



## **PHOTOCATALYTIC DEGRADATION OF PESTICIDES BY TITANIUM DIOXIDE.**

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### **Abstract**

The development of the agrochemical industry has dramatically increased in the last few decades. Due to the widespread intensive agricultural activities, it is necessary to address the issues related to the pesticide applications as well as improper wastewater disposal methods. 2, 4-D and 2, 4-DP are the widely used pesticides that have noticeable influence not only on the plant (leaves and roots), but also the quality of soil. In this article we review on the removal of toxicity in 2, 4-D and 2, 4-DP by using TiO<sub>2</sub> as catalyst. It has been observed that TiO<sub>2</sub> in the nanoparticle form effectively degrade the toxicity of 2, 4-D and 2, 4-DP.

cause: -among all the pesticides a large amount of chlorinated compounds are currently reaches to the environment. This is the most serious agricultural problem and constitutes the most important family of toxic non-biodegradable compounds.

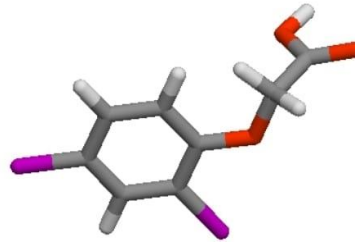
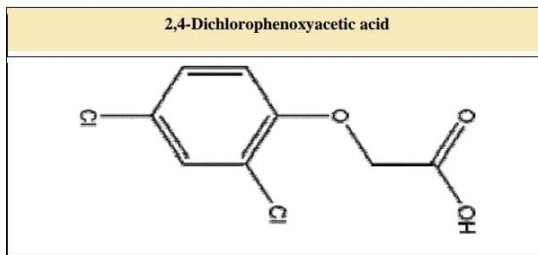
### **INTRODUCTION:** -

Due to an increase in pesticide usage in agriculture worldwide, there exists a need for the development of an effective pollutant removal process for pesticides in agricultural runoff water. It is advantageous for the treatment to not require the addition of treatment chemicals which could potentially have harmful effect on the environment. A reactor utilizes a photocatalyst titanium dioxide with the exposure to UV light for treatment of pesticide 2,4-D, 2,4-DP.

### **2,4-dichlorophenoxyacetic acid (2,4-D) :**

2,4-dichlorophenoxyacetic acid (2,4-D) is a common systemic herbicide which is used in the controlment of broadleaf weeds. It is most widely used herbicide in the world, 2,4-D is also an important synthetic

auxin ( A group of naturally occurring and artificially synthesized plant hormones ),often used in laboratories for plant research.



**Molecular Formula :**  $C_8H_6Cl_2O_3$

This was developed during world war2 by a British team, aiming to increase the crop yields for a nation at war. This herbicide is greatly allowed to enhanced the weed control in wheat,maize,rice and similar cereal grass crop.

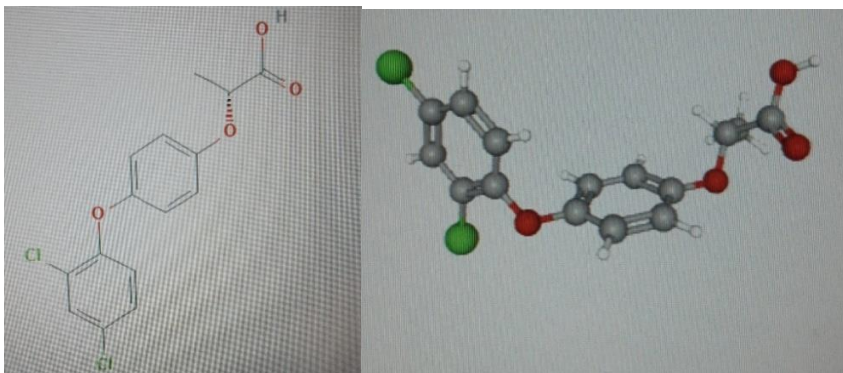
USES:1. weed control, 2.no\_till burndown , 3.control of broad leaf trees in conifer plantings , 4.grass hayfields , 5.cereal grains , 6.corn and sorghum , 7.as a synthetic auxin analogue.

**TOXICITY:**

01. The amine salt formulations can cause irreversible eye damage(blindness)
02. Ester formulations are considered non-irritating to the eyes.
03. This herbicide caused male reproductive problemincluding dead and malformed sperm.
04. Mainly focus on Cancer risk: this is due to the increase in the risk of mortality due to amyotrophic lateral sclerosis.

**2,4-Dichlorophenoxy propionic acid :**

2,4-Dichlorophenoxy propionic acid it is an degrading bacterial strain, it was isolated after numerous sub cultivations of a mixed culture obtained by the soil column enrichment. This herbicide is mainly for to increase the maximum specific growth of the plant.



Molecular formula:  $C_9H_8Cl_2O_3$ , 2-(2,4-dichlorophenoxy) propanoic acid

2-(2,4-dichlorophenoxy)propanoic acid is an aromatic ether that is 2-hydroxypropanoic acid

In which the hydroxy group at position 2 has been converted to its 2,4-dichlorophenyl ether. It is a monocarboxylic acid, an aromatic ether and a dichlorobenzene.

## TOXICITY:

01. There are evidence that 2-(2,4-Dichlorophenoxy)Propionic Acid causes cancer in animals.
02. Exposure to 2-(2,4-Dichlorophenoxy)Propionic Acid can cause fever, nausea, vomiting, diarrhea, stomach pain and poor appetite.
03. While 2-(2,4-Dichlorophenoxy)Propionic Acid has not been tested, it is not classifiable as to its potential to cause reproductive harm.
04. Breathing 2-(2,4-Dichlorophenoxy)Propionic Acid can irritate the nose, throat and lungs causing coughing, wheezing and shortness of breath.

## TITANIUM DIOXIDE:(TiO<sub>2</sub>):-

It has been widely used as a photocatalyst in many environmental and energy applications due to its efficient photo activity ,and high stability, and mainly it available to everyone because of its low cost and the main advantage, it is safety to the environment and humans.

Titanium dioxide is of two types:-

- 01.Homogenous: OH radicals by oxidation of OH<sup>-</sup> anions.
- 02.Heterogeneous: generation of O<sub>2</sub><sup>-</sup> radicals by reduction of O<sub>2</sub>.

## PREPARATION OF TiO<sub>2</sub>:-

This TiO<sub>2</sub> is prepared by sol-gel method by dissolving Ti (OC<sub>3</sub>H<sub>7</sub>)<sub>4</sub> in methanol\ethanol solution with molar ratio 1:1:10. obtained solution maintained at 75degree for 3 hours this sample drained at 110 degree centigrade and calcined at 50degree centigrade for 120 min. this complete photocatalytic reactor and light source experiment done in cylindrical vatch reactor. this procedure and analysis of the mixture is doe with spectrophotometer. And absorbance characteristic with the calibration curve method.

We took a topic called **Photocatalytic degradation of pesticide by titanium dioxide** , so here we are going to reduce the toxicity of the pesticides which are mentioned in the abstract (**2,4-D and 2,4-DP**) , where these pesticides are widely used in our country, but somany are don't aware of the toxicity levels of these pesticides. But still we are at stage of finding the solution to reduce the toxicity level in the pesticides.

According to reduce in the toxicity level the photocatalytic process takes place, and for this process widely used catalyst is **TiO<sub>2</sub>** , by this catalyst we can reduce the toxicity level by the radiation method, and also by the Advanced oxidation processor (AOPs) method. These two methods are widely used in the degradation process. And here among different techniques Heterogeneous technique is an efficient technique to destroy organic pollutants in water.

By the complete process of the photocatalytic activity can effectively degrade the selected pesticides (2,4-D,2,4-DP).

After the reaction the solution can be separated from the suspension. Because the pesticides can sediment in mixture when the stirring was stopped.

But while the  $\text{TiO}_2$  is added to the solution it won't be sedimented by the reaction. Because it has the activity to dissolve any kind of pesticides by this the effect or the transfer of toxicity level be decreased in the environment.

### **CONCLUSION:-**

Here we know that titanium dioxide is a nanomaterial, and their photocatalytic activities were investigated for the photocatalytic degradation of 2,4-dichlorophenoxy acetic acid and 2,4-dichlorophenoxy propionic acid.

The results were found is by the photocatalytic activity where the titanium dioxide as a catalyst we can effectively degrade the toxicity levels of selected pesticides. And we can reduce the level of toxicity in plants, animals, and humans etc.

Finally we conclude this article with the slogan **“Heal the planet we have. Make it a better place to live in for the upcoming race”**.

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