Available online at http://bajas.edu.iq
https://doi.org/10.37077/25200860.2023.36.1.15
College of Agriculture, University of Basrah

Basrah Journal of Agricultural Sciences

ISSN 1814 – 5868 Basrah J. Agric. Sci., 36(1), 173-185, 2023 E-ISSN: 2520-0860

Behaviour Study of Four Insecticides using different Mathematical Modeling

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Received 16th December 2022; Accepted 11th April 2023; Available online 28th June 2023

Abstract: The adsorption, distribution coefficient, Langmuir and Freundlich models and the mathematical evaluation of pesticides have become more interesting from an environmental point of view. The outcomes revealed that indoxacarb, imidacloprid, and lambda-cyhalothrin are subjected to the Pseudo-first order reaction (PFO). The rate of degradation was reached, into 0.01, 0.07, and 0.04 a minute respectively. While chlorantraniliprole reached 0.00002 a minute. This indicates that these insecticides are decreasing in their concentrations depending only on the time. Hence, the time required to decrease 50% of each insecticide (DT_{50}) was various periods. The DT_{50} for indoxacarb, imidacloprid, and lambda-cyhalothrin, and chlorantraniliprole 3.2, 1.9, 10.1, and 2.3 days respectively. The distribution Coefficient Kd as well scored (5.25, 1.30, 0.562, and 0.639) mL g^{-1} respectively. This indicated that indoxacarb, imidacloprid has a mobility behaviour, while the lambda-cyhalothrin and chlorantraniliprole are less mobile in the soil. In terms of Freundlich model (aF), chlorantraniliprole 2.82 and lambda-cyhalothrin 2.75 are more fit than indoxacarb 0.013 L g^{-1} and imidacloprid 0.249 L g^{-1} subjected to the Langmuir model (KL).

Keywords: Adsorption, Batch study, Chlorantraniliprole, Imidacloprid, Indoxacarb, Lambda-cyhalothrin.

Introduction

The accumulation of persistent poisonous substances, chemicals, salts, radioactive materials, or disease-causing agents in the soils that have a negative impact on plant and animal health is referred to as soil pollution (Okrent, 1999). The Persistent Organic Pollutants (POPs) have long half-lives in the sediment, soil, air, and biota. These substances could be transferred into fresh and marine water even with the low concentrations (Ashraf, 2017). All living organisms, especially people, are frequently harmed and poisoned by the wide variety of soil contaminants (Ashraf *et al*., 2014). This pollution is mostly due to frequently used pesticides in agriculture or the public sector (Li *et al.,* 2008). The pesticides can enter the soil directly by the intentional application or indirectly through wet and dry deposition, wastewater, sewage sludge, air, or other means (Fenoll *et al.,* 2011). The main factor influencing a pesticide's ecotoxicological, environmental mobility, and the rate of degradation is soil adsorption. Since it controls the release rate and potential mobility of pesticides in the soil, the desorption process of pesticides is also a crucial process. Since the amount of adsorbed pesticide and its rate of desorption determine its adverse effects on the next crop, the adsorption/desorption behavior