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Adsorption Influence and Isotherm Studies for the Removal of Napthalene using Palm Kernel Shell

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Abstract: Our paper describes the potential of Palm Kernel shell as an effective biosorbent for the removal of naphthalene from aqueous solution. The adsorption isortherm studies such as Langmuir and Freundlich isotherm models were applied to the adsorption equilibrium data in order to determine adsorption efficiency of Palm Kernel shell. The maximum adsorption was carried out at a pH of 7. The adsorbent Palm Kernel shell shwoed moderate efficiency for the removal of naphthalene from aqueous solution. Hence it is concluded that Palm Kernel shell can be used as an effective biosorbent fro the removal of naphthalene which is a simplest PAH.
Keywords : Palm Kernel shell, Naphthalene, adsorption, isortherm, efficiency.

Introduction

Napthalene is one of the Polycyclic aromatic hydrocarbons containing only carbon and hydrogen that are composed of multiple aromatic rings [2]. They are fused in nature. Poly means "many". Hence they include two or more rings in its structure. Natural sources are less significant compared to man-made sources. They are obtained from various sources such as automobile exhaust [2], combustion products [4] and waste effluent [3] from petro refinery plants. The simplest example is naphthalene and others include anthracene and phenanthrene. Many methods are available for the removal of PAH's. Biological method is not effective in the degradation of PAH's [2]. Conventional physic-co chemical methods [5] produce more sludge which is to be further treated and disposal becomes a major problem. Hence adsorption [1] can be considered as one of the effective method in the removal of toxic organic pollutants.

In particular activated carbon is mostly used. Difficulty in regeneration [11] makes a disadvantage for using it as an adsorbent [1]. Other alternatives for the removal of organic pollutants include the use of low cost solid residues obtained from agricultural activities. Large amount of waste materials are produced out of agriculture. This include sugarcane bagasse, coconut shell and palm kernel shell [10]. The study involves the removal of Napthalene from aqueous solution by using palm kernel shell as an adsorbent.

Materials and Methods

Preparation of the Adsorbent

The palm kernel shell is dried and burnt in furncace. After crushing it is made as fine material by means of sieve analysis in the size of 14mm.(the more retained as fine particle.) Then it is subjected to acid treatment by using conc.HCl for chemical activation. The soaking time is nearly 24 hrs and after that it is dried and used as an adsorbent, the adsorbent is added to the PAH.

Preparation of the Adsorbate:

Napthalene is dissolved in acetone (1gm /100 ml) and stock solutions were prepared by using water and acetone 60:40% v/v (50 -200 ppm) by serial diutions with water. pH meter is used for pH measurements.

Adsorption Studies:

The prepared stock solution of different concentrations 50-200 ppm is added with 6 gms of the adsorbent. Then it is centrifuged for a period of 2 hrs. Then the optical density values are measured at a wavelength of 230 nm for every 1hr, 2hr, 3hr, 4 hr, 6hr, 18hr, 20hr and 22 hrs. The obtained optical density values are converted in terms of concentrations. The adsorption capacities were calculated based on the differences between the concentrations of solutes before and after adsorption. The percentage of adsorption is calculated by **%** ADS $= (C_o - C_e) / C_o * 100$

Where % ADS is the rate of adsorption in percentage
C_o is the initial concentration
C_e is the final concentration.

The adsorption kinetics such as Langmuir and Freundlich isotherms have been determined for the naphthalene adsorption by using Palm kernel shell.

Results and Discussion

The percentage of adsorption of napthalene by using palm kernel shell as an adsorbent showed that 200 ppm of naphthalene aqueous solution is adsorbed to a greater extent. The results are given below along with the graph.

Table .1 Percentage Adsorption in Palm Kernel Shell

Concentration (mg/L)	% Adsorbed
50	**36**
100	**60**
150	**69.3**
200	**75.5**
250	**71**

The presence of the solvent plays an important role in the adsorption of solutes. Here acetone acts as a co-solvent and it is added to improve the solubilities but it restricts the adsorption at the surface of the container but the results reported here indicates the adsorption features in aqueous solution of naphthalene.

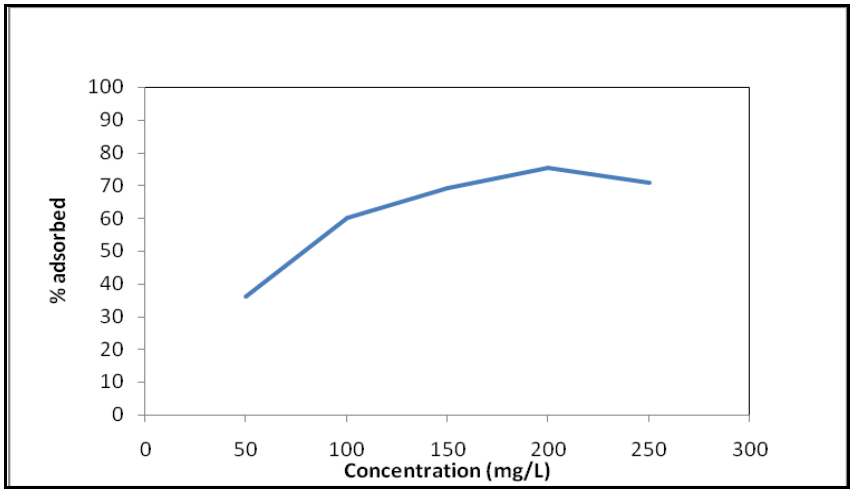

Fig . 1 Graph for the Percentage of adsorption on Palm kernel Shell

Adsorption Isotherms

The adsorption isotherms were studied to determine the adsorption behavior and to find the adsorption capacity. Both the isotherms obtained a sharp initial slope indicating that the adsorbent operates with high efficiency at low concentration and becomes saturated at high concentration**.** The co-relation co-efficient obtained for Langmuir isotherm is 0.905 and the value obtained for the Fruendlich isotherm is 0.997. the high value indicated that Freundlich model is the best fit for the adsorption of naphthalene on to palm kernel shell.

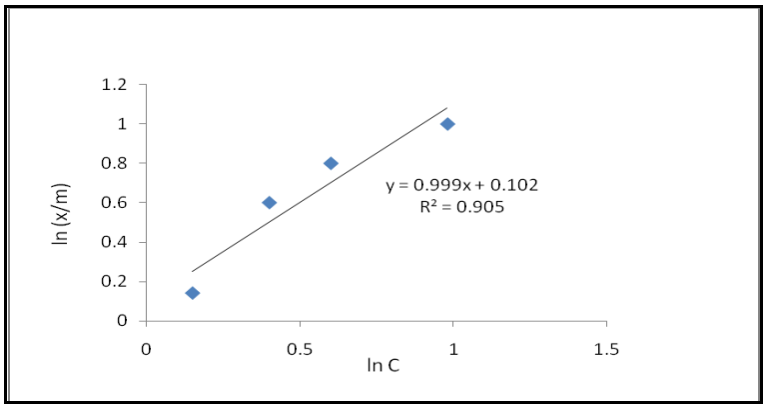

Fig. 2 Langmuir adsorption isotherm for the removal of Napthalene using Palm Kernel Shell

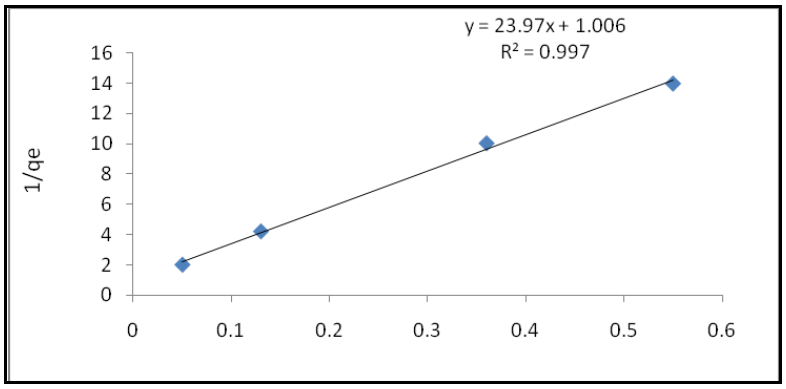

Fig .3 Fruendlich adsorption isotherm for the reomoval of Napthalene using Palm Kernel Shell

Conclusion

The present study explained the adsorption nature of the palm kernel shell for the removal of naphthalene from aqueous solution. The adsoption efficiency is found to be 75.5%. The adsorption data fits to the Fruendlich isotherm model successfully and it provided a good fit to the experimental date with R^2 = 0.997. Hence, Palm kernel shell can be used as a low cost adsorbent for the removal of naphthalene from aqueous solution.

References

1. D.Prabu, R.Parthiban and et al., Adsorptive separation of phenol from aqueous solution using NZVI impregnated cashew nut shell, IJPBS., 2015, Vol 6[2], 129-140.
2. Rudy Crisafully, L. Maria Aparedica and et al., Removal of some polyclic aromatic hydrocarbons from petrochemical waste water using low cost adsorbents of natural origin, J. Bioresource Technology., 2008, 99, 4515 – 4519.
3. Namita Tewari, V.K. Varma and J.P.N.Rai., Comparitive evaluation of natural adsorbent for pollutants removal from distillery spentwash, J. Scientific and Industrial Research., 2006, 65, 935-938.
4. T.Carty, Chiou and et al., Partition characteristics of Polycyclic aromatic Hydrocarbons on soils and sediments, J. Environ.Sci and Technology,1998, 32, 264-269.
5. Kavita Solanki, H.B.Singh and Seema., A study for assessment of Physico-chemical analysis of Oil-refinery Effluent , Res. Jour. Of Agricultural Sciences., 2011 , Vol 2(1), 125-129.

6. Das kumar and Attar.J.salim., Comparitive study of Batch adsorption of Fluoride using commercial and natural adsorbent, Res.Jour. of Chemical Sciences, 2011 , Vol 1(7), 68-75.
7. E. Ayranci., Adsorption kinetics and isotherms of pesticides onto activated carbon-cloth, Chemosphere., 2005, 60, 1600-1607.
8. T.B.Boving., W.Zhang., Removal of aqueous phase polynuclear aromatic hydrocarbons using apen wood fibers, Chemosphere., 2004, 54 , 839-881
9. M.Charlesworth, M.Service., C.E.Gibson., PAHs Contamination of Irish sediments, Mar.Pollut.Bull., 2002, 44, 1421-1424.
10. I.A.W.Tan, A.L.Ahmad., B.H.Hameed., Adsorption of basic dye using activated carbon prepared from oil palm shell – batch and fixed bed studies, Desalination., 2008, 225, 13-28.
11. D.Rajha Amarnath and T.V.N.Padmesh., Adsorption of Reactive Orange 16 onto Gracilaria species a marine alga, Asian Journal of Chemistry., 2009, 21, 4039-4046.
12. F.Yu, Wu.Y, Li.X and Ma.J., Kinetic and thermodynamic studies of Toluene, ethylbenzene and m-Xylene adsorption from aqueous solutions onto KOH activated multiwalled carbon nano tubes, J.Agric Food Chem., 2012, 60, 12245 – 12253.
13. J.A.Kent., Riegel's Handbook of Industrial Chemistry, Van Nostrand Reinhold Publications, Newyork.,1992, 1, 442-455.
14. D.O.Cooney., adsorption designer for waste water experiment, Lewis Publishers., London, 1999, 2, 65-72.
15. Dhram Pal., Adsorption of polycyclic aromatic hydrocarbons using agricultural wastes and affect of lignin content, Institute of Applied ecology, Chinese Academy of sciences, 1998, 28, 364-365.

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