suitable or even, employers' subtle neglect of adequate safety measures for those who work in direct contact with wastewater. The paper suggests that this analysis is important in creating and sustaining optimal occupational safety for workers of wastewater treatment plants.

The propositions of this paper is organised as follows: the first part of the paper analyses technology and organisation as a determinant of safety culture. The second part discusses various cultural dimensions based on Hofstede's model and its relevance for understanding safety culture.This is followed by the analysis about the linkage between culture and safety culture.

Community Participation in Wastewater Treatment and Reuse

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Key words : Wastewater treatment plants, Reuse of treated wastewater, community participation

Wastewater recycling and reuse is a sustainable solution to address the increasing water crisis. Water recycling is also useful for environment protection from water pollution. While wastewaster treatment at the primary level could be discharged into water bodiessafely, two more levels of treatment will increase its utility by people. So, reclamation of wastewater for reuse is invariably expansive and expensive, requires regular maintenance and constant care. Not surprisingly, therefore, optimal utilisation of treated wastewater becomes non-negotiable expected outcome of all these efforts. This paper argues that in a public domain, it would be possible to manage wastewater treatment plants successfylly and achieve optimal utilisation of treated wastewater, if and if the community actively participate in the process of water reclamation and reuse and their participation should be approached innovatively. Community is a collective form of a group of people who come together with a common goal. In Indian context, scaling up the tertiary level of water technology for reclamation and reuse of wastewater will not be sustainable, unless the community is engaged actively. Community participation can be understood in a ladder of lowest to the highest rung of engagement, from non-participation to citizen power, as conceived by Sherry Arnstein (1969) and later developed by many other scholars.

This paper utilises Choguill's (1996) revised version of Arstein's model of ladder of community participation. Choguill modified Arstein's model to suit the requirements of underdeveloped countries, in which the external agency, such as the State or other institutions engage in mutual-help projects. Choguill's model is an interesting frame in the context of India, particularly, in establishing projects like wastewater treatment plants, in which mutual support rendered by the external agency is a reality. In today's context, the external agencies do not indicate the international funding agencies but local private players who are willing to invest in this sector.

The private organisations that comeforth for mutual partnership with different community groups for initiating wastewater treatment plants are varied in nature. According to a research study conducted in 4 states of India, some of the private partners involved in WWTP initiatives include non-profit organisation, housing developers and 'corporate social responsibility' (CSR) wing of companies.Some of the determinants of community participation analysed and observed in these case studies are spread across, empowerment to Self-Management, the highest to the lowest rung of participation. This paper brings out the dynamics between the level of participation of the community and the level of outcome of the treatment plant in terms of its management and utilisation of treated wastewater.

Improved quality of distillery effluent by integrating sequential bio-treatment system

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Key words: Distillery effluent; adaptation, consortium, bacteria, algae, halophyte

In the current study, novel strategy of sequential adaptation of bacterial consortium and algal consortium to distillery effluent enhanced the treatment efficiency. Integrated treatment system of aeration, bacterial, algal, bio-char, and constructed wetland with halophytes has enabled high removal of COD (84%) and BOD (91%) and colour (64%), pH increased from 6.7 to 7.4. The kinetic studies on COD, BOD, TDS and TSS removal by adapted bacterial consortium reveals that they were removed at a higher rate of 460.9 $mgL^{-1}h^{-1}$, 116.7 $mgL^{-1}h^{-1}$, 116.7 $mgL^{-1}h^{-1}$, 536.1 $mgL^{-1}h^{-1}$, 166.1 $mgL^{-1}h^{-1}$ respectively in the aeration tank compared to that by algal consortium in the ST tank under static condition. The EC decreased from 18.7 to 17.6 by bacterial and algal treatment. In CWL, halophytes (Sesuvium sp.) decreased salinity (17.6 to 16.7 mS/cm). The increase of dissolved oxygen in the final treated effluent can be corroborated to the decrease in TDS, BOD and COD. Also, decrease in colour (melanoidin) played an indirect role in allowing the algal consortium to use sunlight for growth and pump oxygen into the effluent. The results depict that, the treatment process is efficient in improving the water quality to reduce pollution and enhance their reuse applications.

A Sustainable Solution to Sulfate Wastewater Under Micro-Aerobic Condition UsingSulfur Bacteria

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Keywords: elemental sulfur, micro-aerobic condition, sulfate reducing bacteria, sulfide oxidizing bacteria, sulfate, sulfide.

Sulfate is a major pollutant which increases salinity of receiving water bodies. The wastewater rich in sulfate is not limited to mining and mineral processing but also other industrial activities such as flue-gas scrubbing, galvanic processes, battery, paint and chemical manufacturing discharge effluents with similar characteristics. In anaerobic biological sulfate reduction, sulfate reducing bacteria (SRB) utilizes sulfate as an electron acceptor and reducing it to sulfide. A mixed culture of sulfate reducing bacteria is isolated from anaerobic biogas plant slurry. At an optimum pH of 8, the mixed culture reduces sulfate up to 80% present in the synthetic wastewater in 8 days. The effect of initial substrate concentration and COD/sulfate ratio on sulfate reduction is studied and found to be 1000mg/L and 2 respectively. After 8 days, sulfate reduction is inhibited because of increase in sulfide concentration. Moreover, sulfide is corrosive to metals and toxic to living species. Hence to remove sulfide from the reactor, a mixed culture of sulfide oxidizing bacteria (SOB) isolated from aerobic wastewater treatment plant is inoculated to the system under micro aerobic condition to convert sulfide into elemental sulfur.

Recent advances in the removal of toxic metals using modified zeolites

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Keywords: Adsorption, Ion exchange, Modified zeolites, Post synthetic routes, Toxic metal removal,

The use of natural zeolites have been extensively studied in the waste water treatment along with other technologies, including chemical precipitation, ion exchange, adsorption, membrane filtration, coagulation flocculation, flotation and electrochemical methods. Zeolites with their uniform micropores are widely used as promising sorbents for water purification and possess many salient features, such as high surface area, adjustable pore size, acidity and high thermal stability. The adsorption characteristics of any zeolite are dependent upon the detailed chemical/structural makeup of the adsorbent, the Si/Al ratio, cation type, number and location are particularly influential in adsorption. These properties can be changed by several chemical treatments to improve separation efficiency of raw natural zeolite. High adsorption capacity of modified zeolites for several contaminants has been reported. Modification of natural zeolites can be performed by several methods, such as acid / base treatment, ion exchange, and surfactant functionalization. These methods are commonly employed to change the hydrophilic / hydrophobic properties for adsorption of various ions. The presentation will include, recent advances in toxic metal removal using modified zeolites. The focus will be on zeolite modification routes and the resultant properties of respective zeolite along with application performed on it.

Treatment of Oily Wastewater by TiO_2-Fly ash Composite Microfiltration Membrane

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Keywords: Ceramic membrane; Fly ash; Oily wastewater; Porosity.

Oily wastewater released to environment and water bodies from industries (petrochemical, metallurgical, petroleum refinery) and domestic sewage (food processing) is hazardous. Nowadays, treatment of this wastewater is considered to be difficult by conventional methods. In this work, a low-cost TiO2-Fly ash composite microfiltration membrane was manufactured and used efficiently to treat oily wastewater. In order to make low cost membrane, fly ash was effectively recycled for the first time to manufacture circular shaped flat membrane, on which a hydrophilic TiO2 layer was further deposited by hydrothermal method. The structural, morphological and mechanical properties of the membrane were analyzed in details. The separation ability of TiO2-Fly ash composite membrane was tested by the treatment of synthetic oily wastewater (100 mg/L). The research findings clearly indicated that the treated water produced from this microfiltration membrane can be directly disposed into environment since it contains the oil concentration of 0.26-5.83 mg/L, which is lower than the disposal limit (10-15 mg/L) suggested by Pollution Control Board norms. The detergent solution (Surf excel) was effectively utilized to accomplish the membrane regeneration. This study is expected to guide an effective way to recycle fly ash not only to solve environmental problems but also to produce a high valued ceramic membrane for very efficient separation application of oily wastewater.

Decolorization and Biodegradation of Reactive Orange 94, a Textile Dye by Newly Isolated *Staphylococcus* sp. K2204

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Keywords: Wastewater, Decolorization; Biodegradation; Reactive Orange 94; Staphylococcus sp. K2204.

Wastewater can cause a great deal of harm to the environment when it is released as domestic, municipal or industrial waste and important to treat the same before it is disposed of. In this case we considered dye wastewater treatment through biodegradation (Environment compatibility, cost competitive, reduced sludge production and yielding non-toxic metabolites.) to help when tackling water shortage as this water can be used for a range of activities. Soil samples collected from the vicinity of textile industry near Tiruppur, India were studied for screening and isolation of bacterial strains capable of degradation of textile dyes. A potential strain was selected on the basis of rapid dye degradation and later identified as Staphlococcus sp. K2204 using 16s rRNA sequence. An isolated bacterial strain is placed in the branch of Staphlococcus genus on the basis of 16s rRNA sequence and biochemical characteristics. From the experimental results, it is confirmed that Staphlococcus sp. K2204 showed 100% decolorization of Reactive Orange 94 (RO 94) dye at 40 ^{o}C and pH 6.6. The Reactive Orange 94 concentration 100 mg/L in nutrient broth was decolorized within 16 h. The biodegradation was monitored by Ultraviolet-visible spectroscopy (UV-vis), Fourier transforms infrared spectroscopy (FTIR) and High Performance Liquid Chromatography (HPLC).

Microbial biofilms for enhanced wastewater treatment and power generation

Microbial biofilms for enhanced wastewater treatment and power generation
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Keywords: Biofilm, Chemical oxygen demand (COD), Power generation, Wastewater treatment

Microorganisms aggregate to form a biofilm on the anoxic anode of a microbial fuel cell (MFC) fed with wastewater as substrate and release electrons by breaking down of the organic wastes. In this work, biofilms were allowed to develop from different inocula on four carbon cloth anodes in a multichambered MFC. Subsequently, raw sewage was added to the four anode chambers each having an electrode containing biofilm from a different source. Chemical Oxygen Demand (COD) of the anolyte was measured at the time of addition of the raw sewage and after a period of three and six days to estimate the extent of treatment. Power density produced by the each of the anodes was measured using a data acquisition system. Biofilm obtained using lab-grown mixed microbial culture in nutrient broth was the best as shown by the crystal violet biofilm forming assay. It also resulted in highest COD reduction of raw sewage of 85% over 6 days and maximum power density of 65mW/m2 among the four biofilms studied. Integration of MFCs with wastewater treatment plants is an innovative and sustainable technological solution to the twin issues that confront the globe today, viz. wastewater treatment and clean energy generation.

One Pot microwave assisted synthesis of clay/polymer Nano composites for the effective degradation of Congo red

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Keywords: Congo red, Intercalation, Polymerization, Micro wave, Nano hybrids, Wastewater Treatment

Sepiolite-poly (dimethylsiloxane) Nano hybrids were synthesized with single pot rapid microwave assisted method. The synthesis procedure involves solid state insitu intercalation and polymerization. The morphology, microstructure and adsorption of the resulting Sepiolite/PDMS Nano hybrids were characterized. The prepared Nano hybrids was selected in which degradation of azo bonds of Congo red dye, which is an important application in wastewater treatment. Kinetic analysis results showed that the pseudo-second-order was predominated for the adsorption of CR onto Nano hybrids. The experimental equilibrated adsorption capacity of nanocomposites was analyzed using Freundlich and Langmuir isotherm models. The results corroborated that the experimental data ?t the Langmuir isotherm the top. The proposed synthetic method is simple and economical for the scalable production of Sepiolite/PDMS Nano hybrids which can be successfully apply for efficient and cost effective for degradation of Congo red (CR) and water purification.

Illustrating the Potential of Riverbank Filtration Technology: Case Studies from Southern India

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River Bank Filtration (RBF) is an inexpensive water treatment technology that consists of one or morewells drilledon a river bank to extract clean water by forcing flow of river water through the alluvial sediments. RBFuses natural, auto-regenerative treatment processes so that properly engineered RBF systems can produce good quality of water and remain effective indefinitely. RBF can be used for producing drinking and domestic water or supporting irrigation water needs.Two case studies will be discussed. The first one shows thatRBF can provide safe drinking water to rural communities in southern India. The second example demonstrates how RBF can meet irrigation needs by providing clean and reliable irrigation water to a small land holding farming community, permitting them to produce higher value crops than what is possible using polluted riverwater for irrigation. The results of these case studies and a comparative analysis of the situation before and after installation of the RBF systems will be described.

Fate assessment of Phthalic acid esters in cyclic activated sludge process based wastewater treatment plant

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Phthalic acid esters (PAEs) are categorized as endocrine disrupting compounds (EDCs) for their estrogenic activity and the compounds are of worldwide concern for their pervasive occurrence and harmful effects. The effluents from wastewater treatment plants are one of the main sources of their presence in the environment. Theobjective of the paper is investigation of fate and removal of four priority PAEs: Diethyl Phthalate (DEP), Dibutyl Phthalate (DBP), Benzylbutyl Phthalate (BBP) and DiethylhexylPhthalate (DEHP) in a full scale sequencing batch reactor based wastewater treatment plant.

All four compounds were detected in the raw wastewater. The detection frequency of BBP was lower (56%) than remaining three Phthalates. The influent loadings of DEP, DBP and BBP from raw wastewater were 146.3, 301.7and 53.1 g/d respectively. DEHP loading was highest (729.3 g/d) as compared to other three compounds.

All four compounds were removed more than >80% in the wastewater treatment plant. The portion of Phthalates removed by biodegradation and adsorption to primary and secondary sludge was 55% and 19% respectively. Contribution of Primary settler to total removal of these compounds was 10-20%. Among four Phthalates, DEHP was removed mostly by adsorption (20% in primary sludge and 16% in secondary sludge).Adsorption to secondary sludge contributed less to overall removal (2-16%) than primary sludge which may be due to the degradation of the compounds during adsorption to biosolids. The efficiency of the sequencing batch reactor in degradation of these compounds was DEP (81%); DBP (75%); BBP (64%) and DEHP (61%).

The percentage of Phthalates released with the effluent was 13-20%. The average concentration of the compounds in the effluent was DEP (0.74 ?g/L); DBP (2.19 ?g/L), BBP (0.26 ?g/L), and DEHP (4.25?g/L). Assuming the dilution of wastewater treatment plant effluents in surface water, the DEHP emissions were below the Environment Quality Standard value of 1.3 ?g/L.

Textile effluent treatment by natural waste absorbents to reduce chemical coagulant dosage

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Keywords: Alum, Bentonite Clay, Coagulation, Corncob, Spent Tea leaves, Textile wastewater treatment.

The presence of dyes and mainly their colour in textile industry effluent is a major concern of the present time due to its adverse effects on life forms. The present work is an attempt to treat the effluent collected from textile industry which was analysed for pH, COD, BOD, TS, TDS, TSS. Then coagulation and flocculation study was carried out using alum as well a combination of Bentonite clay with alum. An optimum dosage of 2g/litre alum was found out leading to 80 % colour removal spectroscopically. Further addition of 1.2 g of Bentonite and 1.5 g of alum together per litre of effluent resulted in 90% colour removal. The adsorption studies using thermally activated spent tea leaves and corncob per litre effluent were done separately to deduce minimum dosage for maximum colour removal. The water thus obtained was further treated with a reduced dosage of alum and Bentonite resulting in 90% colour removal. Thus sorption by these natural waste adsorbents followed by coagulation with Bentonite-alum combination is an efficient technique for the removal of color of dyes from waste water and an attempt to reduce the amount of coagulant simultaneously bringing other parameters in permissible limits.

Life Cycle Assessment of constructed wetland systems for wastewater treatment in Nagpur, India

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The aim of this study was to compare different configurations of constructed wetlands for wastewater treatment in peri-urban area of India from an environmental point of view using life cycle assessment (LCA) methodology.

The system considered in this study will be implemented within the frame of NaWaTech project. It will be located in the Dayanand Park, a multi-utility public garden in Nagpur (Maharashtra, India). The water requirement to maintain the garden is 100 m3d-1. Currently, groundwater from a nearby dug well is being used for irrigating the garden. However, due to depletion of groundwater level, water is not always available and during the summer season untreated sewage is used for irrigating the garden which poses a huge health risk for the park users. The aim is to treat the needed water before the usage for improving population and workers' safety and health. The solution proposed was a constructed wetland (CW) system. The design consists of 5 parallel lines based on different configurations of horizontal (HF) and vertical (VF) flow CWs as well as aerated CW (AEW). The configurations are HF-HF (Line 1), HF-VF (Line 2), VF-HF (Line 3), VF-VF (Line 4) and one AEW (Line 5). The selected primary treatment is a three stage septic tank.

The goal of the LCA was to compare the potential environmental impact of the 5 lines. The functional unit was 1 m3 of treated wastewater. The system boundaries included energy and materials for system construction and operation. Sludge management, saved groundwater for park irrigation and direct greenhouse gases (GHG) emissions were also included (Table 1). Data concerning the embodied environmental aspects of materials were taken from the Ecoinvent v3.1 database. The LCA was performed with the software *SimaPro 8,* using the CML-IA baseline method. The following impact categories were evaluated: abiotic resourcesdepletion, global warming potential, ozone layer depletion, acidification potential and eutrophication potential.

Table 1. Materials and energy inputs and outputs for CW systems construction and operation

	Unit	Line 1 (HF-HF)	Line 2 (HF-VF)	Line 3 (VF-HF)	Line 4 (VF-VF)	Line 5 (AEW)
Construction Materials[1]						
Concrete	m^3/FU	1.09E-04	1.10E-04	1.10E-04	1.12E-04	1.07E-04
Metals (Steel & Iron)	kg/FU	2.37E-02	2.38E-02	2.38E-02	2.38E-02	2.34E-02
Bituminous coating	kg/FU	8.68E-04	8.68E-04	8.68E-04	8.68E-04	8.63E-04
Plasrics (including pipes, geomembranes and geotextiles)	kg/FU	1.69E-03	2.80E-03	2.80E-03	3.92E-03	2.01E-03

contd... **Table 1.** Materials and energy inputs and outputs for CW systems construction and operation

	Unit	Line 1 (HF-HF)	Line 2 (HF-VF)	Line 3 (VF-HF)	Line 4 (VF-VF)	Line 5 (AEW)
Construction Materials[1]						
Bricks	kg/FU	1.41E-02	1.66E-02	1.66E-02	1.91E-02	9.56E-03
Operation						
Chlorine dioxide	g/FU	12	12	12	12	12
Electricity1 Waste	kWh/FU	0.49	0.57	0.75	0.65	1.21
Sludge						
Primary sludge1	kg/FU	1.61	1.61	1.61	1.61	1.61
GHG direct emissions[2]						
CH4	g/FU	21.78	10.89	10.89		
N2O	g/FU	1.12E-02	1.12E-02	1.12E-02	1.12E-02	
Avoided products						
Groundwater	kg/FU	500	500	500	500	500

Table 2 shows the potential environmental impact caused by the differentsystems. Line 5 (AEW) showed the highest impact in all environmental categories. It was due to the highest electricity consumption (Table 1). On the other hand, Line 1 (HF-HF) presented the lowest environmental burdens except for global warming impact category. Indeed, Line 1 is characterized by the lowest energy inputs and lowestquantity of construction materials compared to lines 2, 3 and 4 (Table 1). Direct GHG emissions in Line 1 were responsible for the high value of global warming potential. Materials and processes which had the most significant contribution in all impact categories can be ranked as follow: electricity consumption; construction materials production and manufacturing;and direct GHG emissions.Finally, from an environmental point of view, Line 1 (HF-HF) seemed the most environmentally friendlyconfiguration; however, it has to be noticed that land occupation can be drastically reduced with the implementation of AEW (2.4 m2/p.e and 0.8 m2/p.e for Line 1 and Line 5, respectively).

Table 2. Comparison of the environmental indicators applied to the five alternatives

		Line1	Line2	Line3	Line4	Line5
Impact category	**Unit**	**(HF-HF)**	**(HF-VF)**	**(VF-HF)**	**(VF-VF)**	**(AEW)**
Abiotic resource depletion	kg Sb eq	1.53E-06	1.60E-06	1.65E-06	1.67E-06	1.75E-06
Abiotic resource depletion (fossil fuels)	MJ	5.79E+00	6.78E+00	8.48E+00	7.77E+00	1.28E+01
Global warming potential (GWP100a)	kg CO_2eq	1.01E+00	8.35E-01	9.56E-01	6.62E-01	1.02E+00
Ozone layer depletion	kg CFC-11 eq	5.79E-08	6.67E-08	8.29E-08	7.55E-08	1.25E-07
Acidification potential	kg SO^2eq	3.01E-03	3.44E-03	4.22E-03	3.88E-03	6.21E-03
Eutrophication potential	kg $PO4_3$-eq	2.58E-03	2.73E-03	2.99E-03	2.87E-03	3.65E-03

Assessment of activated carbon from orange peels for greywater treatment

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Keywords: Activated carbon, Adsorption, Greywater, Isotherms, Orange peels.

Orange peels are easily available agricultural waste from juice industry, has been used as precursor for preparation of activated carbon. Orange peel activated carbon (OPAC) was prepared through chemical activation with 1M KOH solution followed by pyrolysis at 450 oC for treatment of greywater. Batch experiments were performed as a function of adsorbent dose, initial concentration, pH and contact time. Adsorption data were studied using Freundlich and Langmuir isotherms. Batch adsorption data were better fitted to Langmuir isotherm (R2=0.9879).

Wastewater treatment using rotating biological contactors: A Review

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Keywords: Rotating Biological Contactors (RBCs), Wastewater Treatment

Huge quantities of wastewater are generated throughout the world every day. However a major portion of these are disposed into the water bodies without proper treatment. The attached growth biological processes havegained popularity among scientists and engineers for the treatment of wastewaters containing organic impurities. Among these processes, rotating biological contactors (RBCs) have an edge over several other treatment technologies. RBCs comprises of a series of rotating disks, media and biofilm reactor. In India the use of RBCs are not as popular as like developed countries. So the present review focuses on how RBCs are used for the treatment of different wastewaters containing organic impurities generated from different sources and a critical comparative study on its applications is discussed. Over the years RBCs have been successfully used for the treatment of municipal and domestic wastewaters. It can also be used for the

treatment of various industrial wastewater effluents from food industries, pulp and paper mills, leather tanneries, sugar refineries, oil refineries pharmaceuticals and decolouration of industrial dyes.The main advantages of RBCs are relative low energy consumption, simple operationand maintenance and less land area requirement. This study gives an opinion that the RBC systems have the advantages of simultaneous nitrification &de-nitrification accompanied by carbon and phosphorous removal. The ultimate goal of our project is to treat kitchen wastewater generated from hostel residences.

Water conservation and water management in Indian sugar industry - An innovative approach

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Sugar sector is the second largest agro based sector in India. A total of about 528 sugar factories are presently operating in different states of India. Large quantity of fresh water is consumed in various unit operations in a sugar factory to produce white/refined sugar and equally large quantity of waste water is generated from sugar factory. Based on the information available from various sugar factories located in Sub-tropical and tropical regions, it reveals that significant quantities of fresh water is consumed to produce white/refined sugar and waste water generated is about 150 - 200 liters/ton of sugarcane crushed. Sugar industry is a seasonal industry and run for about 130-180 days in a year during the availability of sugarcane. Sugarcane itself contains about 70% water i.e. 700 liters/ton of cane which envisages huge potential not only to minimize fresh water requirement to the extent of Zero but also to produce potable water from surplus condensate made available during unit operations.

A study has been carried out by the National Sugar Institute, Kanpur, U.P keeping in view following objectives:

-To develop model "Condensate Conservation and Management System" to achieve zero fresh water requirement and to develop zero discharge concept ultimately.

-To collect the data on the extent of utilization of condensate in selected sugar factories and about fresh water usage.

-To analyze the condensate and waste waters for various parameters to ascertain their suitability from various stages/ unit operations for miscellaneous uses including as potable water.

-To develop appropriate technology for the treatment of condensates and waste waters to convert them into suitable form for sugar manufacturing resources and for other uses.

Data on water management practices and water samples (condensates from various sources, waste water inlet to ETP, overflow from spray pond/cooling tower, ETP outlet etc) were collected from 17 sugar factories on pan India basis. Samples of water were analysed for pH, salinity, Total dissolved solid, conductivity, Chloride, Calcium, Total suspended solid, Total Acidity, BOD, COD to ascertain purity level of various condensates/waste water streams.

Based on the data collected from factories an ideal water management cycle for sugar industry has been developed to facilitate maximum closed loop water re-circulation so as to minimize fresh water requirement in unit operations and also to minimize waste water generation. These will results into conserving our natural resources of fresh water. This institute is exploring appropriate cost effective technologies for treatment of surplus water to make it for other useful purposes otherwise ultimately to make potable water.

In the light of CPCB new guide lines for sugar industry to have online monitoring system for waste water generation and its discharge after treatment , waste water minimization can be considered in lines of volume(or flow) reduction, strength (pollutant concentration) reduction or combination of these reduction. Online monitoring of Total Organic Carbon (TOC) is preferred over BOD or COD, because BOD measurement is slow and readings vary depending on bioassay used. COD analysis is faster but it is affected by variations in chemical oxidation efficiencies. TOC provides a rapid and a reasonably accurate indication of pollution levels.

Engineered Constructed Wetland for Treating Domestic Wastewater

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Keywords: Constructed wetland, Domestic sewage water, Macrophyte, Water quality improvement

Pilot scale engineered constructed wetland was established with vertical flow and intermittent infusion of wastewater at University of Agricultural Sciences, Dharwad, Karnataka, India with a treatment capacity of 50 m3 per day. Macrophytes such as Typha latifolia and Bracharia mutica established in the constructed wetland were evaluated for their efficacy in improving the quality of the domestic wastewater from March-2015 to Feb- 2016. The macrophyte Typha latifolia induced greater reduction of TS (35.8 %), TSS (45.9 %), TDS (30.5 %), BOD (34.8 %), COD (37.4 %), potassium (47.6 %), Ca+ Mg (36.3 %) and Na (35.3 %) while, Bracharia mutica was efficient in reducing total nitrogen (39.3 %), nitrate nitrogen (45.4 %) ammoniacal nitrogen (40.8 %) and phosphates (45.9 %). Both Typha latifolia and Bracharia mutica induced moderation in the quality of the sewage water in respect of SAR, RSC and chloride content (3.8, 0.36 and 3.2; 4.2, 0.25 and 3.9, respectively) as against the raw sewage water (4.8, 0.34 and 5.1). Results indicated that use of combination of macrophytes is ideal for wetland planting for overall improvement in the quality of the domestic sewage water for its utilization.

Water Applied and Water Productivity of Chilli under Different Source of Water

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Key words: Constructed wetland, Crop yield, Domestic sewage water, Water productivity, Water treatment

Raw domestic sewage water is commonly used as a source of irrigation water in the peri urban area as it supplements the required crop nutrients. A field experiment was conducted at University of Agricultural Sciences, Dharwad during Kharif, 2015 to study the effect of six different source of water on the performance of green chilli. Significantly higher chilli yield were recorded in the plots irrigated with domestic untreated sewage water (17.58 t/ha) compared to fresh water (13.31 t/ha) and treated sewage water (14.63 t/ha) and was on par with fresh water altered with domestic sewage water (16.28 t/ha), fresh water altered with treated sewage water (16.18 t/ha) and treated sewage water altered with domestic sewage water (15.6 t/ha). Water productivity of chilli were significantly higher with domestic sewage water (32.39 kg/ha-cm) as compared to fresh water (26.75 kg/ha-cm) and treated sewage water (25.85 kg/ha- cm) and on par with other sources of water. Studies indicated that chilli irrigated with untreated sewage water was found to be better in terms of crop yield and water productivity as compared with other sources of water.

Response of Brinjal to Untreated and Treated Sewage Water

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Abstract: Among the various environmental challenges, fresh water scarcity is predominant one. Hence, recycling and reuse of wastewater generated after proper treatment is the need of the hour. A field experiment was conducted at University of Agricultural Sciences, Dharwad during kharif 2015 to study the effect of six different source of water on the performance of brinjal. Significantly higher brinjal yield were recorded in the plot irrigated with domestic untreated sewage water (17.43 t/ha) as compared to fresh water (15.28 t/ha) and treated sewage water (15.32 t/ha); but it was on par with treated sewage water altered with domestic sewage water (17.37 t/ha), fresh water altered with domestic sewage water (16.96 t/ha) and fresh water altered with treated sewage water (15.94 t/ha). Significantly higher fruit weight per plant was recorded in the treatment irrigated with domestic sewage water (280 g/plant) as compared to fresh water (182 g/plant) and treated sewage water (205 g/plant). Water productivity was significantly higher with domestic sewage water (32.39 kg/ha- cm) as compared to fresh water (26.75 kg/ha-cm) and treated sewage water (25.85 kg/ha-cm) and was on par with other sources of water.

Response of Maize to Drainage and Microbial Culture in Degraded Lands

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Key words: Crop yield, Land improvement, Soil salinity and alkalinity, Spentwash, Subsurface drainage

Abstract: Bio-methanated spentwash is the common waste generated from the sugarcane industry which is usually diluted and applied to land as disposal means. Field experiment was conducted during kharif, 2015 at Ugar khurd, Belagavi district, Karnataka to study the effect of different drainage systems and soil fertility management practices on maize crop yield. Treatments comprising of drainage systems (subsurface, surface and no drainage) as main plot and soil fertility management practices as sub-plot viz. Green manuring in-situ (Dhaincha), use of press mud, microbial culture, green manuring in-situ + microbial culture, use of press mud + microbial culture and Control. Results indicated that among the drainage systems, significantly higher maize seed yield was recorded in subsurface drainage (4775 kg/ha) compared to control (3952 kg/ha) and was on par with surface drainage (4475 kg/ha). Among the soil fertility management practices, use of press mud and microbial culture recorded significantly higher seed yield (4992 kg/ha) over control (3728 kg/ha). Significantly higher maize seed yield was obtained in combination of subsurface drainage with use of press mud and microbial culture (5659 kg/ha) over no drainage with no fertiliser and green manure (3476 kg/ha).

Engineered Constructed Wetland for Treating Domestic Wastewater

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Water treatment residual reuse for colour removal: sustainability through reuse

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Keywords : Artificial Neural Network, Coagulation, Decolourisation, Dyes, Water Treatment Residuals

The colour removal from textile industrial effluent is important to obviate water resources contamination. Amongst various processes coagulation is primarily used method for colour removal. In present study, the viability of utilising raw aluminium-based water treatment residuals (WTR) as a coagulant for dye removal from synthetic wastewater was accessed. Batch jar test were carried out suing a reactive dye (Corafix G Yellow 150% MER). Maximum colour removal obtained was 60% at initial pH 3.0, however colour removal after centrifuge was 67-73% depending on final pH of system. Results were compared with the fresh coagulant (alum) shows similar trends at identical final pH of system. Artificial neural network (ANN) was applied to model the non-linear decolourisation process employing WTR. The performance of model was found very well, with correlation coefficient (R2) value greater than 0.90. The results show that simulations employing ANN unified non-linear behaviour of the system and model predicted and observed values are in close agreement of colour removal with each other. The study thus suggests WTR reuse can be a sustainable and low coast approach for colour removal.

Comparative analysis of roughing filter as pretreatment system in surface water treatment

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Keywords : Gravel, Horizontal Roughing Filter, Pre-filtration, Stone chips

A pre-treatment or a pre-filtration is an essential part for any filtration system to work efficiently and prolong the filtration duration,pre-filtration systems should be selected,analysed, and maintained properly. ECO-India aims at designing and developing cost-effective approaches for production of safe drinking water in rural area of Murshidabad, West Bengal which has arsenic contaminated ground water. Thustreatment of surface water source is one of the approaches to achieve this aim. The treatment system includes Horizontal Roughing Filter (HRF), Slow Sand Filter (SSF) and Activated Carbon Filter (ACF), where HRF is used as a pre-filtration system before filtration by SSF and ACF.
The basic aim to construct HRF is to lower the turbidity value of raw surface water before it enters SSF

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and prevent it from quick logging. Two no. of HRF unitsare constructed,one filled with stone chips which are locally available at pilot site(HRF 1) and the other filled with conventionally used gravels which are transported from outside (HRF 2). Comparison is done on the performance of both the units ensuring same quality and quantity of water to pass through them and also keeping the arrangements same for the units. Varying performance of the two units is observed under varyingconditions.

Hybrid Treatment to Biomethaneted Distillery Spent Wash

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Keywords : Anaerobic, Biomethanted, biochemical oxygen demand (BOD), chemical oxygen demand (COD),

distillery spent wash, reverse osmosis, UV (Ultra Violet).

It is the crucial work to treat the distillery spent wash, distillery spent wash is the conspicuous features of the distillery industry which produce massive quantity of waste water. Distillery spent wash is highly complicated troublesome pollution, exhaustive unwanted dark brown colour residual liquid with very high COD, BOD, highly acidic pH. Distillery industry is one of the highly polluted red industries which produce pollution, seven times higher than the population of India. Anaerobic (Biometahnated) treatment is the primary treatment to handle the raw spent wash generated during ethanol manufacturing. Anaerobic treatment removes the COD up to 70 % and the BOD up to 80%, respectively; it means post treatment is required to treat biomethanted distillery spent wash. In this paper a hybrid technique is implemented to treat biomethanated distillery spent wash. The hybrid technique includes a combination of different filter media such as pre filter, sand filter, pre carbon filter, reverse osmosis membrane filter (R.O.), post carbon filter and UV membrane filter. The result revealed that significant reduction in pH, colour and chemical oxygen demand was obtained. Hybrid techniques are successfully implemented to treat the biomethanted distillery spent wash.

Wastewater reuse by an innovative biological reactor combined with sand filtration

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Keywords : Disinfection; Escherichia coli; Giardia lamblia; Cryptosporidium parvum; Protozoa.

In recent years the availability of high quality water is becoming a constraint in several countries. Agriculture represents the main world water user therefore, wastewater reuse in this area could increase the water availability for other needs. However conventional approach for wastewater treatment and reuse requires

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large and complex plants which include tertiary disinfection processes (i.e. NaClO, UV radiation). The aim of this research was to provide a compact scheme for treatment and reuse of municipal wastewater based on Sequencing Batch Biofilter Granular Reactors (SBBGR).Particular attention was dedicated to microbiological quality of water monitoring a wide group of indicators (Escherichia coli,Salmonella,Clostridium perfringens, Somatic coliphages, Giardia lamblia and Cryptosporidium parvum). The possibility of SBBGR enhancement with sand filtration was also evaluated. The SBBGR removed more than 90% of suspended solids and chemical oxygen demand (COD), and about 80% and 50% of total nitrogen and phosphorous respectively. SBBGR resulted effective also towards microbial indicators removing from 1 up to 4 log units of these microorganisms. The addition of sand filtration increased the disinfection efficiency of the system obtaining an additional removal of 1-2 log units. In conclusion, the biological treatment by SBBGR produced an effluent with properties already compatible with its agricultural reuse according to the WHO's quality criteria. Furthermore, combining SBBGR and sand filtration the plant effluent could even comply more restrictive reuse criteria.

An efficient posthaste removal of heavy metals using bio-ceramic supported magnetic nanoparticles

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Keywords : Arsenite ion-As(III), MHA NPs, Hydroxyapatite, Isotherms and Kinetics

In present study, magneto-hydroxyapatite nanoparticles (MHA NPs) were synthesized with high surface potential, for an efficient and rapid removal of heavy metals. MHA NPs were characterized using ATR-FTIR, SEM, EDX, TEM and XRD to analyzed morphological, elemental, particle size and crystalline behavior respectively. BET and VSM analysis were done to determine surface area, pore size, pore volume and magnetic susceptibility. Further, batch experiments for removal of Arsenite-As(III) as a model heavy metal were carried out to optimize various parameters such as pH of solution (2 to 12), MHA NPs dose (0.05 to 0.5 g/L), As(III) concentration (0.2 to 4.0 mg/L) and contact time (5 to 300 min). Consequently, maximum removal of As (III) was found 98 % at optimized pH 6.5, MHA NPs dose 0.2 g/L, As(III) concentration 0.5 mg/L and contact time 210 min. Adsorption process of As(III) followed Langmuir isotherm and a pseudo-second-order kinetic. The maximum saturated monolayer adsorption capacity of As(III) onto MHA NPs was found 36.0 mg/g. Moreover, thermodynamics data reveals an exothermic and spontaneous adsorption of As(III). Additionally, effectiveness of MHA NPs for removal of various other heavy metals (Ni, Zn, Cd, Hg and Pb) was assessed from batch adsorption experiments in single solution system.

Does design of a wastewater treatment plant matter for its acceptance? Results from a study in Raisen, Madhya Pradesh

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Keywords : acceptance, architecture, design, wastewater treatment plant, willingness to pay

Following the recommendations of a city sanitation plan that was conducted for the city of Raisen in Madhya Pradesh by partner CEMDS with support from Wateraid, a decentralised wastewater treatment plant has been designed as part of the Saraswati project. With support from European Union parts of the city sanitation plan including the decentralised wastewater treatment plant (WWTP) have then been implemented. Implementation for the WWTP is still ongoing. The technology adopted was based on a trickling filter. The plant is situated close to settlements and close to a location of religious importance.

One of the main disadvantages of a trickling filter is its aesthetic impact. In order to overcome this shortcoming, with the help of an architect different designs for architectural beautification of the trickling filter were elaborated.

Based on those design options, then a household survey was conducted, where around 100 households were asked several questions related to their opinion on the design options for the trickling filter, also using AHP methodology. Further, additional questions were asked related to general willingness to pay for the operation and maintenance costs of the wastewater treatment plant and questions to discover any correlation with the design preference for the trickling filter.

The survey has shown that all households had strong preferences for one of the proposed options for architectural beautification, with a clear majority for one of the options. It has further shown that households would be willing to pay up to around 300 INR/months for the O&M costs. However, in the median willingness to pay for O&M was 20–50 INR/month in addition to 50 INR/month current water tax, and also available cash was 50-100 INR in the median (one-sided 95% confidence limits).

A detailed WTP analyses was then conducted with the collected data. The results will be presented in the presentation.

Comparative study of defluoridation of water employing chemically and biologically synthesized nanoparticles

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Keywords : Bacillus coagulans, Bio-synthesis, Chemical synthesis, Defluoridation, ZnO, TiO2, Nanoparticles.

The versatility in size, shape and morphology of nanoparticles introduces unique properties to nanoparticles-based water treatment systems, providing high surface area for adsorption of fluoride. Hence, nano-sized

zinc oxide was investigated for adsorption of fluoride from water samples. These nanoparticles were synthesised both chemically and biologically (Bacillus coagulans). Characterization studies of both forms of nanoparticles i.e., before and after adsorption studies was done employing X-ray diffraction, Fourier transform infrared spectroscopy, scanning electron microscopy and energy dispersive X-ray analysis. The particle size was found to be in the range of 30-40 nm in both the processes. Batch studies for defluoridation of water were conducted employing ZnO and TiO2 nanoparticles. To understand adsorption of fluoride on to the nanoparticles, adsorption isotherms and adsorption kinetics were studied. The thermodynamic parameters for defluoridation were also determined. In this study, we observed that both chemically and microbially synthesized nanoparticles were having the potential to adsorb fluoride from aqueous solution. The microbially synthesized nanosorbents were found to be more viable, eco-friendly and green approach for fluoride removal from drinking water and more preferred than the chemical method.

Grey Water Treatment and its Reuse usingVertical Bio-wall System: A Case Study

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Keywords : grey water, green wall system, natural treatment, recycle of grey water.

Grey water is the wastewater generated from kitchen, laundry, shower, floor washing, wash basin, etc. which is less polluted when compared with black water (toilet, faeces). An assessed total grey water production is 62% out of which 49% generation is from bathing (shower), 7% (hand washing), 27% (laundry) & 17% (kitchen). It is observed that swimming pool requires substantial quantity of water particularly for bathing of users before and after the use of pool quantity of grey water generation is 500-4000 lit/p/d approx. during winter and summer season, assuming 1000 lit/d generation from shower ensuing organic pollutant load in terms of BOD (11gm/d), COD (40gm/d) and TS (185gm/d) are found low in nutrient and microbiological contamination so deliberates better potential reuse by simple treatment resulting safer reuse for irrigation and toilet flushing.. This paper highlights the "Wall Treatment Process" to evaluate the most appropriate system to treat grey water by using indigenous and inexpensive material through linear wetland or bio-filtration.The expected treatment efficiency based on few week performance of the system have been observed through removal rates COD (80%), BOD (84%) and TSS (66%). Hence, this system can found to be finest apt not only to deliver viable treatment technology, but also provides water for non-potable usages. Besides, it offers fresh water savings of more than 40%, improved aesthetics, and air quality of the locality and better acoustics and thermal control of the building.

Titanium Peroxide Nano Strands: An Efficient Adsorbent for Cationic Species from Aqueous Solution and A Very Active Photocatalyst

Under Solar Light
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A highly viscous titanium peroxide gel with unusual physical/structural characteristics has been prepared by using simple solution chemistry using titanium hydroxide and hydrogen peroxide. Freshly prepared titanium peroxide is water soluble and when aged for two days gets condensed/polymerised forming a highly viscous transparent yellowish gel of 8000 to 12000 cps viscosity. The polymerised titanium peroxide gel with 99.9% water and 0.1% solid content with zeta potential in the range of -35 to -80 mV exhibit the stable nature of the gel. Titanium peroxide to water ratio of the gel is about 1:1000, showing very interesting of network of polymerized titanium peroxide and water molecules forming a viscous gel. The titanium peroxide gel when added to water, the titanium peroxide gets dispersed into water forming a suspension of fibrous solid into water and the TEM study of the suspended solids showed the presence of titanium of peroxide nano stands of 1-2 nm thick and 30-40 nm in length clustered together forming a suspension in water. These titanium peroxide nano strands being negatively charged have been found to be an efficient adsorbent for metallic as well organic cationic species from aqueous solution. When added to an aqueous solution of methylene blue, the cationic dye molecules are instantaneously adsorbed on the titanium peroxide nano strands which settles down faster leaving crystal clear water behind which can be separated by simple decantation/filtration process. These titanium nanostrands with adsorbed dye when exposed to sunlight, show very fast degradation of the dyes showing very high photocatalytic degradation compared to other photocatalysts such as Degussa P-25. Once the adsorbed dye on the nano strands is degraded then the nano strands can be reused again for adsorption of cationic dyes and for its further photocatalytic degradation using solar light. Similarly the organic compounds, such as phenol, methanol etc. from waste water have been also photocatalytically degraded using titanium peroxide nano strands using solar light.

Titanium Peroxide nano strands being negatively charged when added to aqueous solution containing metallic actions such as Cu2+, Ni2+, Fe2+, Fe3+, Au3+, Ag2+, As3+, the metallic ions were instantly adsorbed from aqueous solution by the nano strands by electrostatic attraction. The optical properties of the metal doped titanium nano strands changes due to the color change to blue in case of Cu2+ and pink in case of Au3+ providing a very simple procedure for separation of metallic ions from aqueous solution. The metal ion grafted titanium peroxide nana strands showed higher photocatalytic activity than the initial titanium peroxide nano strands due to the metal ions enhanced electron hole pair separation on the photocatalyst.

The titanium peroxide viscous gel has been characterised for its structural and optical properties using various characterization techniques such as FTIR, UV-VIS, TEM for structure property correlation. The synthesis of titanium peroxide nano strands has been scaled up on larger scale and the photocatalytic activity of these nanao strands has been tested on pilot plant scale and the results are quite promising.

Considering the scalable preparation procedure, ease of recovery of catalyst by simple decantation/filtration process for recycle, titanium peroxide nano strands show a very good potential for its use in waste water treatment and metal ion removal for water purification

'MORE WATER' – Model for Restructuring Wastewater Treatment Systems to make Effluent Reusable for Irrigation

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Keywords : Domestic Wastewater; Effluent; Irrigation Water; Sewage Treatment Plant; Water Reuse

Irregular rainfall and depleting groundwater reserves in several parts of India have led to severe scarcity of irrigation water. Management of domestic wastewater needs immediate attention due to its impact on community hygiene. The study presents an innovative approach to address these issues by bridging the gap between shortage of irrigation water and surplus domestic wastewater.

'MORE WATER' provides an incentive to organizations for constructing sewage treatment plants (STPs) in rural areas assuring water for irrigation at a lower cost. A comprehensive study of the setup, working and management of select STPs led to this model.A rural agrarian household in Andhra Pradesh (India) typically spends about Rs. 6 per kilolitre to obtain water for use. Assuming an average per-capita water consumption of 80 litre per day, a sample village of 1000 people would require a STP of 52kilolitre per day (kLD) capacity.

Effluent of the STP would be a low-cost substitute for irrigation water that the farmer would have normally purchased. Considering the costs of construction and maintenance, the STP can operate at reasonable margin of Rs. 1.27/kL. A decentralized approach to this sustainable model would ensure involvement of the local community in maximizing effectiveness of water reuse.

An efficient posthaste removal of heavy metals using bio-ceramic supported magnetic nanoparticles

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Keywords : Arsenite ion-As(III), MHA NPs, Hydroxyapatite, Isotherms and Kinetics

In present study, magneto-hydroxyapatite nanoparticles (MHA NPs) were synthesized with high surface potential, for an efficient and rapid removal of heavy metals. MHA NPs were characterized using ATR-FTIR, SEM, EDX, TEM and XRD to analyzed morphological, elemental, particle size and crystalline behavior respectively. BET and VSM analysis were done to determine surface area, pore size, pore volume and magnetic susceptibility. Further, batch experiments for removal of Arsenite-As(III) as a model heavy metal were carried out to optimize various parameters such as pH of solution (2 to 12), MHA NPs dose (0.05 to 0.5 g/L), As(III) concentration (0.2 to 4.0 mg/L) and contact time (5 to 300 min). Consequently, maximum

removal of As (III) was found 98 % at optimized pH 6.5, MHA NPs dose 0.2 g/L, As(III) concentration 0.5 mg/L and contact time 210 min. Adsorption process of As(III) followed Langmuir isotherm and a pseudo-second-order kinetic. The maximum saturated monolayer adsorption capacity of As(III) onto MHA NPs was found 36.0 mg/g. Moreover, thermodynamics data reveals an exothermic and spontaneous adsorption of As(III). Additionally, effectiveness of MHA NPs for removal of various other heavy metals (Ni, Zn, Cd, Hg and Pb) was assessed from batch adsorption experiments in single solution system.

Decentralized Techno-Economical Sewage Treatment Facility for Water Reuse in India: A Case Study

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Keywords : Anaerobic filter, Constructed wetlands, Natural treatment system, Recycled sewage, Techno-economical system, Water reuse, Wastewater treatment.

This poster demonstrates implementation of a 100 m3/d capacity sewage treatment plant using natural treatment system at Ordnance Factory Ambajhari, Nagpur. Natural treatment of sewage is enhanced by infusing improved anaerobic filter media in Anaerobic reactor at primary stage for a substantial organic matter reduction, followed by providing a subsurface horizontal flow constructed wetland for removal of nutrients and remaining organic matter. River bed filter media of different gradation (starting from bottom) 30-60mm, 12mm and 2-6mm is provided in the wetland. Average sewage characteristics with respect to BOD, COD, TSS, TKN & TP considered in the design of decentralized STP are 150, 300, 300, 25 & 6 mg/l respectively. The treatment system was commissioned in January, 2016 and effluent obtained after the anaerobic filter and constructed wetland has BOD, COD, TSS, TKN & TP concentration in the range of 40-60, 80-100, 25-40, 20-26 & 5-7 mg/l and 10-20, 30-50, 5-10, 5-8 and 0.8-2.0 mg/l respectively. Treated effluent thus obtained is proposed to be further processed through pressure sand filter, activated carbon column and UV disinfection for polishing and reuse for non-potable purposes. Primary sludge management is planned to be carried out through sludge drying reed beds.These studies are in progress.

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Sludge Drying Reed Beds Systems for Sustainable Sludge Management for a Decentralized Sewage Treatment Plant

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Keywords : Primary clarifier, Sludge drying reed bed, Sludge digestion, Sludge dewatering, Wastewater treatment, Wetland Plants.

A decentralized techno-economical sewage treatment facility of capacity 100m3/day is implemented at Ordnance Factory Ambajhari, Nagpur. Sludge generated from primary clarifier is proposed to be treated through sludge drying reed beds (SDRB). Solids concentrations in sludge vary between 3000–3500mg/l. SDRBs are designed for sludge management to the tune of 5m3/day. SDRB vertical flow constructed wetlands, which are divided into three sectors, having filter media (starting from bottom, washed gravel 30-60mm, 12mm and sand 0.2-5mm) and planted with locally available plant Typha. Sludge slurry from the clarifier is fed in SDRB by gravity and measured through a flowmeter. Solid particle trapped on filter media and water percolates down and collected laterally and finally discharged in collection sump. The filtrate is then recycled to the outlet of the clarifier. Solids thus settled on filter media are digested aerobically and converted into manure over a period of time. Nutrients in liquid are assimilated by plants and adsorbed on filter media, thereby remove from sewage.

The SDRB system was implemented in January, 2016 and is under commissioning period. These vertical flow systems are designed for 8-10 years of the sludge removal period and can serve for an indefinite amount of time. The mineralized sludge can be reused as manure or filling material. Therefore the system offers a sustainable and eco-friendly sludge management.

HEALTH BASED RISK ASSESSMENT OF FLUORIDE IN GROUND WATER OF GORAKHPUR, UTTAR PRADESH, INDIA

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Keywords : Groundwater, Fluoride, Electrolytic Defluoridation, Integrated Fluorosis Mitigation.

The evaluation of fluoride concentration in 248 groundwater samples of Gorakhpur district, Uttar Pradesh, has provided useful insight into the extent of fluoride contamination in the study area. It was found that fluoride concentration in 67 samples taken from India Mark-II hand pumps was higher than 1 mg/L. About 73% of the groundwater samples have fluoride concentration of 1.0 mg/L and 14.1% of the samples are within the range of 1-1.5 mg/L. Whereas 12.9% are beyond the maximum limit of 1.5 mg/L. The most affected block is Piprauli where 88.9% samples were found to have fluoride more than 1.5 mg/L. This district is highly affected by both Japanese Encephalitis, Acute Encephalitis syndrome and the dietary surveys also indicated that there is severe malnutrition in this area. In view of the fact that the problem particularly lies in rural areas, the defluoridation techniques involving simplicity of operation and low cost need to be adopted. It is also revealed that electrolytic defluoridation process produces the treated water with 90 - 99% reduction efficiency of excess fluoride. Along with this integrated fluorosis mitigation should be adopted leading to water defluoridation, reduction of fluoride intake through foodstuffs and nutrient supplementation may be required.

Techno-economic assessment of small scale wastewater treatment systems

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Keywords : Affordability; Appropriate system; Cost utilization; Sewage treatment plants; Treatment performance; India

In present study, techno-economic assessment of 16 small scale sewage treatment plants six employing leading market treatment technologies in India, was done in terms of treatment performance, land requirement, capital investment required, operation & maintenance, overall cost of treatment, and electricity consumption, to select an appropriate treatment system using available resources.In this regard, a total of seven technologies i.e. anaerobic and/or aerobic, extended aeration (EA), moving bed biofilm Reactor

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(MBBR), sequencing batch reactor (SBR), rotational biological contractor (RBC), and membrane bioreactor (MBR) were reviewed in this field study using a qualitative approach methodology. The results indicate that mean efficiencies are pragmatic and uniform across the different technologies except for onsite anaerobic systems. Land usage was calculated in the range of 0.125 - 0.8 m2/p.e. and 0.039 – 0.159 m2/p.e. for package and cluster type plants, respectively. The study analyzed approximate cost of treatment in the range of 0.44 - 0.68 (±10%) paisa/litre and 0.23 - 1.23 (±15 -20%) paisa/litre for onsite package type and cluster type plants, respectively. For all the evaluated plants in this study, specific power consumption was analyzed in the range of 0 – 1 KWh/m3 from anaerobic to highly aerobic systems.

Removal of Pesticides from Contaminated Water by Different Adsorbents: A Review

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Keywords : pesticides residue, polymeric adsorbents, biopolymer, Activated carbon, adsorbents

Pesticides are widely used chemicals to prevent the crops damage caused by insects, diseases and other pests. Extensive uses of pesticides in crop protection and industrial exposure have been reported the cause for pesticides contamination to the water, soil and environment. Exposures to chemical pesticides cause serious environmental impacts. Because of their toxicity, carcinogenicity, and mutagenicity pesticides may cause undesirable impacts to human health. Pesticides residue in water is a major challenging task today to us. Number of pesticide residues from organochlorine (OC) i.e. HCH isomers, endosufan and DDT, organophosphorous (OP) i.e. chlorpyrifos malathion parathiuon ethion and herbicides i.e. butachlor, atrazine and pendimethalin detected in different water sources all over the world. Number of researcher studied on pesticides removal from water, and various innovative water treatment methods have been developed for pesticide removal. Present review article deals with the technical feasibility of various conventional and non-conventional adsorbents and focused to providing informations to low-cost adsorbents for pesticide removal. Carbonaceous and polymeric materials have been extensively used in adsorption processes for the removal of pesticides from aqueous solutions. Activated carbon (CAC, GAC, and PAC) is more common adsorbent for the treatment of water and wastewater. Polymeric adsorbents and their derivatives have been widely used as a potential alternative to activated carbon for pollutants removal from contaminated waters. Natural bio-polymers or polysaccharides are also found as good adsorbent for water treatment system. Polymeric materials are characterized with good properties for lower energy demands and, consequently, lower costs for regeneration of the adsorbents, in comparison with carbonaceous and other materials.

EFFICIENCYASSESMENTOF RBC FITTED WITH SPECIALLY CONFIGURED CUP SHAPED ASSEMBLIES

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Keywords : detention time, microorganisms, Rotating Biological Contactors,rotational speed.

Waste water is treated biologically by using suspended growth system or attached growth system. However attached growth treatment system is preferredin many cases because of multiple benefits associated with the treatment. Rotating Biological Contactor (RBC) system is an excellent option for treatment of waste water. It is popular due to its simplicity, low energy cost, easy operationand high specific removal rate. Efficiency of RBC depends uponavailable surface area for growth of microorganism.
A lab scale model of RBC was developed to test the performance of the model. Various modifications were incorporated while developing the model. The conventional rotating plates were replaced by specially designed arms assembly fitted with cup shaped attachments. The rotational speed and detention time was optimized and performance of the model was tested to analyze the efficiency. The performance of the model was tested for various iterations introduced by way of changing the media configuration, type of media, etc. The present paper discusses various aspects related with treatment of waste water by use of RBC. The paper also discusses about the development, performance and optimization of the model. The results obtained during optimization and iteration wise performance will be presented in full length paper.

Public health and socio-economic considerations of drinking water supply in India

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Keywords : rural India, health, QMRA, socio-economic, water supply

Providing safe water in rural India faces various challenges. Peoplerely on combinations of public and private sources and treatments to meet their needs. Although people's behaviour can impact the quality of their own water, health risks are not always clear. Socio-economic factors impact the choice of water source, treatment and storage. We used quantitative microbial risk assessment (QMRA) to estimate the effect of these choices on health risk. Our study of the water use and perceptions in rural communities in Karnataka showed that people prefer traditional supplies such as open wells for various practical, cultural and religious reasons. People are also willing to pay for their water, primarily for convenience but also for (perceived) quality. This can be a house connection to public water supply, buying treated water from water vendors or investing in household water treatment. Through QMRA we showed that advanced centralized water treatment only provides protection when combined with physical and hydraulic distribution integrity (24h pressurized)

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and house connections. Until this is achieved,drinking water safety depends on decentralized or household level solutions. Awareness raising and training of the population are then the most important means to reduce health risks through water.

FEASIBILITY OF ATTACHED AND SUSPENDED GROWTH SYSTEM ASSISTED MOVING BED BIOFILM REACTOR

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Keywords : Attached growth system, BOD, MBBR, Optimization, Suspended growth system, TS

In developing countries like India, the problems of sanitation increases due to the increase in population density accompanied by an increase in water consumption. Waste water with high levels of organic matter and total solidscause several problems such asoxygen depletion, toxicity, turbidity. Moving Bed Biofilm Reactor is advanced technology adoptedfor waste water treatment which incorporates the benefits provided by both attached and suspended growth process.

The experimental study was carried out for treatment of domestic waste water by using combination of attached and suspended growth system assisted with MBBR. A lab scale model of attached and suspended growth system assisted modified moving bed biofilm reactor was developed to test the performance of the model. Various modifications were incorporated while developing the model which consisted of three compartments operated in series. The first compartment was filtration unit, second compartment consisted of hollow paddles packed with media attached with a rotating shaft. The third compartment was operated as simple MBBR. The present paper covers the factors related with operation, maintenance and optimization of the model. The results obtained during the study in iterationswill be presented in full length paper.

Wastewater Treatment options and Environmental Management in Rubber Industries

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Keywords : Attached growth system, BOD, MBBR, Optimization, Suspended growth system, TS

An in-plant survey followed by flow measurement was carried out in a typical factory producing about 3200 tonnes rubber latex concentrate and 200 tonnes of, skill crepe rubber per year. The characteristics of wastewater from different sections as well as of combined waste water were studied on different occasions. The combined effluent had a BOD varying from 5240 to 6100 mg/1 and ammonia nitrogen content varying from 630-750 mg/1. Raising the pH to 11.0 and aerating for 1 hour reduced the ammonia nitrogen content by 83.1%. The BOD is reduced to 480 mg/1 by treating the combined wastewater after aeration for ammonia removal in an aerobic lagoon with a detention time of 30 days and a BOD loading rate of 0.1.4 kg/cu.m/day. The BOD of the wastewater could he reduced below 40 mg/1 by treating anaerobic lagoon effluent in an aerated lagoon with 7 days detention. Based on these studies treatment method is suggested.

Removal of Copper Ions from industrial wastewater using appropriate modifications of coconut coir dust

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Keywords : Activated Carbon; Adsorption; Freundlich isotherms, Modified Coconut Coir Dust; Optimum Values.

Copper can be found in many wastewater sources including printed circuit board manufacturing process, electroplating industries, plating, wire drawing, copper polishing, paint manufacturing, wood preservatives and printing operations. Typical concentrations vary from several thousand mg/l from plating bath waste to less than 1 ppm from copper cleaning operations. Exposure to copper can cause metal fever, headaches, stomach aches, dizziness, vomiting and diarrhoea, and also may cause liver and kidney damage and even death.

The present study aims at using activated carbon produced from coconut coir dust as adsorbent to remove copper ions from stock solution of copper ions (made using copper sulphate) and then from industrial wastewater. The carbon from the coconut shell is to be activated by three different modifications, viz. alkali (sodium hydroxide and sodium bicarbonate), phosphoric acid and formic acid. Batch adsorption experiment is to be conducted to examine the effects of initial metal ion concentration, contact time, pH and temperature on adsorption of copper ions from the wastewater. The contact time, pH and temperatures are to be found out for all the three modifications. Freundlich models are to be made using the adsorption data obtained. The study aims at comparing the data obtained from all three modifications and analyzing them to obtain optimum values for different conditions and applying them for copper ion removal from the industrial wastewater.

Sustainable Decentralized wastewater treatment system for cluster of residential areas in Tamil Nadu

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Keywords : Fixed-film biological reactor; Performance evaluation; Modular design; Lamellar flow tube settler; Design package; Mathematical cost model

Rapid urbanization, population growth and limited land availability have increased the global issue of water crises and wastewater disposal. There is a need for a challenging design for sustainable, economical and reliable wastewater treatment system. In the present study, Moving bed biofilm reactor (MBBR) technology based sewage treatment plant was designed and installed in 50 sites of 7 Tsunami affected districts of Tamil Nadu, India, using modular design concept. MBBR is an advanced technology which is a combination of attached and suspended growth processes and fluidized condition is maintained in the reactor by providing diffused aeration from the bottom of the reactor. The installed Sewage treatment plant (STP) consists of high

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rate MBBR reactor and tube settler forms heart of the treatment system to remove organic and suspended solids. The STPs were designed in 8 modules of capacity 55, 75, 100, 150, 200, 250, 300 and 450 KLD (m3/day). The total area requirement varied 0.64 to 0.746 m2/KLD 6 times lesser than conventional methods. The cost and economic analysis indicated that capital cost, recurring cost and total cost of treatment per KLD varied Rs.13, 620 to 23,980, Rs.384-880 and Rs.14, 094-24,575 respectively. Performance evaluation of the installed STPs at these 50 sites indicated removal efficiencies of 83-85% for TSS, 92-93% for BOD and 74-80% for COD. A computer aided design package was designed and developed for cost estimation and performance evaluation of the mathematical model formulated to predict the STP cost. The models formulated indicated that the accuracy was good.

HYDRODYNAMIC CAVITATION AS A LOW-COST WASTEWATER TREATMENT FOR COMMON EFFLUENT

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Keywords : Advanced oxidation process, BOD, COD, CETP, Hydrodynamic cavitation, Wastewater.

Introduction: There are physical, physico-chemical and biological methods of treatment exercised for industrial wastewater treatment. Normally Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) are expressed for quality of wastewater in terms of nature of pollutants. Cavitation can be in general defined as the phenomena of the formation, growth and subsequent collapse of microbubbles or cavities occurring in extremely small intervals of time (microseconds) releasing large magnitudes of energy over a very small location. The resultant effects are really spectacular. Hydrodynamic cavitation can simply be generated by the passage of the liquid through a constriction such as an orifice plate, valve or venturi.

Materials and Methods: The wastewater from nearly 175 different industries coming for the treatment in common effluent treatment plant at Waluj, Aurangabad which is having very high BOD and COD. The setup includes a holding tank of 10 liter volume, a positive displacement pump of power rating 1kW, control valves, and flanges to accommodate the cavitating device in the main line and a bypass line to control the flow through the main line. The suction side of the pump is connected to the bottom of the tank and discharge from the pump branches into two lines; the main line and a bypass line.

Results: In the present work, degradation of wastewater of SML CETP Aurangabad has been investigated using hydrodynamic cavitation process. In this study, the effect of cavitation was examined for the different time intervals from 0 to 180 mins. Maximum COD & BOD removal achieved was 85% & 95 % respectively and removal was achieved in 150 mins.

Conclusions: The rate of degradation was found to be dependent on the orifice inlet Pressure. The addition of H2O2 enhances the degradation rate due to additional hydroxyl radicals available for the oxidation of wastewater shows a synergy. However, this has also an optimum concentration of H2O2 beyond which, no further enhancement was observed.

DEWATS- DEcentralised WAstewater Treatment System

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Keywords : DEWATS systems, "waste to resource", bio-remediation.

This paper demonstrates that the use of decentralized systems such as DEWATS (Decentralized Wastewater Treatment Systems) approach to wastewater treatment have had more success and there is a need to make wastewater treatment people-centric and effective through the "waste to resource"- approach. The paper explores a few initiatives implemented which uses natural methods DEWATS for use in Sewage Treatment Plants (STPs) with household, urban and rural effluents. Such decentralized initiatives succeeded after broad issues of funding were taken into consideration. There is a need for capacity building of community institutions and participation by rural bodies in order to become aware, scale up and improvise these innovative approaches in the future at rural centers. Decentralized Wastewater Treatment Systems (DEWATS) is rather a technical approach than merely a technology package. Generically, DEWATS are locally organized and people-driven systems that typically consist of a settler, anaerobic baffled reactor, anaerobic filter , Planted gravel filter and a pond. The open pond or the polishing tank stores the remedied water and keeps it available for re-use. The system operates without mechanical means and sewage flows by gravity through the different components of the system. Domestic and non-toxic industrial sewage can be treated by this system. DEWATS applications are based on the principle of low-maintenance since most important parts of the system work without electrical energy inputs and cannot be switched off intentionally. DEWATS applications provide state-of-the-art-technology at affordable prices because all of the materials used for construction are locally available. DEWATS approach is an effective, efficient and affordable wastewater treatment solution for not only small and medium sized enterprises (SME) but also for the un-served (rural and urban) households in developing countries, especially South Asia. For instance, DEWATS can operate in individual households, at the neighborhood level and even in small and big factories not connected to sewage lines. DEWATS can also treat municipal waste. The recycled water is used for irrigation or for growing plants and is absolutely safe for human use. In certain urban areas the processed water is taken for use as flush-water in toilets with further post treatment.

HYDRODYNAMIC CAVITATION AS A LOW-COST WASTEWATER TREATMENT FOR COMMON EFFLUENT

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Keywords : 4-Aminopyridine, Chemical Oxygen Demand, Fenton oxidation, HPLC, Laterite iron, Mineralization.

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