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LOW COST MATERIALS FOR TREATMENT WASTEWATER CONTAINED PETROLEUM POLLUTION

LAYLA ABDULKAREEM MOKIF and NOOR ALAA ABDULHUSAIN

Environmental Research and Studied Center, University of Babylon, Iraq
laylaabdulkareem86@yahoo.com

Abstract

One of the major problems facing the water environment is the pollution resulting from petroleum, refineries and oil industries which resulting a great danger to humans, aquatic organisms and water resources in the world. In this study,*Conocarpus* plantwas employed as natural adsorbent substance which performed to reduce the concentration of contaminates exiting in the petroleum wastewater. The pollutants that have been removed are phenol, grease and oil. The laboratory experiments using Bach technique. Max efficacy of phenols removal was (83.694 %) at pH of (3.7). The highest efficacy of oil and grease removal (99.861 %) achieved at adsorbent mass of (15g), pH (9.77) and time of (120 min.). The *Conocarpus* planthas been shown to be effective in removing of pollutants (phenols, oil and grease) from wastewater. Efficacy of phenol removing progressed in increasing with adsorbent mass. The acidic pH value contributes greatly to increasing the efficiency of removal for both phenols, oils and grease. Max. amount of oil and grease adsorbed in solid phase was (17.369 mg/g).

Keywords: Petroleum pollution, wastewater, grease andoil, phenols,adsorption

Introduction

At the present time, researchers are moving towards the use of inexpensive materials produced from natural, agricultural and industrial wastes and employing them to remove pollutants from wastewater in addition to reducing waste in the environment [1]. Chemical compounds present in contaminated water may be dissolved or solid in suspended state in the aqueous solution and these substances cause harm to humans and aquatic life[2].Numerous studies conducted by researchers have shown the negative effects of hydrocarbons and oily wastewater on health and the environment because they are toxic and resistant to decomposition[3,4].The wastewater produced from industrial oil wastes needs to be treated before it is discharge into water bodies. Therefore, restrictions and legislation have been imposed to limit the disposal of polluted water and make it compatible with standards [5,6]. The danger of oil pollution has increased with the incrementgrowingin industrial activitiesand oil refining, and it has become an important environmental issue, and this pollution has negative consequences for the environment. Diverse physical, chemical and biological methods have been developed to reduce oil pollution [7]. Environmental pollution resulting from petroleum pollutants is divided into several parts, including pollution in the atmosphere resulting from the volatilization of petroleum matters, pollution in water and soil as a result of spills of petroleum products [8].Both toluene and xylene, in addition to benzene, are components of petroleum hydrocarbon, which are considered constituents of crude oil and are usually found in surface and

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groundwater, and treatment processes of them should not include any secondary materials that have a negative impact on the environment[9].Wastewater produced from petroleum and oil refining operations contains quantities of salts and heavy metals, in addition to organic compounds, inorganic matters,oil and grease, and also contains total dissolved and suspended solids [10,11].Traditional physical treatment methods including sedimentation processes, adsorption ,coagulation in addition to flocculation are considered the first and necessary steps in reducing the solids and suspended matter present in petroleum wastewater[12]. In this work a cheap substance was performed as adsorbent to reduce the contaminants concentration in petroleum wastewater

Experimental work procedure

The material used in this study is Conocarpus plant, and it'semployed as inexpensive adsorbentto eliminate the concentrations of pollutants present in petroleum industry and refinery wastewater. The adsorbent was prepared by purification it, washing it with distilled water, drying it and gristing it into powder form.Experiments were proceeded at room temperature.Bach tests technique was exercised in this work. The laboratory work divided into three parts. The part one involved the effect of time (60,90,120) min.on efficacy of contaminants removal. Part two studied the impact of The quantity of adsorbentand finally part three included studied the pHeffect on efficacy of removal . Table (1) illustrate the features of wastewater sample.

Table (1) the features of wastewater sample

parameters	value
pH	9.77
phenols	0.0693mg/l
TDS	2040 mg/l
Oil and grease	112.210 mg/l
SO_4	987 mg/l

Results

A-Section one

This work deals with three parts. In the part one the effect of time contact between adsorbed pollutants and adsorbent substance was examined. Three values of time (60, 90,120) min were employed, adsorbent amount of (5g), pH of (9.77) and volumesample of (1 liter).The result of this part stated in (fig.1.). In the part two the effect of adsorbent substance mass on removing of pollutant efficiency was studied. Various quantity of adsorbent (5, 10,15,20,25 g) were added to one liter of contaminated wastewater, pH of (9.77) andtime of (120 min.). The result of removal of this partexplained in (fig. 2.).The results ofthe removal efficacy of phenolsprogressed in increasing with adsorbent mass.In the third part of the experiments the impact of pH on removing of pollutant efficiency was performed. Different values of pH(3.7, 8.2, 7.7) were included,the mass of adsorbent

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was(5g),volume of contaminated wastewater was one liter, and time of (60 min.). The value of pollutantsremoval of part three illustrated in (fig.3.).Max efficacy of phenols removal was (83.694 %) at pH of (3.7). The highestefficacy of oil and grease removal (99.861 %) achieved at adsorbent mass of (15g), pH (9.77) and time of (120 min.).

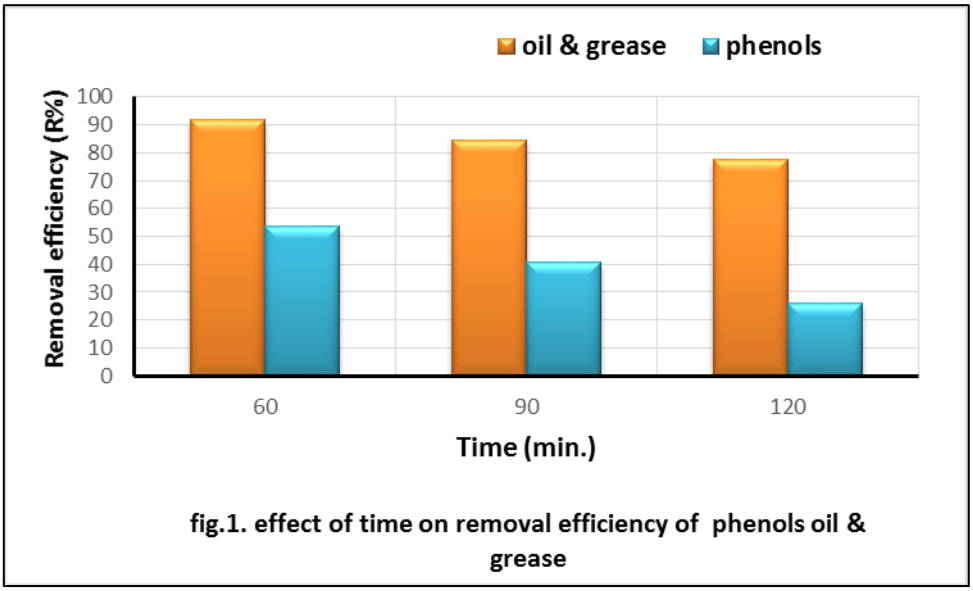

fig.1. effect of time on removal efficiency of phenols oil & grease

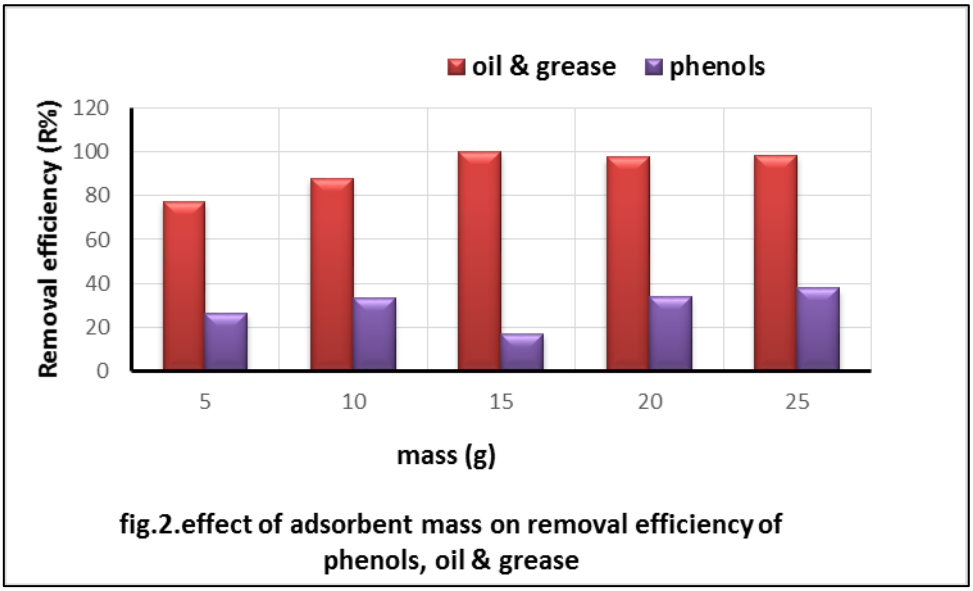

fig.2.effect of adsorbent mass on removal efficiency of phenols, oil & grease

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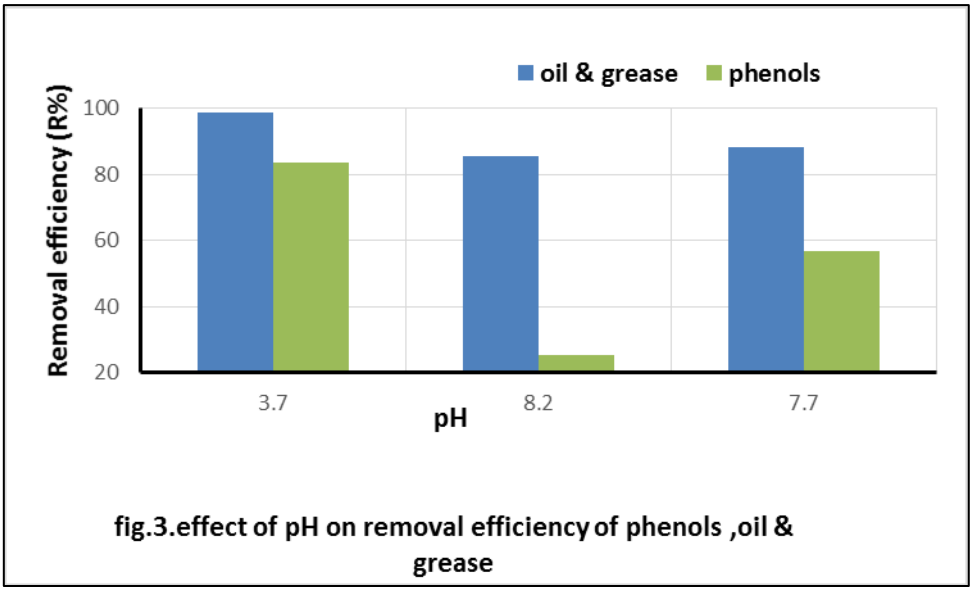

fig.3.effect of pH on removal efficiency of phenols ,oil & grease

B-Section (2)

Isotherm of adsorption models

In this section of work the adsorption models were employed (Langmuir and Freundlich)models for oil and grease, and phenols

$Cs=x/m= (abCe)/ (1+bCe)$..... (1) (Langmuir model)

$Cs=x/m=KCe^{(1/n)}$..... .(2) (Frendlich model)

$R\ \%=(C_o-Ce)/C_o *100$

Where

C_o: initial contaminant concentration (mg/l)

Ce: remaining concentration of contaminants (mg/l)

At equilibrium

Cs: amount of contaminant adsorbed in solid phase (mg/g)

m: mass of adsorbent (g)

a, b: Langmuir constant

x: mass of adsorbate adsorbed on solid phase (mg)

k, n: Freundlich coefficient

R: removal efficiency

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1- Oil and Grease

The results of the adsorption models of"Langmuir and Freundlich"for oil &grease, illustrated in tables (2, 3, and 4),figures (4,5 and6).

Table (2) data estimated for Langmuir plot (oil &grease) for One liter of wastewater volume (V= 1 liter) ,(Co=112.210 mg/l)

m (g)	Ce (mg/l)	x=(Co-Ce)V (mg)	Cs=x/m (mg/g)	Ce/Cs (g/l)	Removal% R%
5	25.364	86.846	17.369	1.4602	77.396
10	13.33	98.88	9.888	1.348	88.12
15	0.156	112.054	7.47	0.021	99.861
20	2.654	109.556	5.478	0.484	97.635
25	1.567	110.643	4.426	0.354	98.604

Table (3) data estimated for Freundlich plot (oil &grease)

m(g)	Ce(mg/l)	Cs(mg/g)	logCe	logCs
5	25.364	17.369	1.404	1.239
10	13.33	9.888	1.1248	0.995
15	0.156	7.47	-0.807	0.873
20	2.654	5.478	0.424	0.739
25	1.567	4.426	0.195	0.646

Table (4) adsorption Parameters ((oil &grease)

Langmuir Eq. 1		Freundlich Eq.2	
a	18.182	K	6.64
b	0.2115	n	6.127
R^2	0.8571	R^2	0.3713

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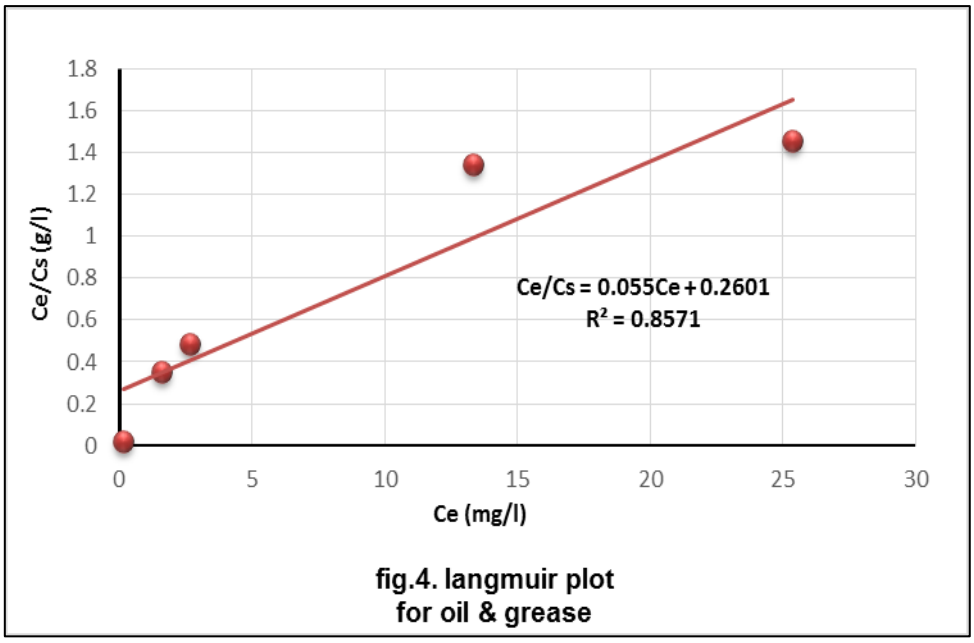

fig.4. langmuir plot for oil & grease

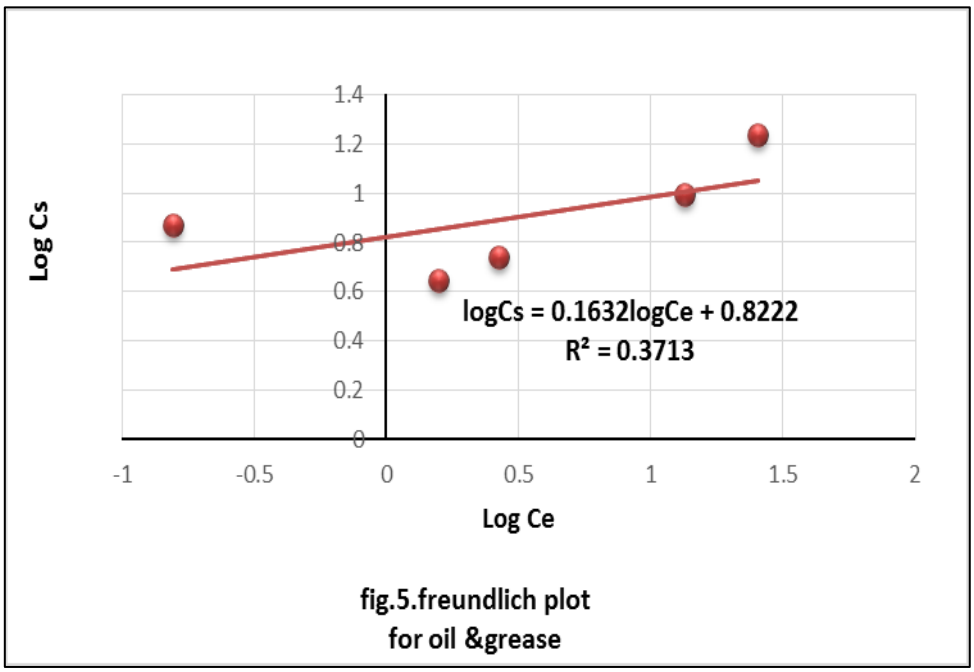

fig.5.freundlich plot for oil &grease

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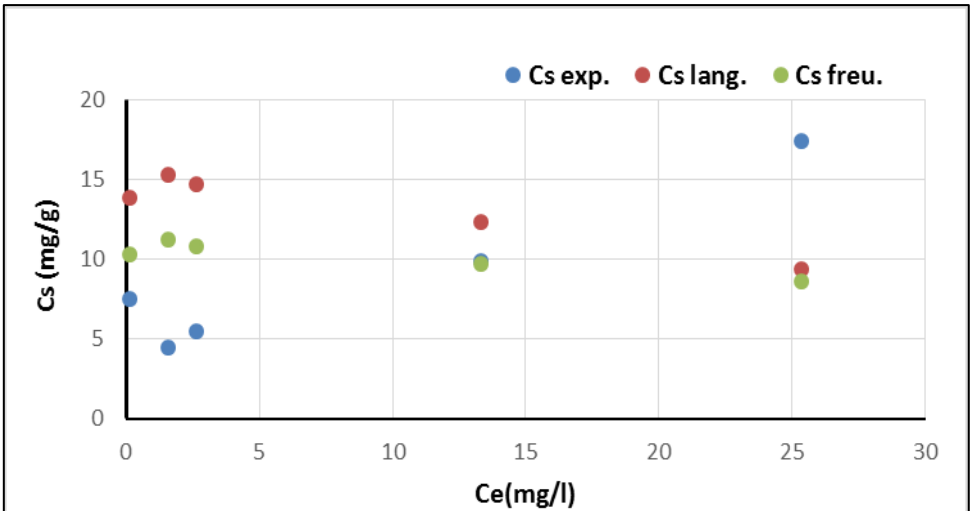

fig.6. equilibrium adsorption of oil & grease onto adsorbent

2-phenols

The results of the adsorption models of"Langmuir and Freundlich" for phenols , stated in tables(5,6 , and7),figures (7, 8and 9) .

Table (5) data estimated for Langmuir plot (phenols) for one liter of wastewater volume (V=1 liter), (Co=0.0693 mg/l)

m (g)	Ce (mg/l)	x=(Co-Ce)V (mg)	Cs=x/m (mg/g)	Ce/Cs (g/l)	Removal% R%
5	0.0511	0.0182	0.00364	14.038	26.262
10	0.0464	0.0229	0.00229	20.262	33.045
15	0.05766	0.01164	0.000776	74.304	16.797
20	0.0458	0.0235	0.001175	38.979	33.911
25	0.043	0.0263	0.001052	40.875	37.951

Table (6) data estimated for Freundlich plot (phenols)

m(g)	Ce(mg/l)	Cs(mg/g)	logCe	logCs
5	0.0511	0.00364	-1.29158	-2.4389
10	0.0464	0.00229	-1.33348	-2.64016
15	0.05766	0.000776	-1.23913	-3.11014
20	0.0458	0.001175	-1.33913	-2.92996
25	0.043	0.001052	-1.36653	-2.97798

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Table (7) adsorption Parameters (phenols)

Langmuir Eq. 1		Freundlich Eq.2	
a	0.0005	K	0.0027
b	-28.902	n	-1.758
R^2	0.2862	R^2	0.0107

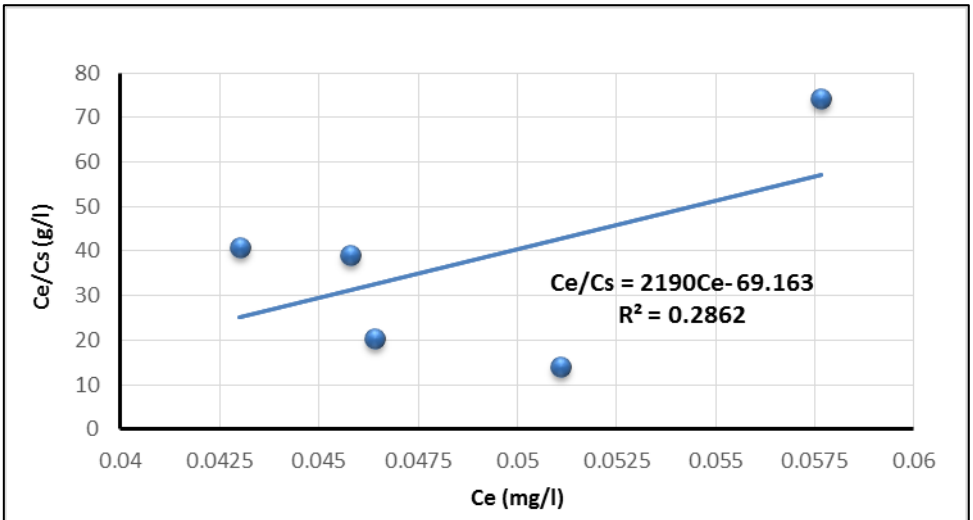

fig.7.langmuir plot for phenols

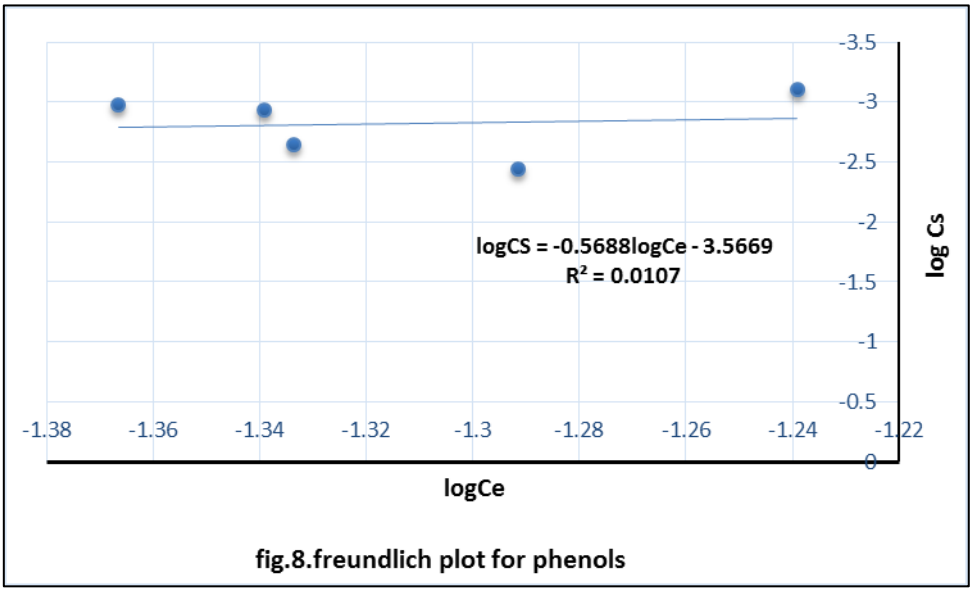

fig.8.freundlich plot for phenols

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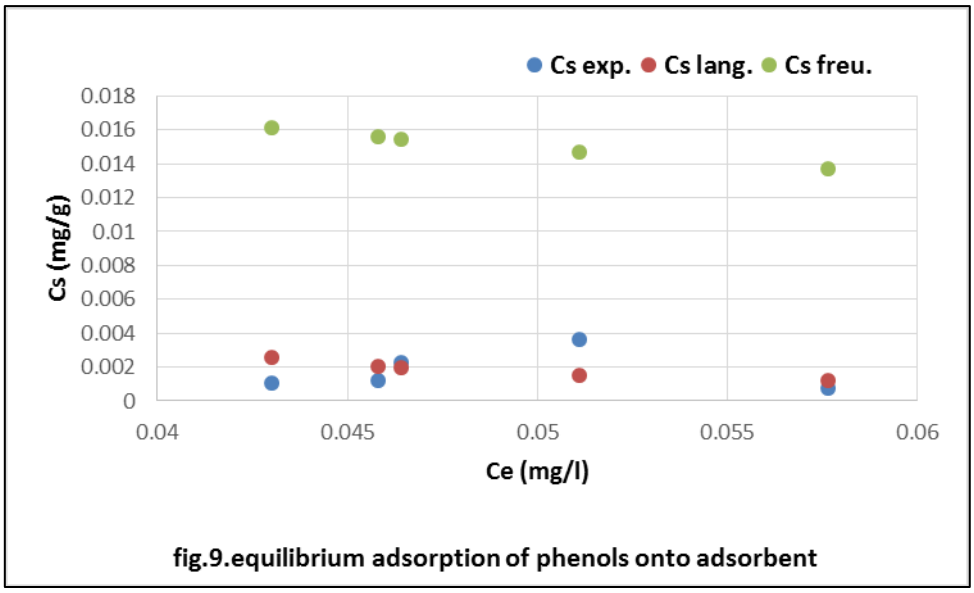

fig.9.equilibrium adsorption of phenols onto adsorbent

Conclusion

The *Conocarpus* planthas been shown to be effective in removing pollutants (phenols, oil and grease) from wastewater. Efficacy of phenol removing progressed in increasing with adsorbent mass. The acidic pH value contributes greatly to increasing the efficiency of removal for both phenols, oils and greases. Max. amount ofoil and grease adsorbed in solid phase was (17.369 mg/g).

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