

## Studies of Thermodynamic Parameters of Carbofuran on forest loam soil

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**Abstract:** The adsorption thermodynamics of carbofuran on forest loam soil at 30°C and 60°C have been taken into consideration thru the important adsorption isotherms. The information have been properly fitted by way of the Freundlich circumstance and yielded S-shaped isotherms at each the temperatures tested. Thermodynamic limitations like the thermodynamic stability steady (K<sub>o</sub>), the standard loose electricity exchange ( $\Delta G^\circ$ ), the standard enthalpy trade ( $\Delta H^\circ$ ) and the same old entropy change ( $\Delta S^\circ$ ) have been determined for of looking ahead to the concept of the adsorption cycle.

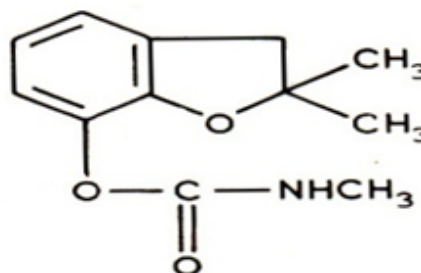
**Keywords:** Adsorption, distribution coefficient, thermodynamic parameters, Isotherm, Carbofuran, Freundlich Equation.

### Introduction

In Indian farming the pesticides are commonly utilized for controlling bugs and illnesses in crops. Once implemented to soil they may be moved profound and could become unsafe. This has pushed each agrarian and ecological researchers to end up greater eager on finding out the natural destiny and shipping of insecticides. The research of the adsorption conduct of pesticides in soils is critical in mild of the fact that dirt colloids are recognised to reply with pesticides. Two notable surveys cowl one of a kind elements of the adsorption of

pesticides and natural synthetic compounds via soils, (1-2).

Carbofuran (2,3-dihydro-2,2-dimethyl-7-benzofuranyl) Methylcarbamate which addresses a considerable collecting of insecticides, has been little tested. It's miles a foundational non-ionic expansive range carbamate insect spray/nematicide and has been utilized widely in India from now into the indefinite future pretty a while to battle nematode problems which have created in plants. It is design may be addressed as



As of overdue, its adsorption on soils, fly particles, antimony(V) silicate, and Sn(IV) arsenosilica cation exchangers was focused with the aid of Singh et al. ( three-eight ) . In any case, writing referring to adsorption thermodynamic barriers of carbofuran on Indian woods soils is extremely meager. In the end, this examination was started out to pay attention at the impact of temperature on soil adsorption of carbofuran. Freundlich constants and stream coefficients had been likewise decided. The motivations in the back of this

examine had been to realize the essential technological know-how of carbofuran in soils and to evaluate the thermodynamic limitations for the collaboration of carbofuran with soils.

## MATERIALS AND TECHNIQUES

The dust examples applied for this look at became accrued from advanced fields at 0-30 cm profundity of woods topsoil soil from the Sawaimadhopur place of Rajasthan. Soil become ground in a mallet plant geared up with a one hundred lattice sifter to get tests with a bit and nearly homogeneous molecule length. The physicochemical properties of the nevertheless up in the air by means of the same old techniques, and values are summed up as follows:

Sand 50.0 % , Silt 30.60 % , Clay 19.40%., texture loam , pH 6.8., Ec , 3.90 ds/m, organic carbon 1.20 % , CaCO<sub>3</sub> 2.80 %., CEC (Cmol/kg ) 7.5 , surface region 236.4 m<sup>2</sup>/g .

Carbofuran (Furadan 3G) became received from Pesticide India (Udaipur, Rajasthan). Any closing synthetic compounds and reagents were of (BDH) AR grade.

A inventory association of carbofuran of fixation 250 ug/ml became equipped via dissolving 2.083 g of carbofuran 3G in 250 ml of methanol.

### Adsorption research

Adsorption of carbofuran on regular timberland topsoil soil at 30 ° and 60 ° become dissected by means of the bunch stability method as depicted by Singh ( 9,10) One gram of soil was moved to numerous 100ml funnel fashioned carafes outfitted with screw covers containing differing volumes (zero, 2, 3, 4 ,5 ,6, 7 ,8, 9, 10

, 12 ml) of carbofuran arrangement (250 ug/ml ).The suspension of each jar changed into made upto 25 ml with required refined water.

To pay attention at the impact of temperatures, suspensions arranged as above had been shaken at 60°C concerning everyday soils as adsorbents .

The move coefficient (K<sub>d</sub> ) values for temperature impacts on soil were determined by using using the condition :

$$X/m = K_d \cdot C_e \quad (1)$$

Where x/m (ug/g )is how a good deal carbofuran adsorbed consistent with gram of soil and measure of carbofuran in harmony suspension per ml (C<sub>e</sub>) after balance , separately.

The real regular of all K<sub>d</sub> values have been decided by way of direct relapse condition limited thru the start ,

$$K_d = \frac{\sum \left( \frac{x}{m} \cdot C_e \right)}{\sum C_e^2} \quad (2).$$

The adsorption conduct of carbofuran on woodland topsoil soil at both temperature become suited to the Freundlich condition .The freundlich constants okay and N had been received from the instantly relapse exam via situation :

$$\log x/m = \log ok + N \log C_e \quad \text{--- (3)}$$

In which x/m is how plenty carbofuran adsorbed consistent with gram soil (ug/g ) and C<sub>e</sub> is the fixation (ug/ml ) of carbofuran in balance suspension . Okay and N are experimental not set in stone from the block and slant of the directly line one at a time .The upsides of okay and N were 30.10 and 0.95 at

30 temperature and 13.40 and 1.07 at 60 temperature. This once more confirmed better adsorption of carbofuran on woods topsoil soil at decrease temperature. These effects in a way with regulate of these of Singh et al., (12) who worked out at the adsorption of carbofuran via soils and with the ones of Van Bladel and Moreale (13) in regards to the adsorption of Fenuron and Monuron on montmorillonite.

To gather the thermodynamic balance constant  $K_0$ , upsides of  $\ln(C_s/C_e)$  are plotted against  $C_s$  observed with the aid of extrapolation to  $C_s = 0$  as portrayed via Biggar and Cheung (14).

$$K_0 = \frac{C_s}{C_e} \cdot \frac{\nu_s}{\nu_e} \quad (4)$$

Where,  $C_s$ , is how a lot carbofuran adsorbed per gram of the dissolvable in contact with soil and  $C_e$ , the convergence of carbofuran in harmony suspension in ug/ml.  $\nu_s$  and  $\nu_e$  are the action coefficients of the adsorbed solute and solute in balance suspension, one by one and thought to be harmony in weaken range.

The upsides of  $C_s$ , have been decided via utilising the relationship:

$$C_s = \frac{(\rho/M)A}{S/N(x/m)} \quad (5)$$

In which  $p$ ,  $M$ , and  $A_n$  are the thickness, sub-atomic weight, and move-sectional place of the dissolvable, for my part,  $S$  is the surface place of the adsorbent, and  $x/m$  is how a lot carbofuran adsorbed.  $N$  is Avogadro's variety. The pass-sectional region of the dissolvable ( $\text{cm}^2$ ),  $A$ , is classed from the scenario

$$A = 1.091 \cdot 10^{-16} \left[ \frac{10^{24}M}{N} \right]^{2/3} \quad (6)$$

Thermodynamic parameters consisting of fashionable unfastened electricity ( $\Delta G^\circ$ ), enthalpy ( $\Delta H^\circ$ ) and entropy ( $\Delta S^\circ$ ) adjustments for adsorption of carbofuran are evaluated from the equations—

$$\Delta G^\circ = -RT \ln K_0. \quad (7)$$

$$\ln \left( \frac{K_{T_2}}{K_{T_1}} \right) = \frac{-\Delta H^\circ}{R} \left[ \frac{1}{T_2} - \frac{1}{T_1} \right] \quad (8)$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \quad (9)$$

The results of thermodynamic limitations were given like thermodynamic stability consistent  $K_0$ , adjustments in preferred unfastened power, enthalpy and entropy ( $\Delta G^\circ$ ,  $\Delta H^\circ$ ,  $\Delta S^\circ$ ) got at 30 and 60 are pretty a good deal as given as:

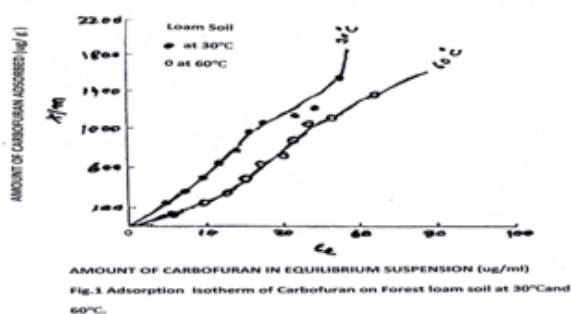
At 30 temperature, the Upsides of  $K_0$   $3.96 \times 10^9$ ,  $\Delta G^\circ$  (kcal/mol) - 55.46,  $\Delta H^\circ$  (kcal/mol) - 19.5.

At 60  $K_0$   $1.96 \times 10^9$ ,  $\Delta G^\circ$  (kcal/mol) - 59.01,  $\Delta H$  (kcal/mol) - 19.5,  $\Delta S^\circ$  (kcal/mol/degree) at both the temperature is 0.12.

## RESULTS AND DISCUSSION

Adsorption isotherms (Fig.1) for each the temperatures have been like S-type as portrayed via Giles et al (15). It recommends that the adsorption of carbofuran turned into extra truthful, possibly due to the major restrict of the powers of fascination over the carbonyl amassing ( $C=O$ ) of carbofuran, prompting a collaboration with soil locales.

Fig 1



On the factor while the influences of temperature on adsorption of carbofuran on soils are looked at, obviously isotherms reflect that adsorption of carbofuran diminishes with a climb in temperature, real to shape from the exothermic concept of the adsorption cycle. The lower adsorption of carbofuran at 60°C is often due to debilitating of captivating powers amongst carbofuran and soil locales and a part of the way due to upgrade of heat energies of adsorbate, on this way making the appealing powers amongst carbofuran and soil destinations good enough to keep carbofuran. Although, the idea of the response remains unaffected within the soils.

The higher upsides of  $K_o$  at 30°C than at 60°C again affirm that red topsoil soil from the two locales had lower inclination at higher temperature. The negative upsides of standard free energy changes ( $\Delta G^\circ$ ) demonstrate that the responses are unconstrained with high fondness for carbofuran and recommended a high diligence and protection from corruption of carbofuran in touch with the dirt. Negative upsides of standard enthalpies ( $\Delta H^\circ$ ) showed that carbofuran and soil cooperations are exothermic and items are vivaciously steady with high restricting of carbofuran to soil locales.

The consequences of standard entropy changes ( $\Delta S^\circ$ ) kept in the current examination show a loss in entropy really during adsorption of carbofuran on

timberland topsoil soil demonstrating a more prominent request created the adsorption peculiarities.

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