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Kinetics Of Oxidation Of Permethrin By Gibbs Reagent

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ABSTRACT

In our previous studies 2,6 -Dichloro quinone -4- Chloroimide(Gibbs reagent) used as a mild oxidizing agent with various substrates. In our present study we are presenting the reaction rates of permethrin by Gibbs reagent. Generally Permethrin used in medications and insecticide .Permethrin generally used in agricultural field and veterinary medicine . It is a pale brown water insoluble substance. Its molecular formula is 391.29.Permethrin is a blend of stereo isomers .The reactions are consecutive : the first stage of oxidation of permethrin is by [OH^-] and the second stage of oxidation is by 2,6-Dichloroquinone. The reactions are found to be first order in oxidant and first order in substrate. The reactions were independent of [OH^-].The rate of reaction is increased with increasing the temperature .Majority of the reactions studied at room temperature. The mechanism is likely to involve atwo stepoxidation reaction to generate a p-quinoid species. A blue colour Gibbs -permethrincomplex is formed after completion of the reaction. A suitable mechanism is postulated to explain the result .

Key Words : Permethrin -Gibbs reagent – p-quinoid species- two step oxidation -Gibbs –permethrin complex

I. Introduction

In household and agricultural settings, permethrin (3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethyl cyclopropane carboxylate) is a commonly and widely used pesticide. Several studies have shown that permethrin residue is widely present in surface water and enters aquatic ecosystems through a variety of routes. Permethrin exposure over time is also thought to cause neurological disorders in both adults and children. Perchloric use is on the rise, which might be extremely dangerous for both human health and the terrestrial and aquatic habitats. It is critical to identify low-cost, environmentally acceptable strategies to lessen the threats that pyrethroid use poses to the environment and public health.This method helpful to identify the concentrations of permethrin.

II Experimental

Methods of purification and preparation of solutions:

Purification methods, solution preparations and analytical estimations of some important reagents are briefly described in the following pages. The melting point (m.p.) or boiling point (b.p.) refers to the uncorrected and observed temperature (in Celsius^0 C).

Titrimetric methods:

Estimation of 2,6-dichloro-quinone-4-chloro-imide (DCQCI):

The solution of 2,6-dichloro-quinone-4-chloro-imide and the aliquots from reaction mixture as well estimated iodometrically. 5.0 ml of 2,6-dichloroquinone-4-chloro-imide solution is dumped into an iodine flask containing 5 ml of 5N sulphuric acid and 5 ml 5% potassium iodide solution in a CO_2 atmosphere and kept in dark for 3 minutes. Then the solution is titrated against standard sodium thiosulphate taken in a burette to the disappearance of starch iodine blue endpoint.

The data related to reaction velocity and the resulting values in this instance were the dependent variables. Typically, the independent variables included temperature, time, and concentration units; however, functions of reaction velocity or concentration units were also included occasionally.

III Result Discussion

The kinetic orders are observed are first order in Oxidant .Plot of log(a-x) vs time is linear. It is also confirmed by constancy of first order rate constants under varying concentrations of oxidant.

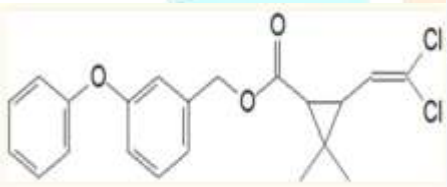
In case of permethrin first order is observed .Plot of log k_1 vs log [S] is linear with unit slope indicating first order dependence on substrate .The reactions were observed independent of Concentration of [OH^-].

Table:1 The Kinetic data of Permethrin and 2,6-Dichloroquinone -4-Chloro imide (Oxidant) at 30^0C

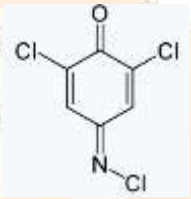
Variant	Concentration of variable component	$k_1 x\ 10^{-4}$ (sec^{-1})
	$2.5x10^{-4}$M	15.4
Oxidant	$5.0x10^{-4}$M	16.5
	$10x10^{-4}$M	15.5
Permethrin	$15x10^{-4}$M	15.4
[NaOH]	0.00025M	9.2
	0.005	16.5
Temperature	0.01	19.5
	0.02	20.2
AcOH		
	0.1M	
	0.2M	16.5
	0.3M	16.8
		17.1

	30^0C	
	40^0C	16.5
	50^0C	20.8
		25.2
	10%	
	20%	
	30%	16.5
		14.2
		13.5

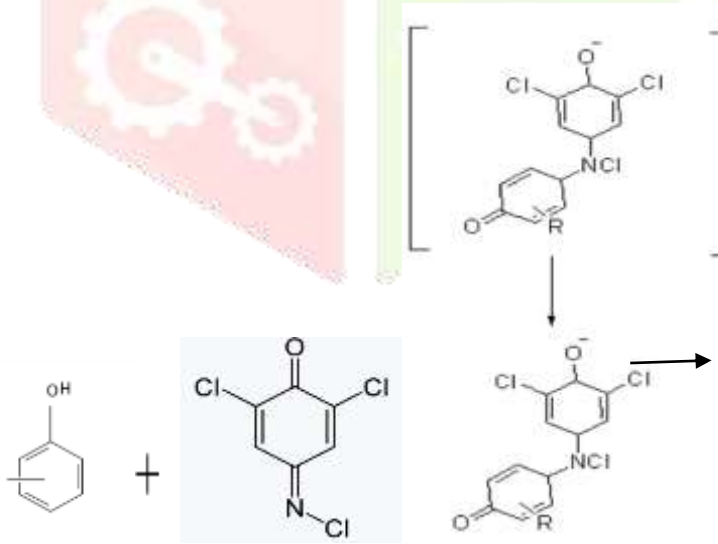
Molecular Structure of Permethrin



Molecular structure of Gibbs Reagent



Reaction between Gibbs Reagent and Permethrin



Permethrin **Gibbs Reagent** **Gibbs – permethrin complex**

(Phenolic form)

This Blue color Gibbs -Permethrin complexis useful for rapid screening of surface water treated wood products before detailed analysis using tedious procedure is performed.

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