Poll Res. 42 (4) : 510-513 (2023)

ISSN 0257–8050
DOI No.: http://doi.org/10.53550/PR.2023.v42i04.018

REMOVAL OF OIL AND GREASE FROM VEHICLE WASHING STATIONS USING NATURAL ADSORBENT – A NEW APPROACH

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(Received 19 July, 2023; Accepted 17 September, 2023)

ABSTRACT

The study aims to study removal efficiency of oil and grease which may contaminate fresh water and ground water table. The removal of oil and grease from vehicle washing stations is rationale is to remove most organics and oil and grease from the liquid waste. Oil and grease was produced from various sources. The discharge of liquid waste into the aquatic system may cause towards the ecological system. The study aim into appraise the ability of two natural adsorbents, which are Coconut shells (CS), and Fruit juice solid waste (FJSW) which were selected as adsorbent in removing oil and grease from liquid waste generated in vehicle washing station. The study involved the characterization and performance of the adsorbents. Physical and chemical properties of the adsorbents were appraised. SEM was used to measure the surface morphology of the adsorbents. Dosage of adsorbent and contact time was appraised to study the performance studies including ability of adsorbents in removal of oil and grease from the liquid waste.

KEY WORDS : Natural adsorbents, Liquid waste, Removal of oil, Vehicle washing station.

INTRODUCTION

Various pollutants are entering into ecological system; one of the key pollutants that causes aquatic ecological issues is the current of oil and grease. High contents of oil and grease inside the aquatic system may create clogging due to presence of oil and grease. The clogging may encourage the water pollution as the contact with the pathogens (Williams *et al.,* 2012; Bridges, 2003). The key challenging job of industrial, agricultural and urban areas is treatment of waste into the streams (Salam, 2019; Bujang *et al*., 2012; Aweng *et al.* (2014). Oil and grease pollutants are the liquid waste generated from oil production, iron processing, lubricants production, restaurants and from vehicle washings (Lan *et al.,* 2009). Some of oil content existing in the ecological system for long period when percolate through the upper layer of the soil and accumulate in sediments, life in the marine water and also wildlife (Akpor *et al.,* 2014).

Oil and grease (O&G) are also called as Organic toxic waste damages the aquatic ecology, which is for aquatic organisms, flora, fauna and equally chronic effects for human being. They discharge of oil contaminated liquid waste form layer and decreases dissolved oxygen. Formed with O&G layer decreases the biological phenomenon in treatment process and microbes are covered with web layer. This phenomenon reduces the DO in the water indirectly causes the water bodies (Facchin *et al.,* 2013 and Alade *et al.,* 2011). The aim of this work was to remove oil and grease from the liquid water generated from vehicle washing stations using natural adsorbents like Coconut shells (CS) and Fruit juice solid waste (FJSW).

METHODOLOGY

Study Area

Liquid Waste for chemical variable evaluation was collected from main source from vehicle washing stations in and around the Davangere city. Liquid waste was collected from vehicle washing units which area running successfully from the year 2015 (Fig. 1).

Liquid Waste Collection

Liquid waste collected from six vehicle washing sites with different type of washing. Physico-chemical variables along with COD, BOD were determined as per the method (APHA, 2012). One liter of glass bottles were filled with liquid waste to estimate the O&G. Physical, Chemical variables were measured during the sampling day in order to minimize the error that may be caused due to atmospheric temperature variations.

Field and Laboratory analysis

In-situ field estimations are temperature, TDS, pH were measured using temperature probe, TDS meter and pen type pH meter respectively. The ex-situ variables are important water quality variables play key role in the human health was conducted as per the standard procedure (APHA, 2012). EC by EC meter, TDS by Gravimetric method, DO and BOD by winkler method and COD by distillation method. Concentration of oil and grease was estimated before and after treatment with natural adsorbents by adopting gravimetric method.

The collected liquid waste was extracted using n-Hexane, HCL at 1:1 ratio to maintain the pH less than 2 since to store the sample for further process. The mass is weighed using analytical balance; extraction process was done for three times to remove n-hexane from the liquid. The liquid was dried at 105 ^{0}C overnight to remove water content. The reside is weighed using analytical balance, along with this weight of the flask also measured to get constant weight after heating it for 15 minutes in the oven after cooling 45 minutes. The percentage of removal of O&G was calculated using formula % removal of Oil= $\frac{C_i - C_f}{C_i}$x100 where $C_i - C_f$ represents initial and final reading of the samples respectively.

Preparation of coconut shell (CS) and Fruit juice solid waste (FJSW)

CS was collected from local temple in Davangere city. CS was initially washed with water to remove impurities. Further CS was dried in sunlight for 8-10 hours to remove moisture content. The CS was powdered using ball mill and grinded. Further, the small pieces were sieved using <1 mm sieve for further process and to prepare CS powder. This is labelled as CS. FJSW were washed using double distilled water to remove impurities, which is present at the outer layer of the waste. Samples were then kept in oven at 60 ^{0}C -70 ^{0}C overnight to attain constant weight. This is labelled as FJSW. Both the adsorbents are appraised physical and chemical characterisation,

RESULTS AND DISCUSSION

Properties of Liquid waste

Table 1 indicates the outcome of the liquid waste properties. From the experimental results, the average concentration of oil and grease in liquid waste is 114.80 g/l which is considered as high. SEM was used to measure the surface morphology of the adsorbents are given in Fig.1 and Fig. 2.

Table 1. Liquid waste properties (n=6)

Variable	Value
Oil and Grease	114.80 g/l
pH	6.48 – 6.52
Temperature	30 ^{0}C
DO	3.1mg/l
COD	327 mg/l
BOD	98 mg/l

Removals of oil and grease using CS and FJSW

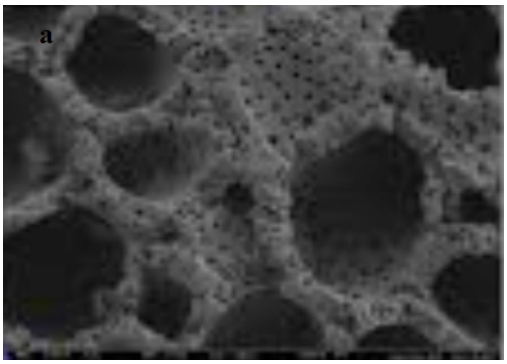

Fig. 1. SEM for CS at x250

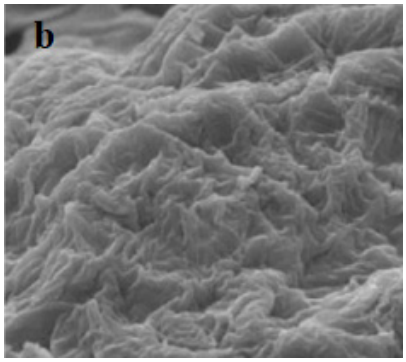

Fig. 2. SEM for FJSW at x500

The two variables were adopted are contacted time and dosage of adsorbent. For contact time, the capacity of the adsorbent to absorb the oil and grease at the attractive time was reported. The time contact appraisal is to identify the desirable time for the maximum of oil removal in the current study. Earlier research studies reported that, two phases present during adsorption (Ibrahim, *et al*., 2009).

The phases are a pioneer rapid phase and later a slow phase. The first rapid phase can be seen from Fig. 1 where the percentage removal increases with the increase of contact time. After a 40 minutes, the percentage removal starts to slow down which can be represented from the graph, where both the adsorbents CR and FJSW are slightly varied in the percentage of removal at varied in contact time. For CR, the percentage removal indicates an increasing pattern where the highest removal is at 93%. For FJSW, the maximum percentage removal is at 56%.

From Fig. 3, the percentage removal indicates quick changes with the addition of dosage of adsorbents. For adsorbents dosage experiment, the percentage removal of CS indicates at maximum removal at 75% removal using 5g of adsorbents. The trend from Fig. 3 represents the percentage of removal increases with the amount of dosage of adsorbents. For CS, the maximum removal efficiency is at 92% with the quantity of dosage at 1g. It is proved that with the increasing in dosage of adsorbents, the accessibility of adsorption is increased. Thus, the adsorption efficiency increases reported by (Ibrahim, *et al.*, 2010; Wahi, *et al.*, 2013). Another adsorbent study also confirms with the increase in dosage of adsorbent with the increase in surface area (Wahi, *et al.*, 2013).

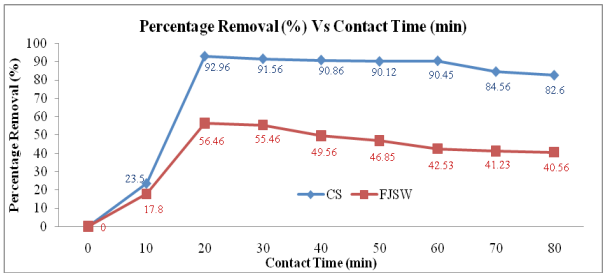

Fig. 3. Removal Efficiency Vs Contact time on the percentage of oil removal

Analytical results (Fig. 4) represent the removal efficiency of oil and grease at pH 7.0 at room temperature using CS and FJSW correspondingly. It was noticed that for oil and grease, there was 93% and 56% removal applying 1g of CS and FJSW at

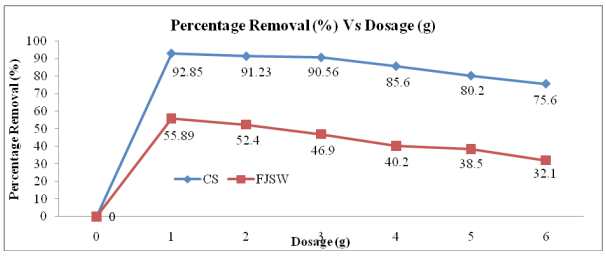

Fig. 4. Removal Efficiency Vs Dosage on the percentage of oil removal

contact time of 30 minutes. This analytical value was also observed in another study (Ibrahim, *et al.*, 2010). The outline indicates that both CS and FJSW do not required longer contact time to complete economically and carefully remove oil and grease from liquid sample. The removal efficiency of oil and grease is not specific with time. Furthermore, the analytical value indicates that less time will be considered for CS and FJSW to achieve efficiently.

CONCLUSION

The current study concludes, among two adsorbents CS and FJSW the effective decreasing capacity is noticed in FJSW adsorbent. It is very efficient in reducing oil and grease content from the collected liquid waste from vehicle washing units. The removal of oil and grease from liquid waste by using two natural adsorbents is experimented with a notified result as CS adsorbent is best adsorbent. Compare the two adsorbents, the CS adsorbent gave best analytical result out of the two adsorbent. Hence, the current study reveals that, about 75% of vehicle washing unit liquid waste can be reused and recycled to decrease the ground water table contamination and surface aquatic system. The techniques used in the study are very simple and cost effective.

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