
Study the adsorption of lignin on surface of poly vinyl chloride

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Abstract

In this study , poly vinyl chloride (PVC) was used as solid adsorbent for removal of lignin from aqueous solution employing bath method. The obtained results concluded that the lignin adsorbed onto pvc are driven by entropy effect, exothermic and nonspontaneous processes. Also results have shown that Freundlich isotherm fitted the equilibrium data well. According to Dubinin-Radushkevich isotherms the adsorption capacity of pvc (q_{max}) is 2.8303 mg/g. Mean free energy (EDR) value calculated by analyses of equilibrium data with Dubinin-Radushkevich equation indicates that the adsorption mechanism is hydrogen bonding. The lignin was removed by (39.2%) at pH equal 2 and at 30 C[□]

Introduction

Lignin as one of the most abundant organic polymers on the earth is the by-product of paper and emerging cellulose ethanol industries. It is an amorphous (i.e. it has no long-range order of atoms), highly cross-linked and an aromatic polymer of phenyl propane unites, with a complex structural heterogeneity that makes up its particular resistance to microbial degradation.

Moreover it may contain hydroxyl, ether and carbonyl groups. Many studies have shown that lignin has the potential to act like an adsorption material due to its high adsorption capacity^(1,2). Additionally, lignin adsorption capacity can be enhanced by chemical methods such as the addition of functional groups or crosslinking⁽³⁾.

Therefore the surface lignin has drawn increasing attention in recent years. Surface lignin Concentration have been reported to be three to five time higher than the corresponding bulk lignin Concentration for both Kraft softwood and Kraft hardwood pulp^(4,5). These high surface lignin concentration have prompted numerous discussion and speculation about the influence if surface lignin on subsequent processes Such as bleaching and inter –fiber bonding. Lain and Stenius⁽⁶⁾ found that surface lignin had a strong impact on bleaching and higher surface lignin concentration persisted through the bleaching stages. The adsorption of material such as Xylan and lignin on pulp

fibers during pulping has been reported in several Studies⁽⁷⁾. However the mechanism of this Process is not yet clear .It has been termed as re deposition retake, sorption and precipitation, which indicates some inconsistency in understanding the fundamentals involved. The objective of this investigation to obtain an understanding of the equilibrium and thermodynamic adsorption of lignin on PVC. The Freundlich , Dubnin – Radishkeich and generalized isotherm equations were used to examine the equilibrium data. The effects of time, temperature, concentration and pH of solution are Studied.

The aim of this work to study the ability of PVC as surface to removal the lignin as industrial waste from the pollution water.

Experimental materials and methods

The lignin used was (B .D.H Co.), a sample of pollute was without further purification. The adsorption isotherm share been determined by allowing pollution solution of know initial concentration to be mixed with accurately weighted amount of PVC in a tightly closed flask at a certain temperature and pH .The amount of PVC in the slurry has been (0.7) gm/10 ml solution. A constant mixing at a constant temperature and pH was achieved using a shaker water bath. The pre-solution have been equilibrium for one hours, polymer suspensions have been-then filtered and the supernatant solution was subjected to analysis using ultra violet-visible technique (UV-Visible) at (218) nm , the same experimental was reported at different initial concentration, temperatures and pH.

The amount of lignin adsorbed in mg/g was calculated using the following equation 2:

$$qe = V (Co - Ce) / ms \dots\dots\dots(1)$$

where qe is the amount of adsorbed Cr (VI) on lignin mg/g. C_o and C_e are the initial and equilibrium concentration in solution mg/L respectively, and m_s is the mass of pvc.

Equilibrium Isotherms

The equilibrium data of lignin adsorption were correlated with the models of Freundlich ,Dubinin-Radushkevich and Generalized isotherm equations. The linearized Freundlich equation is shown below:

$$\log qe = \log Kf + 1/n \log Ce \dots\dots\dots 2$$

where qe is the amount of lignin adsorbed per unit mass of adsorbent (mg/g), C_e is the equilibrium concentration of lignin in the solution (mg/L). The Freundlich formula is an exponential equation and accordingly, the model assume that the amount of a dsorbate on the adsorbent surface increases by increasing the a dsorbate concentration. The maximum adsorption capacity for Freundlich equation can be determined by using the expression given by :

$$k_f = \frac{q_m}{C} \dots\dots\dots 3$$

QUOTE $e^{1/n}$