EFFECTIVE TREATMENT METHODS OF COD AND BOD FROMBIO-METHANATED SPENT WASH (BSW)

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ABSTRACT

Though industries encourage economy of the country, the contamination produced by them has to be measured in order to protect the ecological system from degradation. The current work has been pointed for the removal and reduction of chemical oxygen demand (COD) and total dissolved solids (TDS) of the distillery industries liquid waste using natural adsorbent individually. About 2g, 4g, 8g and 10g of Bagasse and commercial activated carbon were used separately and in combinations. The batch studies reported that maximum removal COD, BOD, Chloride and Sulphate of 91.4%, 98.5%, 98.4% and 91.4% were removed using 10g of Bagasse for 1 day. For Bagasse has been reported that the dosage of 10g has resulted in four variables and the statistical appraisal revealed a positive correlation between decrease and the time.

Key words: Bagasse, liquid waste, biomethanated, COD and BOD

INTRODUCTION

The chief sources of water pollution are domestic, industrial, farming, thermal and radioactive liquid waste (Gaur 1997). Surface water originates in direct contact with the atmosphere, periodical streams, gullies and surface gutters. So, their presence exchanges of dissolved and atmospheric gases while the liquid wastes are introduced through water passages. The industries, which promote much to water contamination, are chiefly industries like pulp and paper, distilleries, oil refineries, pharmaceutical, textile, paint industry, dairy, and flour mills etc. (Kudesia 1994). Liquid waste entered from distilleries is extremely colored and toxic to aquatic species in receiving waters. Contamination of water sources with color, COD and TDS is not desired, as they are aesthetically offensive. The BSW is also preventing re-oxygenation in entering waters by controlling off sunlight infiltration. Along with these also most of the liquid wastes as coloring substances are toxic to aquatic species. Existing industrial technology for BSW liquid waste treatment such as progressive oxidation techniques, electro-chemical reduction, etc. may be effective for the removal of COD and TDS but their primarily and working costs are very high.\

Industrial liquid waste management is one of the chief significant ecological problems today's world manufacturing and processing industries generate a variety of liquid waste pollutants treatment is problematic to switch and costly (Kadam, 2012). Additionally, the requirement for water and the production of liquid waste is enhancing quickly, while the discharge of liquid waste is quiet a main issue faced by number of production industries might be the difficulty and massive volume of liquid waste with very small space fortreatment and discharge (Chopra, 2012).

The development of adsorbent from production and manufacturing industry by-product is a probable exploration area since; it is commercially activated carbon is costly. Bagasse Fly ash is by-product from the Energy production industry in the sugar factory. Usage of Bagasse Fly ash as an adsorbent for the liquid waste treatment is evidenced to be an operativeand good phenomenon (Kumar, et al., 2014 and Kushwaha, et al., 2010).

Bagasse Fly ash is a solid waste to the ecologically affects create enormous issue in sugar industry. The attempt of paying of this by-product as an adsorbent for treatment for liquid waste, bagasse fly ash may be best solution for the ecology and perfect exercise of liquid waste to resources transformation. A variety of researches appraised so far on adsorption treatment of liquid waste have been enlightened on either to appraise the efficiency of the treatment. However, in the current work, adsorption kinetics is estimated during treatment of distillery spent wash (DSW). Therefore, the opinion that the work is to appraise the physical chemical variables of the DSW and its treatment using activated Bagasse Flay ash.

MATERIALS AND METHODS

The DSW was collected from a Distillery industry. The physico-chemical variables like Temperature, pH and electrical conductivity (EC), Total Solids, Nitrate, Phosphate, COD, BOD, Chloride and Sulphate measured as per the standard methods for the estimation of water and waste-water (APHA, 1998). Sample collected for a period of three month (DSW-1,DSW-2 and DSW-3) are 1st, 2nd and 3rd month of sampling, correspondingly. But CPCB refers the maximum permissible limit of DSW to be discharged. Each value of the variable described as average value± standard deviation at n = 3.

Batch type experiments: About 100 mL of the sample was taken in separate conical flasks. Accurately 2, 4, 8 and 10g of Bagasse and commercial activated carbon were added individually and in varied combination. After mixture of adsorbents the flasks were kept for 30 minutes to 1 hour, then filtrate will be separated. The separated filtrate was subjected to physical and chemical variables determination.

Statistical analysis: The percentage reduction of variables attained in the study by various treatments was exposed to statistical appraise. The regression equation has been consequent and the correlation co-efficient (r) has been calculated. The correlation coefficientrepresents the relation between the dosage of the agents and the % removal of COD, Nitrate, Phosphate, BOD, Chloride and Sulphate (Palanisamy and Manoharan 1994).

RESULT AND DISCUSSION

The physical - chemical variables of DSW were determined and the analytical values were presented in terms of temp., pH, EC, Cl^-, BOD, COD, nitrate, PO_4^{3-} and SO_4^{2-}sulphates. This estimation was conducted for period of three months and the average values are presented in Table 1.

Table 1 Physical-Chemical Variables of DSW

Variables	DSW-1	DSW-2	DSW-3	Average	Standard
pH	3.98±0.03	3.94±0.02	4.16±0.06	4.03	5.5 – 9.0
EC (mS/cm)	42.6±0.50	46.8±0.58	51.5±1.04	46.97	-
Temp (°C)	45.7±0.70	48.2±0.26	48.6±0.51	47.50	< 5°C
BOD (mg/L)	37662±52.78	42880±40.6	35781±52.6	38774.33	30
COD (mg/L)	126682±25.21	138209±20.8	167872±77.56	144254.33	250
BOD/COD	0.297	0.310	0.213	0.27	-
Nitrate ($N-NO_3^-$), (mg/L)	2.50±0.82	4.02±0.23	5.71±0.82	4.08	10
Phosphate (PO_4^{3-}), (mg/L)	18.77±0.71	23.45±0.92	16.18±1.41	19.47	5
Chloride (Cl^-) (mg/L)	5982±62.18	4852±62.49	76001±35.16	28945.00	1000
Sulphate (SO_4^{2-}), (mg/L)	4425±18.31	4918±35.78	6014±38.46	5119.00	-

The relation of BOD and COD is a good index for the percentage of degradability of organic substance by the microorganisms and the condition of bio-chemical process in liquid waste treatment unit. Hence, the relationship between COD and BOD in DSW was appraised and the analytical values were given in Table 1. This relation between the variables indicated positive and linear with a well-defined outline.

The average values of temperature 45.6°C and pH 4.06 were recorded in raw DSW which are out of the CPCB distillery liquid waste discharging limits < 5°C and 5.5 to 9, correspondingly. The enhancing in liquid waste temperature will reflect on the ecology by changing in the chemical reaction and biological phenomenon in water body and soil (Saranraj, 2012).

The average DSW organic substance COD and BOD showed found to be 144254.33 mg/L and 38774.33 mg/L correspondingly. These values are extremely exceeded the permissible limit for land disposal level set by CPCB distillery effluent (Table-1). Thedisposal of effluent with such high loads of BOD and COD into the stream and land can create toxic conditions by immediate depletion of oxygen which disturbs the water chemistry and biological communities (Zaher, et al., 2014 and Figaro, et al., 2006).

The contact time is one of the significant variables that should be measured in batch adsorption lab studies. The contact time between the contaminants and adsorbent plays a supreme significance in adsorption treatment of liquid waste. Fig 1 to Fig 2 represents the effect of contact time on reduction of COD and BOD. The adsorptions of contaminants are found to increase with increase in contact time. The lab set up indicated that after 24 hours at adsorbent dosage of 10 grams/200ml, COD and BOD reduction were found to be 12364 mg/L (91.4%) and 564 ppm (98.5%) correspondingly. The same trends were noticed in other pollutants like Nitrate and Chloride (Fig 3 to Fig 6).

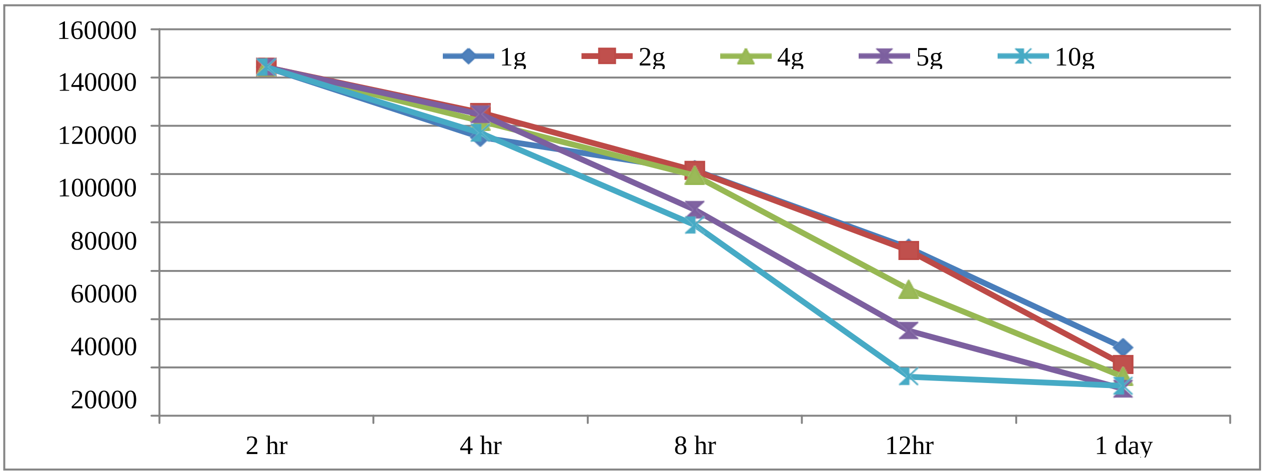

Fig 1 Removal efficiency of COD

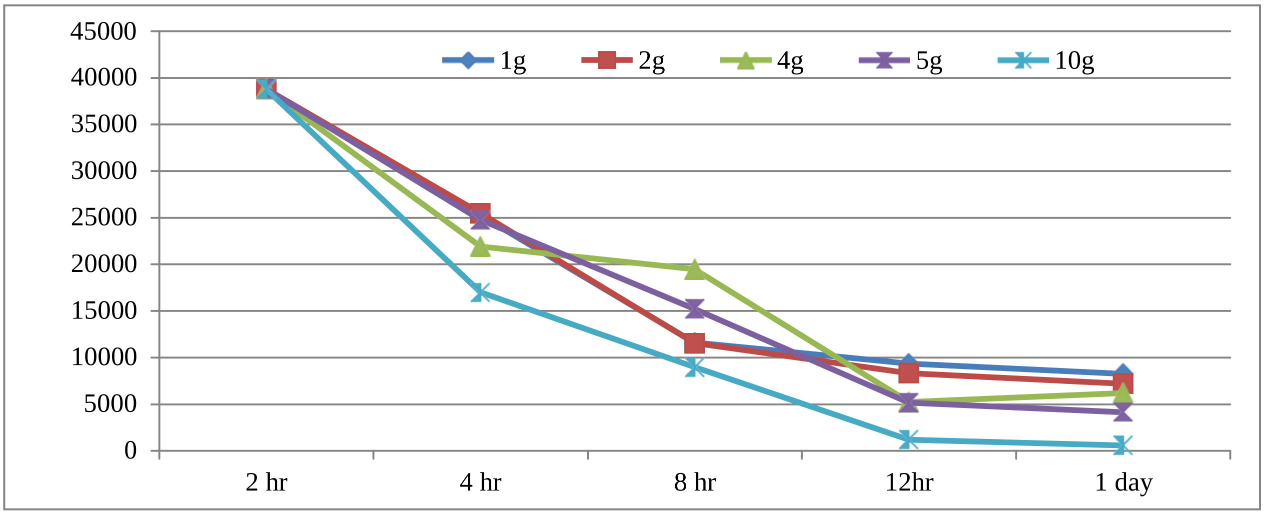

Fig 2 Removal efficiency of BOD

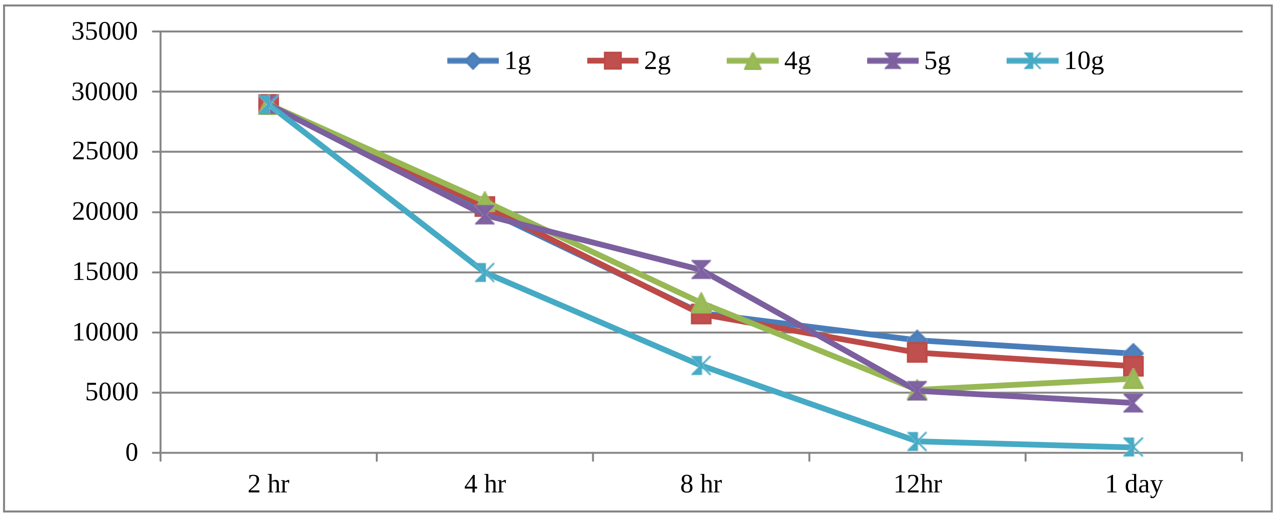

Fig 3 Removal efficiency of Chloride

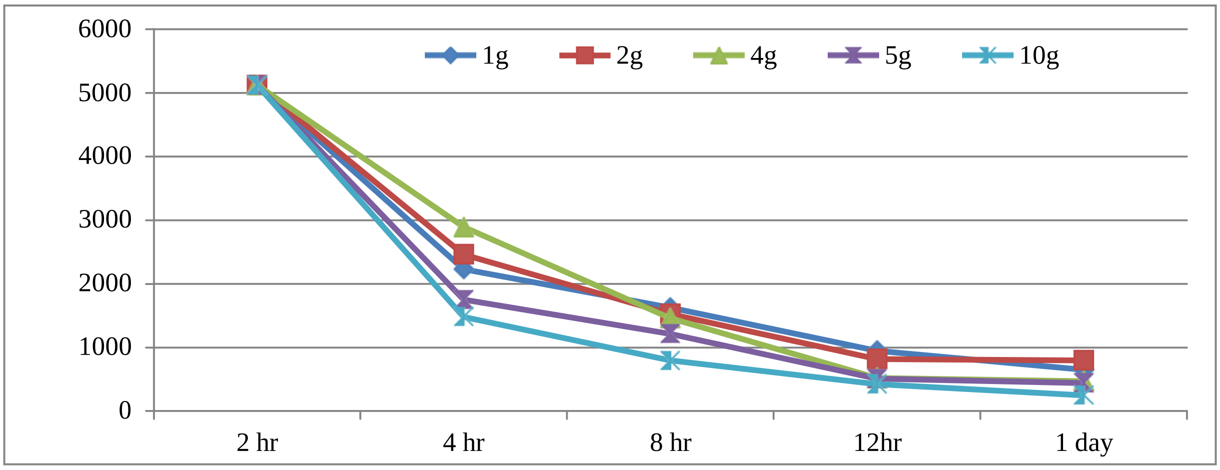

Fig 4 Removal efficiency of Sulphate

Adsorption equilibrium is generally described through isotherms, which are the quantity of adsorbate on the adsorbent as a utility of its content at constant temperature. The amount adsorbed is nearly constantly normalized by the weight of the adsorbent to permit comparison of different materials. Various arithmetical relationships have been used to describe the dynamic equilibrium distribution of adsorbate between the adsorbent and bulk liquid phases.

The pH value changed from 4 to 10 under the experimental setup of an adsorbent dose of 10g in 100 mL, contact time 24h and initial COD and BOD content (Simmi Goel, 2011). This might be accredited to the result of the activating agent of adsorbent which increased the positive ion on the surface on the adsorbent and extends adsorption process at acidic media for negatively charged DSW. Moreover, the adsorptive capacity of Bagasse and commercial activated carbon was subjective chiefly by the contact between the adsorbent and DSW in solution media either the H^+/ OH^- (Mane, et al., 2007 and Gupta, et al., 2003)

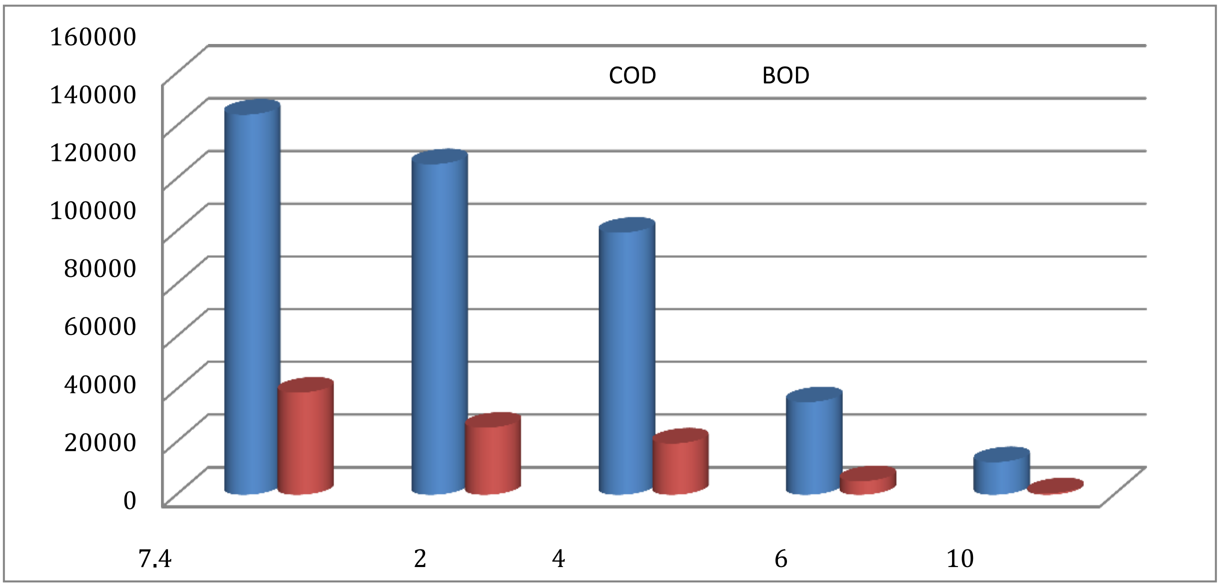

Fig 5 Effect of pH on removal of COD and BOD

CONCLUSION

The current study appraised the effectiveness of Bagasse and commercial activated carbon for the treatment of DSW. The batch studies reported that maximum removal COD, BOD, Chloride and Sulphate of 91.4%, 98.5%, 98.4% and 91.4% corresponding were obtained at optimum operating variables of 24 hours of contact when treated with a Bagasse and commercial activated carbon dose of 10g/mL at pH 4. The statistical appraisal revealed a positive correlation between decrease and the time. Hence it can be concluded that Bagasse and commercial activated carbon could be a practicable alternative for the treatment of BSW.

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