IMPACT OF PARAQUAT DICHLORIDE PESTICIDE USE ON ENVIRONMENT AND PUBLIC HEALTH

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Abstract: Pesticides are nothing new in human life, especially farmers. Apart from having benefits for plants and humans, these pesticides also have negative effects that can be harmful to the surrounding environment and humans. According to the World Health Organization or WHO, in 2017 there were 18.2 disorders in every 100,000 people from all over the world due to health problems as a result of the use of pesticides. In fact, most people believe that using pesticides can protect plants and crops, livestock and fish from losses caused by various pests. Because with the help of pesticides, farmers believe they can avoid losses due to attacks by plant pests consisting of pests, diseases and weeds. So this paper was created with the aim of providing information about the use of pesticides and their impact on the environment, especially in the agricultural sector and their impact on humans. The method used is reviewing previous literature studies. Paraquat dichloride is a herbicide with the active ingredient 1,1'-dimethyl-4,4'-bipyridinium dichloride. This compound is toxic to plants and animals. Paraquat dichloride is also toxic to humans. Direct exposure or inhalation can cause severe lung damage and in some cases, can be fatal. The use of paraquat can cause negative impacts on the environment, especially if used incorrectly or excessively. This can include water and land pollution.

1 INTRODUCTION

Pesticides are nothing new in human life, especially farmers. Almost all people, especially those engaged in agriculture, use pesticides in agricultural activities. In general, pesticides are defined as toxic chemicals that are used to control nuisance organisms (insects, pests and weeds) that can harm human interests, such as crop yields that are not optimal and can reduce farmers' production results. Apart from having benefits for plants and humans, these pesticides also have negative effects that can be harmful to the surrounding environment and humans. In fact, it is certain that the use of pesticides in the community will continue to increase every year in order to maintain food globally. In this case, it will certainly be a challenge in itself over a long period of time for the environment and also public health in general. According to the World Health Organization or WHO, in 2017 there were 18.2 disorders in every 100,000 people from all over the world due to health problems as a result of the use of pesticides. Meanwhile, in Indonesia there are also many cases of disturbance due to the use of pesticides, this is in line with the incidence of pesticide poisoning in Indonesia, there were 771 cases in 2016 and 124 cases in 2017 (Oktaviani & Paauthor, 2020).

In fact, WHO also said that disruption due to the impact of pesticides will increase every year, especially for workers in the agricultural sector in developing countries.

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According to Theresia, S, E, et., al, 2023, from a health aspect, pesticides pose a continuous threat and have a serious impact on human health. Various forms of health problems caused by pesticides to farmers or humans, include exposure to the skin, exposure to breathing, exposure to the mouth, exposure to the eyes, and contamination of the food and water consumed, which in turn will cause various threats of disease and disorders in humans, including the threat of cancer, acute respiratory disorders, diabetes mellitus, Parkinson's disease, leukemia, mental disorders, neurological diseases and so on.

In the health sector, pesticides are an important tool. Mainly used to protect humans from direct interference by certain organisms or indirectly by various vectors of infectious diseases. Various insect vectors that transmit dangerous diseases to humans have been successfully controlled with the help of pesticides. With pesticides, humans can be freed from the threat of various dangerous diseases such as malaria, dengue fever, elephantiasis, typhus and so on (Ida, 2017).

In the agricultural sector, the use of pesticides has also been found to be beneficial for increasing production. In fact, most people believe that using pesticides can protect plants and crops, livestock and fish from losses caused by various pests. Because with the help of pesticides, farmers believe they can avoid losses due to attacks by plant pests consisting of pests, diseases and weeds. Therefore, the use of pesticides among farmers is increasing with various types of pesticides being used to the point of causing dependence (Ida, 2017).

Paraquat is one of the herbicide active ingredients most widely used by the public, because the price is relatively cheap and affordable. However, the many uses of pesticides, especially paraquat, also have negative impacts on humans who apply them and also have an impact on the environment. This is caused by farmers' lack of knowledge regarding the correct use of pesticides and according to the regulations. Excessive pesticides can cause environmental degradation, and the resulting residue can even harm humans themselves.

Based on this background, this paper was written as information material about the use of pesticides and their impact on the environment, especially in the agricultural sector and their impact on humans

.2 METHOD

This research uses qualitative methods by describing the results of reviews of previous research. Iterative study is knowledge that shows understanding of a particular topic. A literature review also includes critical evaluation of the material; therefore, it is called a literature review rather than a literature review.

3 RESULTS AND DISCUSSION

3.1. Paraquat Dichloride Pesticide

Paraquat dichloride is a chemical compound used as a herbicide, namely a substance used to kill dangerous plants or weeds. This compound is often used in agriculture to control the growth of weeds which can damage cultivated plants. Paraquat dichloride is also known by the chemical name 1,1'-dimethyl-4,4'-bipyridinium dichloride (Huda, M, M., et., al, 2020). Paraquat dichloride is a solid crystal that dissolves in water. This compound is toxic to plants and animals. Paraquat works by damaging plant cells through the formation of free radicals in plant tissue. This results in necrosis or death of plant cells. After application to plants or weeds, paraquat will penetrate the plant cell membrane and enter the cells. In the cell, paraquat undergoes redox (oxidation-reduction reaction) by taking electrons from other molecules in the cell, forming free radicals. This process causes cell damage and ultimately plant death. Free radicals produced by paraquat can cause oxidation and damage to cell components such as proteins, lipids and nucleic acids.

Paraquat dichloride is also toxic to humans. Direct exposure or inhalation can cause severe lung damage and in some cases, can be fatal. Therefore, the use and handling of paraquat needs to be done with caution, and farmers or workers involved in its use must use appropriate personal protection. In fact, several countries have restricted or banned the use of paraquat dichloride due to its high risk of toxicity. Its use is strictly regulated in many regions to protect human health and the environment. And the importance of using pesticides according to the directions and regulations for each use.

3.2. The Impact Of Using Pesticides With The Active Ingredient Paraquat Dichloride On Humans

Exposure to the pesticide paraquat dichloride can have serious impacts on the human liver. Paraquat dichloride, as an herbicide, has significant toxicity to body organs, including the liver. Some possible impacts on the human liver due to exposure to paraquat:

1. Hepatitis:
   Paraquat can cause inflammation of liver cells, known as hepatitis. Hepatitis can cause liver cell damage and disrupt its normal function.

2. Liver Necrosis:
   High enough or chronic exposure to paraquat can cause necrosis or death of liver cells. This can lead to severe liver damage.
3. Fibrosis and Cirrhosis:
   Prolonged exposure can lead to the development of fibrosis (replacement of normal tissue with connective tissue) and ultimately cirrhosis of the liver. Liver cirrhosis is a serious condition in which the liver experiences severe damage and loses its functional ability.
4. Metabolic Function Disorders:
   Paraquat toxicity can cause disturbances in liver metabolic function, including the detoxification process and removal of harmful substances from the body.
5. Decreased Liver Enzyme Production:
   Paraquat can cause a decrease in the production of liver enzymes, which are necessary for normal metabolic processes. This can affect overall liver health.
6. Possible Development of Liver Cancer:
   Several studies have linked pesticide exposure to an increased risk of developing liver cancer. Although there is no direct evidence linking paraquat to liver cancer, its toxic impact on the liver may increase this risk.

Liver damage from paraquat exposure can depend on a number of factors, including the level of exposure, duration of exposure, and individual sensitivity. High level exposure or continuous exposure tends to have a higher risk of causing serious health effects.

According to Djojosumarto in Pamungkas (2016), pesticide contamination through the skin was found to be more than 90% via the skin exposure route. Several factors that influence this include the spraying process, mixing pesticides, and the process of washing equipment. It is not uncommon for workers using pesticides not to use skin protection, resulting in continuous exposure or contamination. Based on research by Theresia, E, S, et., al, 2023, it can be an environmentally friendly alternative pesticide to replace the use of carbofuran in controlling brown planthoppers and rice stem borers. Environmentally friendly and sustainable alternatives in the use of pesticides are very necessary to avoid potential contamination of the soil and water used as planting media, potential residues in agricultural products, as well as health impacts that arise for farmers. The easiest alternative to apply is the use of plant-based pesticides with active ingredients in the form of certain plants which contain ingredients or active substances that make pests intolerant but whose properties can be biodegraded in the environment so they do not leave dangerous residues (Haerul et al., 2016).

Paraquat dichloride has a mechanism of action that is toxic to humans when exposure occurs. It is important to note that paraquat can cause serious damage to organs in the human body and has a high potential for death. Here are some potential mechanisms by which paraquat may disrupt human tissue metabolism:

1. Respiratory Exposure:
   One of the main modes of exposure is through inhalation of paraquat dust or mist, especially during use or handling of this herbicide.
2. Cell Penetration and Free Radical Generation:
   Paraquat can enter human cells, especially lung epithelial cells, and undergo redox reactions that produce free radicals, especially superoxide (O2-).
3. Cell and Lipid Damage:
   Free radicals can cause oxidation and damage to cell structures, including cell membranes and lipids in cells.
4. Oxidative Stress:
   Exposure to paraquat causes increased oxidative stress, where oxidative reactions exceed the ability of cells to cope and recover.
5. Damage to Lung Cells:
   Paraquat can cause direct damage to lung epithelial cells, resulting in lung inflammation and fibrosis.
6. Respiratory System Disorders:
   Paraquat can damage cells in the respiratory tract, resulting in decreased lung function, dyspnea (difficulty breathing), and in severe cases, respiratory failure.
7. Vascular Permeability:
   Paraquat may affect vascular permeability, causing inflammation and increased vascular permeability, which may result in edema and other organ damage.
8. Systemic Toxicity:
   Paraquat can damage other vital organs such as the liver and kidneys, resulting in systemic toxicity.

It is important to remember that exposure to paraquat is very dangerous, and in general, cases of direct exposure or ingestion of paraquat can be fatal. Therefore, paraquat should be avoided or used with extreme caution, and strict instructions for use and protection should always be followed. If exposure occurs, immediately seeking emergency medical assistance is essential.

4 CONCLUSIONS

The active ingredient of the pesticide paraquat dichloride is 1,1'-dimethyl-4,4'-bipyridinium dichloride. Pesticides with the active ingredient paraquat dichloride are very widely used among

farmers or workers in the agricultural sector. This pesticide is considered effective, fast application, relatively low cost. However, the negative impact of using pesticides with the active ingredient paraquat dichloride Paraquat dichloride is very toxic to humans, and exposure to even small amounts can cause damage to the lungs and other internal organs with a high risk of death. The use of paraquat can cause negative impacts on the environment, especially if used incorrectly or excessively. This can include water and land pollution.

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