Modelling for a Class-II Sedimentation-Part I : Preliminaries, Experimentation and Modelling

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For a class-II sedimentation, the design parameters, such as the overflow rate, detention time, etc., are at present evaluated from the results obtained from the column tests. To evaluate the effect of the initial suspended solids concentration and the nature of the suspended materials to be removed, column settling tests were conducted for the different initial concentrations of the several suspended materials, such as in the sugar mill waste and domestic wastewater (both containing the settleable organic solids), and the flocs of the aluminium hydroxide and the ferric hydroxide (both representing the chemical flocs). Using the column test data, a general predictive model has been developed to determine the overall percentage removals in relation to the depth of the basin, initial suspended solids concentration and overflow rate for the above said suspended materials. The settling material characteristics of the organic wastes and chemical flocs expressed through the sludge volume index (SVI) has been correlated with some of the model coefficients. Such predictive models can be used to evaluate the interrelationships between clarifier design parameters. The paper is presented in three parts, respectively dealing with : (I) Preliminaries, experimentation and modelling, (II) alternate modelling based on the data of other authors and (III) modelling utilizing the polynominal approach. This paper is only dealing with preliminaries, experimentation and modelling for a class-II sedimentation. Part lI and III will be discussed in the coming issues.

Eucalyptus Globules Bark-Economical Adsorbent for Chromotrope Dye Removal From Aqueous Solution

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Removal of chromotrope dye by adsorption onto *Eucalyptus globules* bark carbon and commercial activated carbon (CAC) have been made at 30±ºC. The percentage removal was found to increase with decrease in initial concentration of dye and increase in contact time and dose of adsorbent. The dye adsorption is found to be pH sensitive. The % removal decreases with increase in initial pH for chromotrope dye. Adsorption data were modeled in the Freundlich and Langmuir isotherms first order kinetic equations, like Natarajan-Khalaf,

Lagergren and Bhattacharya and Venkobachar equations and intraparticle diffusion model based on Δq (%) values. It is concluded that instead of CAC, EGBC could be used in the effluent treatment especially for the removal of dye in general and chromotrope in particular.

A Study on Recycling and Bio-treatment of Wastewater From Chemical Laboratory

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The wastewater from the chemical laboratory causes a lot of pollution in soil and water but it is unavoidable. So measures can be taken to reduce this pollution by : (1) Recycling the possible metal ions and (2) removing the metal ions from polluting soil by : (a) Biosorption using sawdust and (b)phytoremediation by plants of balsam variety. From the studies it has been found that metal ions can be precipitated in their respective group, dissolved in dilute HNO_3 and can be reused with an exception of ammonium ions. Common sawdust was found to be a better adsorbent for metal ions than neem sawdust. By phytoremediation studies it has been found that the plant *Peperomia pellucida* has better capacity to remove metal ions lead, zinc and magnesium, of which lead ions are removed greater than other metal ions. Ornamental balsam plant too showed phytoremediation properties in which lead ions where taken upto greater extent. Thus it is suggested that lab wastewater, if possible can be used for recycling metal ions and otherwise if treated with a bed of sawdust and a bed of plants can be made less polluting the soil and water.

Removal of Reactive Red 2 and Acid Blue 158 Onto Chitin/ Chitosan

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The dye sorption capacity (DSC) of respective reactive red 2 (RR) and acid blue 158 (AB) dyes onto chitin from aqueous solution were found to be 4410 and 4278 mg/kg. On chitosan it was found to be 4830 and 4666 mg/kg for RR and AB, respectively. The sorbents were characterized using FTIR spectra. The effect of pH and co-ions were studied. Equilibrium data were fitted with Langmuir and Freundlich isotherm model and thermodynamic parameters were evaluated to establish the mechanism of dye removal.

Suitability of *Trichoderma viridae* for Removal and Recovery of Cd, Cu, Co, Cr(T), Ni and Zn From Multimetallic Aqueous Environment

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Metals, like Cu, Fe, Zn, Co, etc., are essentially required in traces in human diet for normal metabolic function. However, when these are present above the permissible limits, the hazardous impacts could be visualised with varying degree and extent. Increased mining and metallurgical activities resulted in an increased flux of metallic contaminants in the aquatic environment. With the better awareness of the problems associated with these metals appear an increase in research studies related to improvement in the remediation technologies. To meet the current need of developing cost effective treatment and disposal technology, applying the microbes is contemplated to reduce treatment cost of metal bearing industrial effluents in lien of conventional activated charcoal adsorption and/or application of ion exchange resins. Exploring microbial potency to remove and recover various heavy metals from aqueous environment is an area of current research interest for detoxification of metal bearing effluents and recovery of these contaminants in the most acceptable and ecofriendly manner. In the present investigation, a fungal culture was isolated from metallic waste disposal site and tentatively identified as *Trichoderma viridae.* The isolate was tested for variety of metals, like Cd, Cu, Co, Cr (T), Ni and Zn from the multimetallic aqueous system under the influence of variety of environmental variables for maximum removal and recovery. The 144 hr old isolate have shown maximum sorption of test metals. At this stage of study, at the initial metal concentration of 50 mg/L, the removal of Co was found maximum (17.9%) and minimum for Zn (5.1%). The increases in metal concentrations have shown further improvement in the sorption efficiency of the isolate. However, for maximum sorption of different metals, the culture has to be treated in various pH ranges. Increased RPM have further shown the sorption efficiency of the isolate. The performance of NTA as eluent was observed maximum for efficient- and effective recovery of most of the test metals than other eluents, like EDTA, HCl, HNO_3 (1N solution of each). Based on findings of present investigation, it could be concluded that the *T. viridae* efficiently removes various heavy metals from multimetallic aqueous system, which could also be effectively recovered by using appropriate eluting agent.

Thermodynamics and Isotherm Modeling of Adsorption of Brilliant Green on Commercial Activated Charcoal

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The present study deals with the removal of brilliant green (BG) on commercial activated charcoal (CAC). The effect of initial concentration of dye, contact time, dose of adsorbent, temperature and surfactant on the removal of brilliant green by adsorption on CAC has been studied. The percentage removal of dye on adsorbent was found to increase with increase in initial concentration of dye. The percentage removal of dye was found to increase and reaches a maximum value with increase in contact time. The percentage removal of dye by adsorption exponentially increases with increase in dose of adsorbent. This was due to the availability of active sites. The percentage removal of dye was found to decreases with increase in temperature. From this data the thermodynamic parameters, such as ΔH^0, ΔG^o and ΔS^0 were calculated. The percentage removal of dye was found to decrease with increase in surfactant. Langmuir and Freundlich models were tested. The system covered monolayer adsorption.

Study of Adsorption Equilibrium of Methylene Blue with Low Cost Adsorbent

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Adsorption of a basic dye, methylene blue (MB), from aqueous solutions onto potato husk has been investigated. A batch adsorption technique was used. The effects of pH, initial concentration, temperature, particle size, contact time, etc., was investigated. The adsorption of MB to the adsorbent was found to be maximum at pH=10. The values of thermodynamic were found to be ΔH=$^-$17.925 KJ /mol and ΔS=49.426 J/mol.

Biosorption of Pb^{2+} and Hg^{2+} by Using Four Indigenous Fungal Species

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The presence of heavy metals in environment poses threat to living organisms. The conventional technologies for treating heavy metal rich wastewater are expensive and

contaminate environment, therefore, there is an urgent need for developing low cost technology. Use of microbial biomass can be an effective cheaper alternative for removing heavy metals from wastewater. In the present study, fungal species, namely *Phanerochaete chrysosporium*, *Penicillum chrysogenum*, *Aspergillus nidulans* and *Aspergillus flavus* were tested for their efficacy to remove heavy metals, such as Pb and Hg. Fourier transform infrared spectroscopy (FTIR) analysis showed that functional groups mainly -OH, -C=O and $>CH_2$ were involved in heavy metals to cell surface.

Bacterial Tolerence and Utilization of Azo Dye as Carbon Source or Nitrogen Source or Both Carbon and Nitrogen as Azo Dye Degradation by Selective Bacterial Isolates

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Microorganisms that have the ability to decolourize dyes have been reported by several researchers.Although several bacterial strains are known to decolourize several dyes, which are difficult for practical application because of their difficulty for survival in and adaptability to wastewater. But application of microorganisms has prooved to be more effective in successful degradation of the dyes.Orange G is present under the class of monoazo dye and it is valuable acid dye used in many straining methods including papani colour's OG stain. All the strains were found to resist, sustain upto 75 ppm above which only *P. flurocenes*, *B.subtilis, Pantoea aqqlomerans,P.pyogenes,E.dissolvens a*nd *E. coli* were able to tolerate. All of them were found to utilize orange G as a sole carbon or/and nitrogen source with distinctive decolouration while the pH optima of these strains ranged from 8 to 10. Their temperture optima were 37°C except one *E.coli* 44°C. In accordance with the abundant occurrence in the soil ecosystem *P. flurocenes* were found to decolourize orange G more effectively that other strains (assay was carried out by both plate and spectro method).

Detoxification of Nickel (II) Ions by Adsorption Onto Carbons Prepared From Agricultural Materials-A Comparative Study

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The adsorption of nickel (II) ions from agricultural materials, such as lemon peel carbon (LPC), pomegranate shell carbon (PSC) and its compared with commercial activated carbon (CAC) were carried out at 30±1°C under various experimental conditions. The percentage removal

increased with decrease in initial concentration and particle size and increase in contact time and dose of adsorbent. The adsorption is highly pH sensitive. Adsorption data were modelled with various isotherms and first order kinetic equations. Intraparticle diffusion is one of the rate determining steps. LPC and PSC could be used as low-cost adsorbents as alternative to commercial activated carbon (CAC) in effluent treatment, especially for the removal of metal ions. It is confirmed by FT-IR studies before and after adsorption.