ADSORPTION OF 2,4-DICHLOROANILINE ON SILICA GEL

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2,4-Dichloroaniline (2,4-DCA) which comes from herbicides and pesticides contaminate water bodies and cause adverse effects on living beings. The objective of this study is to investigate the adsorption of 2,4-DCA on nontoxic and chemically stable silica gel. The influence of pH, ionic strength, initial concentration and contact time on the adsorption of 2,4-DCA by silica gel was investigated.

The effect of pH on the adsorption of 2,4-DCA on silica gel was determined in the pH range of 2 to 12. Adsorbed 2,4-DCA concentration was high at around pH 7 whereas that was low at extreme pH conditions. It was revealed that the repulsive electrostatic forces results the low value of adsorbed 2,4-DCA concentration at extreme pH conditions. Favourable hydrogen bond formations between the adsorbate (2,4-DCA) and adsorbent (silica) may result in the higher value of adsorbed 2,4-DCA concentration at neutral pH conditions.

Ionic strength of the medium showed a significant effect on the amount of adsorbed 2,4-DCA and it was higher at low ionic strength values than at high values. Competition between the counter ions and the surface charge of the adsorbent influenced the amount of adsorption. This reveals that the outer sphere complexes predominate during the adsorption process. A linear dependence between the amount of adsorbed 2,4-DCA and the initial 2,4-DCA concentrations was found. Amount of adsorption reached an almost constant value making a saturated surface at 600 ppm. This behavior was common at all ionic strength values. The adsorption data fitted well into the Freundlich adsorption isotherm, indicating the formation of multi-layer over a heterogeneous adsorbent surface. The coefficient of determination value (R) was greater than 0.9 at all ionic strengths.

Effect of contact time on the adsorption was also studied. Adsorption kinetics was evaluated at pH 7 at initial 2,4-DCA concentrations of 25 ppm and 600 ppm. The rate of adsorption was rapid initially and then slowed down gradually until it attained an equilibrium beyond which there was no significant change in the rate of adsorption. The amount of adsorption after 2 hours was not significantly different from that after 4 hours. Therefore 2 h was considered sufficient to reach the equilibrium. The adsorption reaction was found to be first order at all ionic strength conditions.

These investigations suggest that neutral pH conditions, low ionic strength and 2 hour agitation time result higher amounts of 2,4-DCA adsorption on silica gel.

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