system that incorporates the characteristics of processes with growth of biomass in suspension and adhered biomass (biofilm). Biofilm development is the initial and essential step in developing MBBR. The present study was conducted to identify difficulties in biofilm development and assess the performance of MBBR for domestic wastewater. Laboratory scale experimental studies were carried out in a rectangular reactor (0.6m X 0.30m X 0.3m) with working volume of 20L and 40% occupied by media. There were many operational problems (Biofilm sloughing while feeding, variation in batch loading etc.) observed at the time of biofilm development process. The possible reasons include feed quality and quantity of sludge in reactor, amount of aeration provided in reactor, substrate provided and characteristics of media. The performance evaluation results showed that average percent COD removal efficiencies of 90.6, 76.4 and 57.5 for batch times of 5 hr, 3 hr and 1.6 hr respectively. The study concluded that 30 days are required for the development of biofilm provided the operating parameters are properly controlled.

Photocatalytic Degradation of an Industrial Waste Water Containing Dyes

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Keywords : photocatalysis; photocatalytic reactor; dyes; water purification.

Municipal and industrial waste water contain organic water pollutants, oxo dyes and micro-organisms which are not removed by conventional mechanical and biological treatment. This problem can be overcome by the advanced technique of photocatalysis, a "green" technology with potential applications in various disciplines, such as chemical synthesis and environmental technologies. The present study aims at photocatalytic degradation of industrial waste water containing hazardous oxo dyes. The basic considerations made while designing photocatalytic reactor are: nature of glass, type of illumination source, type and nature of photocatalyst. The reactor consists of single hollow quartz tube in which catalyst is freely suspended. Photocatalytic reactors with suspended catalyst give much better contact between photocatalyst and dissolved impurities compared to reactors with immobilized catalyst. The device couples positive aspects such as wide exposition of catalyst to the radiation to effective use of UV tubes which are long lasting, robust, small in size and better in light efficiency. The various parameters were studied to observe behavior of designed reactor such as catalyst dose, initial dye concentration of waste water and residence time. Experiments were carried out for different oxo dye concentrations of waste water ranging from 20-500 ppm. The obtained results indicated maximum dye removal for concentration below 200 ppm in reasonable time with 0.2 g/L of photocatalyst. The present study thus established the effectiveness of photocatalytic process for removal of dyes from waste water.

Determining Water Quality Index for River Mutha, Pune

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Keywords : River Mutha; Water Quality Parameters; Water Quality Index

Abstract: Rivers play a very important role in social, cultural and economic development of any region. River Mutha in Pune is highly polluted due to discharge of municipal sewage (partially treated or untreated), industrial waste as well as solid waste. Despite of various standards and laws made by government, many industries are discharging their waste directly into the river and making its quality poor day by day. Detailed

analysis is needed to evaluate different factors in polluting water. The aim of the work is to calculate water quality index for Mutha river considering the physical, chemical and biological parameters such as pH, temperature, turbidity, dissolved oxygen, biological oxygen demand, total solids, electrical conductivity, sulphates, phosphates, nitrates, chlorides and MPN. The indices will be computed for winter and summer season for four locations such as: Khadakwasla downstream, near Vitthalwadi, near Omkareshwar Temple and near Sangam Bridge. The result showed that water quality varied from good to very poor range. In general the water quality was degraded downstream. Khadakwasla Dam water quality better than other three locations. This research has large scope to understand effect of rapid industrialization on deteriorating river water quality leading to environmental problems and health issues.

Performance Evaluation of greywater treatment by a Laterite soil vegetated vermifilter

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Keywords : Eisenia fetida, greywater, laterite soil vegetated filter, laterite soil vegetated vermifilter filter.

The present study addresses performance evaluation of a hybrid natural system comprising of settling tank, Vertical flow sand-gravel filter (VFSGF), Laterite soil vegetated filter (LSVF) and laterite soil vegetated vermifilter (LSVVF) for the treatment of greywater. The sequential batch experiments were conducted in a pilot scale experimental set-up. The Organic loading rate (OLR) was varied from 20 to 140 kg BOD₅/ha-day and the hydraulic retention time (HRT) used was from 0.50, 1, 2 and 3 d. The BOD₅ removal efficiency was found to be in the range 15-30%, 48-60 % and 70-80 for 3 d HRT in VFSGF, LSVF and LSVVF respectively. The efficiency of the system for BOD₅ removal was observed to be 75-85% at 3 d HRT. The effluent can be recycled and used for non-potable purposes in a household. The developed system is a potential option for the decentralized wastewater treatment in developing countries.

Modeling of Ganga River Water Quality Parameters Using PLSR, MLR and ANN Techniques

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Keywords: Partial least square regression, Multiple linear regression, Artificial neural network and Ganga river

The paper illustrates linear and non-linear modeling for simultaneous prediction of the Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD) concentrations in the river Ganga by using water quality parameters. Multiple linear regression (MLR), Partial least square regression (PLSR) and Feed forward back-propagation artificial neural network (FFBP-ANN) techniques are used to predict the BOD and COD by using five input variables (Temperature, pH, Conductivity, Dissolve oxygen and Total coliform) from ten years monthly data (2003-2013). These three different models are compared for their generalization and prediction abilities using statistical criteria parameters viz. coefficient of determination (R²), mean square error (MSE). In Linear modeling, MLR is performed better than PLSR model but in case of non-linear modeling, ANN performances are relatively better than both PLSR and MLR models. In ANN, Levenberg-marquardt algorithm (ANN2) has given the best result in comparison to Gradient-descent with adaptive learning rate back-propagation algorithm (ANN1). The developed models can be utilized as a tool for the river water quality prediction.

Preparation of Activated Carbon from Bio gas Plant Sludge and Removal of Direct Red 23 dye from its Aqueous Solution

Rajnish Kumar Chaurasiya, Dr.Shashi (IIT Roorkee)

Keywords: Activated carbon, Bio gas plant sludge, Chemical Activation, Direct red 23 dye.

Firstly activated carbon was prepared from the bio gas plant sludge by chemical activation with potassium hydroxide and its potential feasibility for the removal of direct red 23 from aqueous solution was investigated. The sludge contains 42.23 % of carbon on dry basis which motivated for preparation of activated carbon. The sludge was first carbonized and then activated in tubular furnace under the nitrogen flow and final temperature of 7000C. The prepared activated carbons were characterized for their surface chemistry by FTIR, as well as for their porous and morphological structure by SEM and nitrogen adsorption at 77.3 K. The BET surface area of 285.49 m²/g, total pore volume of 0.178 cm³/g and average pore width of 2.49 nm was obtained. For maximum removal of dye, the effect of parameters like contact time, adsorbent dosage, initial dye concentration and initial pH was examined. The maximum removal of dye i.e., 99 % was achieved. This adsorbent removes textile dyes from waste water effectively and can be applied for treating waste water.

Safe reuse of municipal wastewater using solar driven SAT-UV and SAT-AO disinfection technology

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Keywords: wastewater treatment, disinfection, ultra- violet, anodic oxidation, chlorination, iron removal, soil aquifer, coliform

The paper highlights the performance of two solar driven disinfection systems treating water from the Soil Aquifer that has been heavily influence by wastewater infiltration. The first system is an Ultra-Violet (UV) and the second an Anodic Oxidation (AO) unit that were implemented at Kalyani Waste Water Treatment Plant at Kalyani, Nadia District in the state of West Bengal, India. The systems are implemented under Indo-European Bilateral Programme "SWINGS" research project within FP7 Framework Programme for research, technological development and demonstration under grant agreement N°308502 for Innovation in Water Technology and Research. A portion of municipal wastewater passing for reclamation through integrated conventional and biological treatment system percolates into the ground water through unsealed banks. The study investigated the safe reuse of municipal wastewater using an abstraction well and two parallel operated solar driven treatment systems.

Both systems are additionally equipped with a filtration setting to remove iron and manganese from the water. Chlorination (only for AO) and catalysis on the filtration media, subsequent precipitation followed by mechanical filtration. The UV system has been demonstrated to reduce the counts for faecal and total coliforms by 74% and 91% respectively, whereas the AO System removes them completely. Both systems showed good performance for the removal of iron up to 81 % (UV) and 100% (AO); turbidity by 92% (UV) and 87% (AO) as well as phosphate (90 (AO) and 75 % UV via co-adsorption. The reduction of concentrations of Ammonia-N and Nitrate-N in the treated water were higher for UV than for AO system. With the achieved water quality, the treated water can be safely and effectively reused in irrigation and domestic purposes. Thus the efficiency of these solar driven SAT-UV and SAT-AO treatment technologies are reflecting their potential towards water conservation in India.

SPONSORS & SUPPORTING ORGANISATIONS

1. Department of Science & Technology (DST)

Department of Science & Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organising, coordinating and promoting S&T activities in the country. The Department of Science & Technology plays a pivotal role in promotion of science & technology in the country. The department has wide ranging activities ranging from promoting high end basic research and development of cutting edge technologies on one hand to service the technological requirements of the common man through development of appropriate skills and technologies on the other. These four projects are sponsored by DST, Government of India.



2. European Commission (EC)

It proposes new legislation to the European Parliament and the Council of the European Union. These projects were externally funded by European Commission under Seventh Framework Programme.



3. Maharashtra Jeevan Pradhikaran (MJP)

Maharashtra Water Supply and Sewerage Board (MWSSB) was established as per MWSSB Act 1976 for Rapid development and proper regularization of water supply and sewerage services in the State. MWSSB was subsequently named as Maharashtra Jeevan Pradhikaran in 1997.



Principal responsibilities of MJP according to Act are as under:
 Planning, designing and implementation of water supply and sewerage schemes including facilitation for necessary financial provisions, As directed by the Government of Maharashtra (GoM), taking over any water supply as well as well sewerage scheme for operation and maintenance, To establish service level bench marks for water supply and sewerage sector, To extend relevant support, regarding water sector, to GOM as well as Local Self Governments, To support GoM to prepare Annual Plan and to establish / modify tariff / tax / cess structure in water sector.

4. Pune Municipal Corporation (PMC)

The Pune Municipal Corporation is well known as Pune Mahanagar Palika and is serving citizens since 1950. To Serve Citizens better Pune Municipal Corporation has taken initiative for e-Governance. Presently a few big corporations like Persistent Systems are lending help for developing the E-governance system, as a part of their social service initiative. A public-private partnership is perceived to bring tremendous changes in the future. The PMC is in charge of the civic needs and infrastructure of the metropolis.



5. International WaterWorks Association (IWWA)

The Indian Water Works Association (IWWA) is a voluntary body of professionals concerned and connected with water supply for municipal, industrial, agricultural uses and treatment and disposal of wastewater. IWWA focuses basically on the entire Water Cycle" encompassing the environmental, social, institutional and financing issues.



IWWA was founded in 1968 with headquarters at Mumbai. IWWA has 32 Centres spread across the country and is very active in conducting different activities in the areas of Water Supply and Wasterwater Treatment and Disposal. IWWA has a membership of more than 9000 plus professionals spread all over the country and abroad. IWWA brings out a quarterly Journal and a bi-monthly newsletter called Mid-stream.

6. Indian Plumbing Association (IPA)

Indian Plumbing Association (IPA) is the apex body of plumbing professionals in India. Established in 1993 with the objective to promote development of plumbing and building services industry, IPA membership is open to everyone engaged directly or indirectly with the construction industry. The aim and objectives of IPA are as follows:



To uphold the dignity of the profession by encouraging members to:

1. Adopt correct business practices
2. Adhere to ethical codes of conduct
3. Aim for the highest standards of workmanship
4. Promote and foster healthy relationships within the fraternity

To promote advancement of plumbing services in the country by:

1. Organising Seminars, Exhibitions, Symposiums to educate members of the trade and general public.
2. Providing a platform for dissemination of information and exchange of ideas on matters related to the plumbing profession
3. Establishing harmonious means of communications to facilitate better interface between the Plumbing Community, Government/ Quasi government agencies, Statutory bodies, NGOs and Private Agencies.

7. International Water Association (IWA)

The International Water Association (IWA) is a worldwide network for water professionals and companies, with a membership comprising leading companies in the fields of water services, infrastructure engineering and consulting as well as more than 10,000 individuals. The IWA network is structured to promote multi-level collaboration among its diverse membership groups, and to share the benefit of knowledge on water science, technology and management worldwide. Each year IWA organises and sponsors over 40 specialised conferences and seminars on a wide variety of topics in water management in locations worldwide. IWA publishes 12 scientific journals and 40+ books per year on water management. IWA develops leading edge innovations and synthesises these through the work of the 52 IWA Specialist Groups and a set of global programmes. IWA has a worldwide staff of approximately 70, with headquarters in London and offices in The Hague (Netherlands), Bucharest, Bangkok, Singapore, Beijing and Nairobi.



8. Water Quality India Association (WQIA)

The Water Quality India Association (WQIA) is a legal entity in the Republic of India. This not-for-profit entity was incorporated on September 16, 2014, under the Indian Companies Act and has been promoted by the members of India Task Force of Water Quality Association (WQA). This not-for-profit entity collaborates with the Water Quality Association USA (WQA), but functions independently.



9. NJS Engineers India Pvt Ltd (NJSEI)

NJS Engineers India Pvt Ltd (NJSEI), established in 2007 in Pune India, is a wholly owned Subsidiary of NJS Consultants Co. Ltd., Japan (NJS). The parent company was established in Tokyo, Japan in 1951 and is one of the leading environmental engineering companies in Japan. NJS has over 60 years of worldwide experience and enjoys a reputation for providing technical excellence and a superior quality of work to its clients.



In spite of being in the nascent state, NJS Engineers India Pvt Ltd has been working on a number of projects with NJS as well as other International and Indian Companies since formation. NJSEI has a registered office in Pune and regional offices in Mumbai, Delhi, Bangalore and Hyderabad. The Goal of NJSEI is to become one of the leading engineering consultancy service providers in India over the next five years. The services provided by NJS Engineers India Pvt Ltd, cover a full range of environmental engineering disciplines together with a complete project cycle, from initial project identification studies; Master Planning; Technical; Economic and Financial feasibilities; detailed engineering design, cost estimations; to preparation of tender documents; tender evaluation; construction supervision and contract management.

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Alfaa UV is the leading manufacturer of UV disinfection systems in India. With over 18 years experience in ultraviolet (UV) technology. Alfaa UV, an ISO 9001:2000 certified company and a leader in its field. Alfaa UV has been disinfecting water for pharmaceutical, food, beverage, and other industrial applications to the highest standard. Alfaa UV is based out of Mumbai and has a pan India presence with sales and service offices across the country. Alfaa UV systems are also exported to over 15 countries around the world.



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ULTRA-TECH Environmental Consultancy and Laboratory [recognised by Ministry of Environment, Forests & Climate Change, Govt. of India] is an established Environmental Services provider since 1986. We celebrated our Silver Jubilee in 2011. Ultra-Tech in six environmental Domains :



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- Post EC Compliances,
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SVS Aqua Technology

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Amanora Park Town

Amanora Park Town is a sprawling 400-acre township located in Pune City. It is a joint venture between City Corporation Limited and Everstone Investment Advisors Pvt. Ltd. The surrounding area consists of several towers for apartments, buildings, school, hospital, fire station, parks, and power and water supply stations. The township has been awarded with many recognitions/awards in categories such as urban design, green projects and women empowerment.



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Construction of Groundwater Scheme-Eco-ndia Project



Construction of surface water scheme-Eco-India



Top view on HRF/SSF/ACF filters with PV cover



Vertical Flow Constructed Wetlands-SWINGS Project



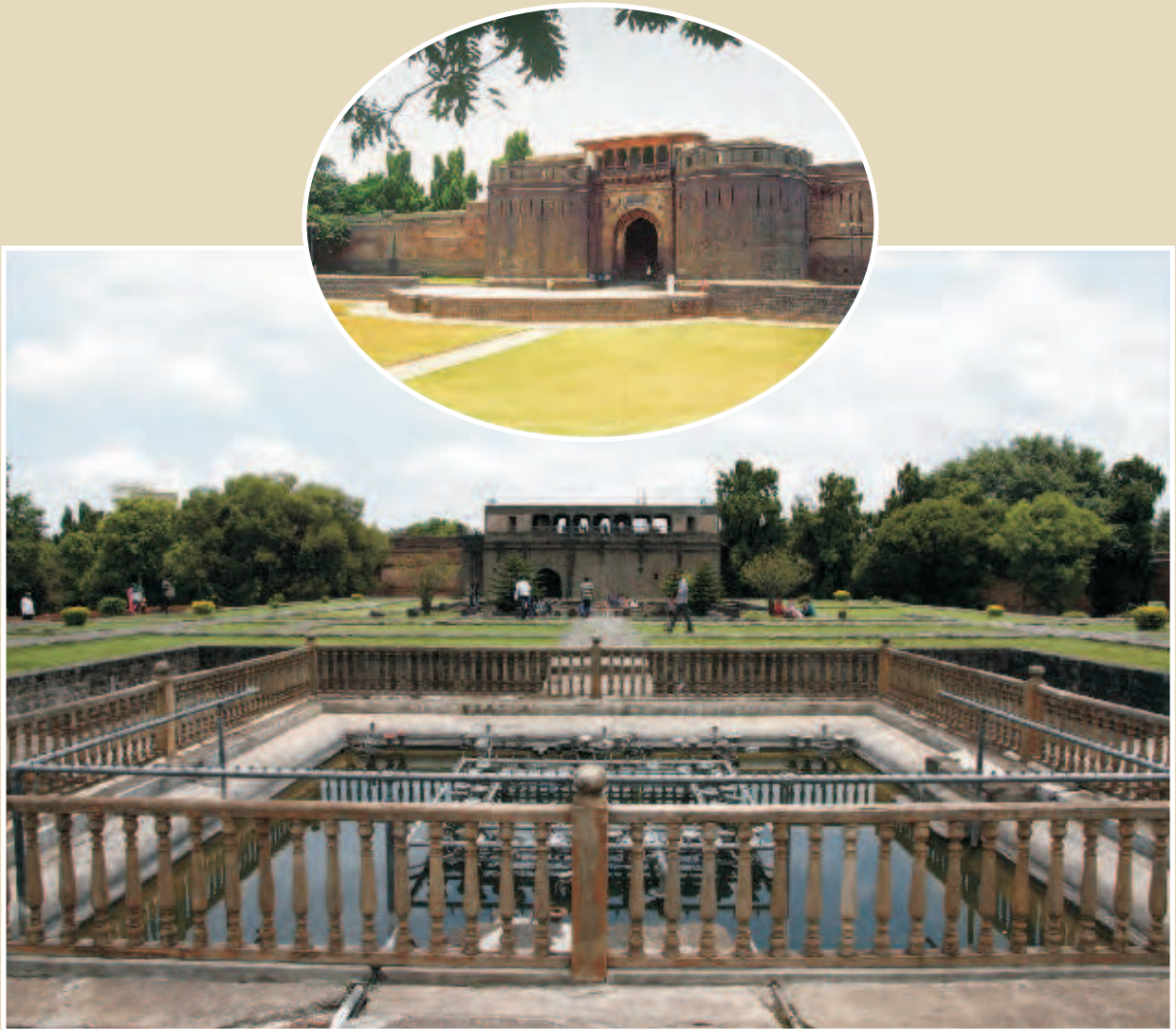
Village women collect arsenic free water
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Horizontal Flow Constructed Wetlands
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Kalyani Pilot Installation-SWINGS Project



SHANIWAR WADA, PUNE

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