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Experimental Study of Nitrate Absorption Isotherms Determination on Latium Composite Overactive Carbon

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Abstract

The aim of this study is to verify the amount of nitrate absorption on Latium composite over active carbon in which pH parameters, temperature, pollutant concentration, contact time for absorbent were considered. It was determined that optimum condition for absorbent are pH=3, T= 0 ˚C and initial concentration of solution=10 ppm, then absorption parameters verified and after drawing absorption isotherms (Langmuir, freundlich) in nitrate absorption process it was evident that languir model had the most conformity with experimental data gained Latium composite on active carbon.

Keywords: Nitrate, Absorption isotherms, Active carbon, Latium.

1. Introduction

Underground water is a major source for provision of drinking water all over the world. Different sources such as agriculture waste water, industrial waste water treatment plants. Azotized fertilizers agriculture true runoff water is the water pollution sources by nitrate which produce many problems for environment. One of the major pollution sources is nitrate [1]. Consumption of water polluted by nitrate could threat the human health. Methomoglubinmia disorder or children aqueous syndrome is caused due to consumption of water

polluted by nitrate. In assertion the possibility of cancer by consumption of water pollutes by nitrate also was reported. Haken Demiral (2010) and colleagues verified nitrate omission from aqueous solutions by activated carbon derived from sugarberry biogases. Characteristics of carbons produced cavities measurement and its porosity size were determined. Structure of micro carbons activated by SEN test was ascertained. Maximum surface area specified for activated carbon product was about 1826 m^2/g in 700 ˚C with 3:1 ratio [2-3]. The activated carbon produced is used for nitrate omission from aqueous solution. In these study effects of PH, temperature, contact time and isotherm studies were considered absorption experiments by NaNo3 solution in presence of product active carbon were performed and No3 concentration product by UV apparatus at wave length of 340mm was measured. In order to verify the PH effects on nitrate absorption, PH nitrate solution in different amounts i.e. between 3-10 was ascertained. PH alteration in tis range changed the nitrate absorption from 34.65 %- 41.2 % mean while maximum absorption in pH=3 with 41.2 % was also reported.

In Table A isotherm parameters for nitrate omission are shown. At it is observed, Langmuir model complete fits with experimental data.

Table A. isotherm parameters for nitrate omission

Isotherms	Temperature (K)	Constants			
		Q_o	b	R_L	R^2
Langmuir	298	9.14	0.070	0.258	0.984
	308	15.48	0.204	0.126	0.974
	318	27.55	2.112	0.014	0.995
			k_f	n	R^2
Freundlich	298		1.45	2.49	0.936
	308		6.38	5.17	0.821
	318		21.29	15.43	0.776
			B	A	R^2
Temkin	298		3.118	0.287	0.755
	308		2.244	9.431	0.876
	318		4.691	11.251	0.797

1.1. Research stage

1.1. Research procedure

1.1.1. Solution preparation

Nitrate sodium salt is used to prepare standard solution of nitrate potent ion solution (500mg/l) is prepared with nitrate sodium salt (0.677g). Then solution with concentration of 10, 15, 20, 25, 30, 35, 40 mg/L is prepared from main potential solution. In all experiment steps the volume of 20ml of solution was used. PH quantities by NaOH an HCl are determined for 0.1 molar.

2.2. Synthesis of active carbon and Latium nitrate

For synthesis of absorption we load Latium nitrate on active carbon. For this purpose first active carbon is weighed then Latium nitrate and is placed in ultrasonic for 30 minutes. Then because for the react on between active carbon, Latium nitrate and hex methyl tetra mine a high temperature is required, for this reason after ultrasonic bath the balloon is an oil bath at temperature 85-90˚c with a magnetic agitator and after one hour materials inside the balloon for the porpoise of absorbent removal from solution are placed in to centrifuge apparatus glasses and materials inside them are centrifuged. After wards besher is placed on a

heater for 3 hours to obtain completely dried and dehydrated amounts of synthesized absorbent. Then absorbent quantities obtained are weighed.

1.1.2. Experiment procedure

2 OCC of solution containing nitrate with require concentration is poured into a besher and PH of solution is adjusted and 0.1g of absorbent is poured inside each besher and placed under experiment temperature. Then on the basis of pre-determined contact times for each sample an opportunity is provided to achieve absorption then after sample filtration the concerned absorption number is read by spectrophotometric apparatus. Results are shown in table2. For calculation of absorption percentage from aqueous solution by absorbent expression (A) and for absorption capacity expression (B) are applied.

A) Removal % = ——

B) q —— —

Removal %: absorption percentage

Q: absorption capacity

$_0$: Initial concentration (mg/L)

C_e: Final concentration (mg/L)

V: volume of solution (ml)

M: mass of unit absorbent (g)

Table B. results for final concentration, absorption capacity absorption percentage for active carbon absorbent/ Latium nitrate.

PH	temperature	Initial concentration	time	UV absorption no.	Final concentration	Absorption percentage	Absorption capacity
3	0	10	30	0.036	0.9651	90.35	1.81
7	0	25	210	0.12	2.9703	88.12	4.41
11	0	40	120	0.253	7.4742	81.31	6.51

1.1.3. Effect of pH on nitrate absorption process for active carbon absorbent/ Latium nitrate

On the basis of the results obtained from Fig A the percentage of nitrate omission in acidic pH range of solution is more than basic range so that maximum absorption in PH=3 would be about 87.11% . in high PH No-3 ions compete for absorption on absorbent active sites thus No-3 ions absorption is reduced. In contrast when PH is reduced competition between OH^{-}, NO_3^- , would be reduced which leads to nitrate absorption. It is also observed that in pH=7.11 there is not great difference in nitrate absorption process.

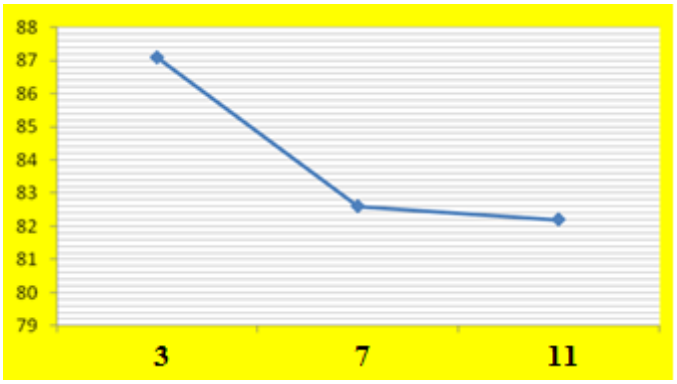

Fig A: Effect of pH

1.1.4. Effect of initial concentration on nitrate absorption process for active carbon absorption/ Latium nitrate

Results obtained from Fig B experiment shows that maximum omission of nitrate with 10ppm concentration occurs at about 89.4% whereas minimum will occur with concentration of 40PPM at about 80.3%, for low concentrations due to less no-3 ions than absorbent sites, high percentage of nitrate ions will be absorbed to saturate the absorbent. Increase in initial concentration increases the amount of No-3 ions available in solution and places over absorbent as compared to nitrate ion decreases therefore the percentage of ions omission will be reduced.

In an absorption process, the initial concentration of ions available in solution plays key role as a motive force on resistance of mass transfer between liquid – solid phase. Therefore it is expected that the amount of nitrate ion absorbed, increases with increases in initial concentration of solution. On the other hand at higher initial concentration absorption is saturated and for more absorption there is no site in access thus efficiency of nitrate omission at high concentration compare to low concentration decreased.

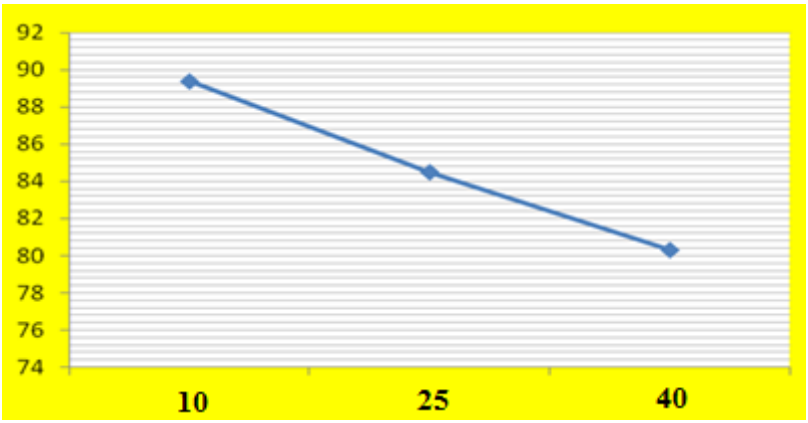

Fig B. Effect of initial concentration

1.1.5. Isothermal studies

To study the behavior of absorbent for pollutant omission and to draw the absorption isothermal procedures are used. Majority of these procedures include test in disconnected state. One of these procedures is use of solution with constant initial concentration and variable absorbent a mount (m) and another procedure is to use constant amount of absorbent (m) and solution with variable initial concentration.

Is this section in order to verify the absorbent behavior and determination of a model for absorbent anticipation isotherms of freundlich and Langmuir are used? Langmuir theory is based on synthetic principles which states that the

velocity of absorption (product of impact velocity to area in impact coefficient which is sometimes called place coefficient or accommodate) is equal to repel velocity from surface langmuir equation $(x/m) = q_{max}(\frac{b.c_e}{\quad})$ in which (x/m) is concentration of absorbent which is a criterion for intensity of absorption related to absorb ale molecules. q_{max} is maximum concentration for absorb ale equal to one layer coating, greater "6" Langmuir constant will cover more area with absorbable molecules which is the result of higher affinifry of absorbable molecules to ear surface.

Freundlich isotherm is among first equations used for description of balance data. This isotherm is as follows $(x/m) = k_f.C^{1/n}$ in which (x/m) is the amount of absorbed ingredient, k and n are freundlich isotherm constants which are temperature dependent. Parameter "n" is usually greater than 1. Greater n makes more un linearity is isotherm and it's behavior is more diverted from un linear state "k_f" represent absorption capacity of absorbent $(1/n)$ is absorption intensity. When n>10 isotherm tends toward irreversible isotherm. Freundlich isotherm for description of data related to adsorption of organic matters over active carbon from aqueous solution is widely used.

As it was mentioned previously k_f and n are Freundlich isotherm constants. Also in Langmuir isotherm "q_{max}" and "b" are Langmuir constant is both isotherm, ce balance concentration, x amount of absorbed nitrate (mg) and "m" absorbent weight used (gr). For plotting isotherms, simplest way is linearization of their relations. By using this technique isotherm could be easily drawn linearly and after achieving curve fitting isotherms coefficients are obtained.

C) Linearization of langmiur isotherm

$$\left(\frac{x}{m}\right) = q_{\max}\left(\frac{b \cdot C_e}{1 + b \cdot C_e}\right)$$

To plot the langmiur isotherm two type of langmiur linear isotherms are used:

C.1) Linearization of first procedure

— – (——)(–) —

Now after drawing $\left(\frac{1}{q_e}\right)$ diagram according to $\left(\frac{1}{C_e}\right)$ and specifying width from origin and line gradient, Langmuir 1 isotherm constant are obtained width from origin: $\frac{1}{q_{\max}}$ and line gradient $(\frac{1}{q_{\max}.b})$

C.2) Linearization of second procedure

— — ——

Here after drawing — according to and specifying width from origin isotherm constants for Langmuir are obtained width origin: —— and line gradient: (——)

D) Linearization of freunlich isotherm

(8-3)[–] $^{1/n}$

$$\log\left(-\right) = \log(q_e) = \log(K_f) + -$$

Linearization therefore drawing $\log(q_e)$ diagram according to$\log(C_e)$ and specify width from origin and line gradient we can obtain freundlich isotherm constants

– And line gradient: $\log(K_f)$ width from origin

Experimental data resulting from nitrate adsorption over synthesized absorbent are verified for their fitness with each isotherm. Referring to table3 results obtained from abortion isotherms experiments were determined and 3-4 diagram was drawn.

Table C. Experimental data for drawing absorption isotherms by active carbon Latium nitrate at 0˚C.

qe(freundlich)	qe(langmuir)	qe(experiment)	c0 (mg/l)
1.91	**1.82**	**1.81**	**10**
3.89	**4.22**	**4.41**	**25**
6.97	**6.86**	**6.51**	**40**

Fig.C.1)

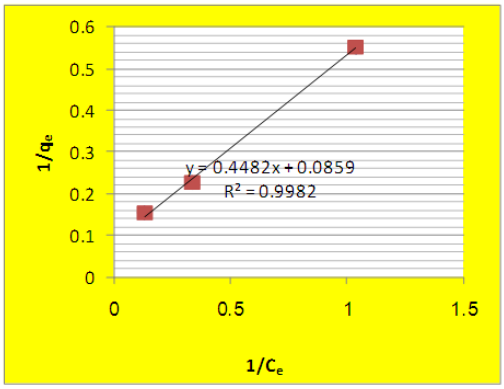

Fig.C.2)

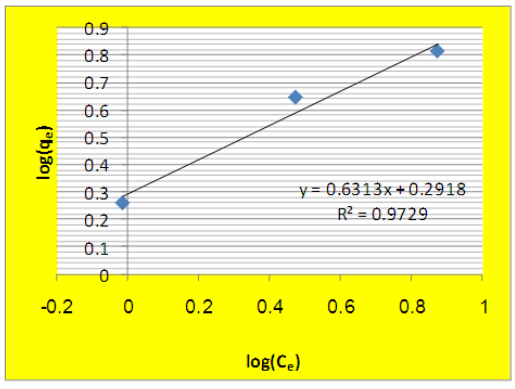

Fig C- freundlich at 0˚C (Fig.C.2) and Langmuir at 0˚C (Fig.C.1)

1.1.6. Selection of suitable isotherm

In order to verify the conformity of experimental data and anticipation of absorption process, absorbed amounts using isotherms were calculated (table C) witch was plotted along with experiment date on diagram. For selection of suitable isotherm the least square method is used. In this method R2 parameter for comparison is used (table D)

Table 4-anticipation of absorption process by active carbon/Latium nitrate at 0˚C.

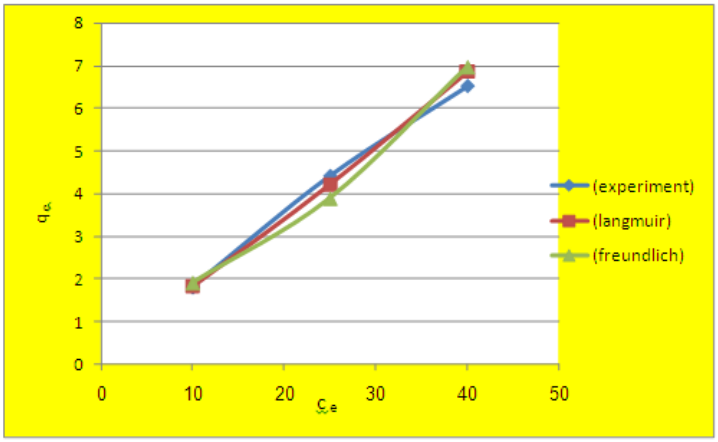

Fig D. Representation of experiment data conformity with amounts obtained from isotherms for active carbon absorbent at 0˚C.

Table D. Correlation coefficient for different absorbent isotherms of active carbon/Latium nitrate**.**

	Langmuir	Freundlich
Tem(˚C)	R2	R2
0	0.9982	0.9729

Conclusion

As pH increases the percentage of absorption will decrease and optimum pH for composite absorbent of Latium nitrate/ active carbon equal to 3 was obtained. With increase in initial concentration of solution, the efficiency of absorption decreases and absorption capacity increases and best concentration in absorption process is equal to 10 ppm. In verification of absorption isotherms results of experiments showed that experiments date and absorption isotherms of Langmuir and freundlich had good overlap but Langmuir. Isotherm overlap was better.

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