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STUDY OF PESTICIDES IN THE ENVIRONMENTAL CHEMICAL EDUCATION

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ABSTRACT

Agrochemicals known as pesticides, come from various chemical components, and have raised questions about their use, as many of these compounds accumulate in our bodies, causing cancer, in addition to causing serious environmental problems. Thinking of a perspective of making students aware of the chemistry discipline in high school at a public school in Paraiba, Brazil, a didactic sequence was developed addressing the chemical concepts related to the use of pesticides and the environmental problems caused. In general, students had little knowledge about the serious risks of discriminating the use of pesticides. A questionnaire was applied as an evaluative method, where the results were satisfactory: the students were able to understand that the excesses of pesticides in food can bring serious health risks, in addition to contaminating soils and water tables because some pesticides may contain the presence of heavy metals.

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INTRODUCTION

The teaching of chemistry is seen by students as a difficult subject, as they find it difficult to make a connection between the subjects addressed and their daily lives, the scientific knowledge acquired is often misinterpreted, making it difficult to reason for existing problems in society (WARTHA, 2013) . The term every day for some years has been characterized by being a resource in order to relate common situations linked to the daily life of people with scientific knowledge. Agrochemicals, also known as pesticides, appear as a good topic to be worked on in the classroom with students. Pesticides are derived from various chemical components, and are raising questions about their use. One of the first pesticides used by man was during World War II the dichloro-diphenyl-trichloroethane, which was used to fight the mosquito that transmits malaria, after some studies on this compound, it was discovered that it, as well as organochlorine substances, accumulate in the body, causing cancer, in addition to causing serious environmental problems (SANTOS et al., 2019). Pesticides that are related to acute intoxications, chronic diseases, reproductive problems and environmental damage, are countless cases worldwide that address the consequences of the discriminated use of pesticides in plantations. It is important that teachers seek to relate content to the problems of everyday life, so that there will be an understanding of the concepts and an application of what is being worked on in the classroom, providing a greater interaction between teacher and student (CAVALCANTI et al., 2010; SANTOS et al., 2017). The proposed theme brings chemistry introduced into the environment, raising questions about the use and manipulation of chemical components. Chemistry is integrated to students in the ninth grade of elementary school, and deepened in high school, where it is up to the teacher to contextualize the subjects, in addition to developing the necessary skills and abilities so that students can leave with the notion and critical sense of reality present in social life (SANTOS et al., 2016). It is necessary to carry out scientific research in high school to improve the criticality capacity of more complex subjects, which require chemical contents to be worked in a contextualized way, preparing students to identify chemical aspects in several areas. Research in classrooms facilitates the teaching-learning process, involves teacher and student, trains more critical citizens, with a researcher profile and enriches professional skills. In addition, it is worth noting that classes become more attractive and fun, students do not notice the time passing and still improve the knowledge acquired (SANTOS et al., 2016). The pesticide generator theme enables a wide field of content that can be applied as a research source for chemistry students, in addition to involving several areas, with an interdisciplinary approach between the disciplines. The contents that can be developed are innumerable from elementary grades to high school, it is up to the teacher to use, in the best way, the teaching methods, depending on the school structure and the equipment that one wishes to use (CAVALCANTI et al., 2009). Pesticides can be used as a guiding principle in learning

the content of the Chemistry program, for example, substances and mixtures, among others. Educational practices are important so that there is a dialogue between the teacher and the student, avoiding conflicts that generate disorder in the classroom, where the educator does not lose autonomy. Working in a contextualized way ends up motivating and arousing interest in the matter of chemistry, from pesticides this work reflects on adapting it to meet the grades from 1st to 3rd year of high school, developing criticality and raising students' awareness (SANTOS and SILVA, 2019). Lately we have heard a lot about issues addressing pesticides, which are chemicals manufactured by large industries, called pesticides, because it has the function of eliminating pests and insects that attack plantations, also to fight diseases in plants (SANTOS and SANTOS, 2020). Arise with the need to increase food production in a worldly manner, scholars say that with the growth of the population, the natural production of food would be affected, since the proliferation of pests and insects would directly affect production, lacking food, generating hunger and misery in large countries.

Pesticides, chemical pesticides, plant remedies and poisons, these are some of the numerous names related to a group of chemical substances used in the control of pests (animals and plants) and plant diseases (RIBAS, 2009). Pesticides are commonly used in the farms of large farmers. In the second world war, the first agricultural pesticides were used by man, known in the world, one of the first to be used was dichloro-diphenyl-trichloroethane (DDT), without many studies on these compounds, they used it without knowing the facts of its consequences. , was used to eliminate insects, and to fight diseases transmitted by them, such as malaria, typhus and yellow fever, the problems caused by their uses are enormous. One of the main problems caused by the exaggerated use of pesticides is the environmental problems that can be of various forms, one of them is the chemical components, which can contain heavy metals in their composition that when deposited in the soil, these metals can reach the rheumatic scarves. Agrochemicals used in an uncontrolled manner near Rivers and lakes raise concerns; the contamination originating comes directly and indirectly. The considerable increase in the volume of applied pesticides has brought a series of disorders and changes to the environment, both due to the contamination of the communities of living beings that compose it, as well as due to their accumulation in the biotic and abiotic segments of the ecosystem (biota, water, air, soil) (RIBAS, 2009). The herbicides containing Atrazine is one of the main pollutants of effluents, its molecular formula is C8H14ClN5, containing chlorine and nitrogen atoms, this compound is harmful to human health. (PESSOA, 2003).The occurrence of pesticides in waters used for human consumption. Among these products are herbicides, mainly Atrazine. Pesticides containing organic compounds in contact with water increase the number of decomposing microorganisms, in addition to these substances accumulating in the animals' organisms, which can cause poisoning.

Chemical components are substances that are often toxic, harmful to humans, agrochemicals from organ chlorines, accumulate in the body of birds and humans, causing cancer, DDT, is an organ chlorine component, in addition to causing serious health consequences, it is discarded in the environment, taking about 30 to 40 years for its complete degradation, causing serious risks to the ecosystem. Pesticides contaminate in various parts of the environment, resulting in a wave of degradation of ecological areas, as they can be applied to forests (native and planted), in water, urban and industrial environments and, to a large extent, in agriculture and pastures for livestock (RIBAS, 2009). Research and work with pesticides allows the perspective of involving students, with the serious problems caused by the users of these chemical agents, awareness classes were created and addressed, so that these students can see the real problems behind the rampant use of these chemicals substances, in addition to the critical and conscious training of citizens. What often happens is that teachers do not connect content with the student's reality, generating an abstraction in relation to what happens today, concepts and formulas are played as if they were just intended to decorate. Chemistry teaching requires students to be prepared to identify solutions and problems faced on a daily basis, the consumption of foods that have a high concentration of toxic products, such as organ chlorines, have accumulative properties in the body, which entails serious health risks, awareness is of paramount importance, after all it is the duty of education, to prepare people so that they can exercise their criticality (SILVA et al., 2016; SANTOS et al., 2019; SANTOS, 2020; SANTOS et al., 2021). Despite being widely publicized in the media, students find it difficult to understand the chemical processes involving substances in which they are part of the composition of pesticides. In this perspective, investigative classes were developed for high school students, where they would approach chemical contents related to pesticides, raising awareness of the chemical processes involved and the damage caused to health and the environment, with the help of a scientific article, to complement the understanding of the consequences and benefits of using these substances.

MATERIALS AND METHODS

Classes were taught at the State School Jose Rolderick, with the class of the 1st year of high school. First, a table was built with the contents that could be applied in the classroom with the study of pesticides. We realized that agricultural pesticides and their numerous substances contained in them, in addition to reactions that happen in the environment in which they are inserted, there are a wide variety of subjects that can be highlighted, as shown in the Table 1.

Table 1. Contents from pesticides in teaching chemistry

- **Chemicalnotationandnomenclature**
  - Notation and nomenclature of chemical elements;
  - Atoms, molecules and ions;
  - Atomic number;
  - Mass number.
- **Atomhistory**
  - Evolution of atomic models;
  - Electronic configuration at atom levels and sublevels.
- **Periodic table**
  - Evolution of the periodic table;
  - Groups and periods;
  - Classification of elements of the periodic table.
- **Chemical bonds**
  - Valencia;
  - Ionic bonding;
  - Covalent, normal and coordinated connection.

The table points out the main contents that the chemistry teacher can work with the students of the 1st year of high school (ARAÚJO and SANTOS, 2018). After assembling the board, some classes were held on the topic of pesticides and the impacts caused to the environment, and the health of living beings, it was known, during the classes and the questions asked, that the students had no idea of the consequences generated due to the indiscriminate use of these substances, this reflects the little knowledge of these products in their daily life, since the majority of students are from rural areas, where their parents practice subsistence agriculture, this knowledge acquired in class is extremely important so that they can , bring awareness to your daily life. After the applied classes, a questionnaire was elaborated, to verify how the students understood the subjects highlighted in the article, whose title is, the chemistry of pesticides the impact on health and environment, along with the content explaining during classes, awareness of the use of agrochemicals. This shows the relevance of working with the innovative method that will generate a problematization, making a contextualization with the daily coexistence of substances that cause various risks to health and the environment. Table 2 shows the questions prepared for 1st grade students to analyze how the classes related to the pesticide theme were.

RESULTS AND DISCUSSION

During classes, the types of pesticides and their toxicological ranges were exposed. We know that there is a band, those of class I, where we have the band of red color, are extremely toxic. In this case, the application of these doses of LD50 in the body can cause acute effects so that the individual acquires cancer or severe intoxication. Thus, the importance of the types of agrochemicals that large industries are selling was discussed, as we know that pests and insects are gaining immunity and becoming more and more resistant, and over the years, more and more toxic substances will develop harmful to human beings. Thinking of alerting the students, a table was set up, with the classes and bands corresponding to the toxicological level of the pesticides. The table below (Peres and Moreira, 2003) shows the levels of toxicity, class and range.

pesticides, since there are several types such as herbicides, fungicides, among others. The substances contained in these products have different effects and symptoms on people depending on what pests are threatening the crops. Aiming to make the understanding of the students clearer, a Table 4 (Peres and Moreira, 2003) was created with the main types of pesticides used and what symptoms they can achieve with their incorrect use. Continuing the process of raising awareness about pesticides, we discussed the pesticides produced by hand, which for farmers who practiced family farming was the best option, and would still cause low cost benefit. We found that some plants, as well as fruits, produce toxins capable of fighting some insects and pests, and the best feature that do not degrade the soil, and have no side effects for living beings. After all the classes on the subject, a questionnaire was applied with the questions elaborated during the period of study of the proposed theme.

Table 2. Questions asked to 1st year students about pesticides

Number	Questions
1	What are pesticides?
2	Pesticides are divided into three main groups. Which ones are they?
3	What protective equipment should workers use when handling pesticides?
4	What can cause pesticide poisoning?
5	In your view, which group of workers will suffer the most from the effects of agrochemicals: rural workers or consumers of food from pesticides? Justify your answer.
6	Before consuming food, we must follow some procedures for consumption. How should the correct washing of food be done?

Table 3. Toxicological classification of pesticides

Toxicologicalclass	Toxicity	DL50 (mg/Kg)	Coloredstripe
I	Extremelytoxic	≤ 5	Red
II	Highlytoxic	5 - 50	Yellow
III	Mediumtoxic	50 - 500	Blue
VI	Slightlytoxic	500 – 5,000	Green

Table 4. Symptoms of pesticide poisoning

Classification	Symptomsofacuteintoxication	Symptomsofchronicintoxication
Insecticides	Weakness, abdominal colic, vomiting, muscle spasms, convulsion, nausea, involuntary muscle contractions, irritation of the conjunctiva, sneezing, excitation.	Delayed neurological effects, chromosomal changes, contact dermatitis, cardiac arrhythmias, kidney damage, peripheral neuropathies, allergies, bronchial asthma, mucosal irritation, hypersensitivity.
Fungicides	Dizziness, vomiting, muscle tremors, headache, difficulty breathing, hyperthermia, convulsion.	Respiratory allergies, dermatitis, Parkinson's disease, cancers, teratogens, chloroacnes.
Herbicides	Loss of appetite, nausea, vomiting, muscle fasciculation, nosebleed, weakness, fainting, conjunctivitis.	Induction of liver enzyme production, cancers, teratogens, liver damage, contact dermatitis, pulmonary fibrosis.

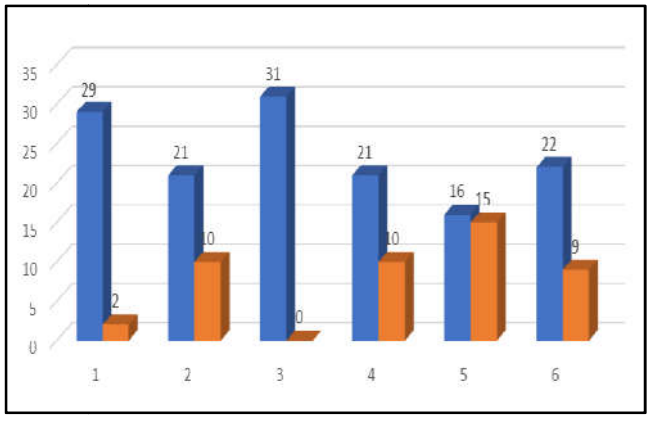

Figure 1. Answers to the application of the questionnaire on pesticides

The classification is in accordance with the results of tests and studies carried out in laboratories, which aim to establish the 50% lethal dosage (LD50), which is the amount of substance needed to kill 50% of the animals tested in laboratory centers (RIBAS, 2009). It is important to take the information so that the data can awaken the degree of danger of the food eaten with the high rate of these chemical components. The toxicity of a substance can also vary depending on the mode of administration, and product labels are identified by colored bands. During an article discussed in the classroom, the debate led to many questions about the types of

Some previous knowledge of the students was raised, where we realized that the degree of knowledge of the students on the part of this theme was minimal taking into account that the majority of the students are from the city´s rural area. Agrochemicals are often raised in controversies about how to apply them to plantations and their chemical compounds, since countless cases of disease have been reported worldwide and more than that, the media alert the population to these signs of contamination. Therefore, students' awareness is extremely important to make them critical citizens. Below we show the graph (Figure 1) referring to the applied questionnaire and its

answers. According to the analyzed questionnaires, 93.54% of the students say that pesticides are chemical substances that aim to eliminate pests and increase food production. In that first question, it was very clear that they really understood the real purpose of using pesticides.67.74% of students say that the most used groups of pesticides are pesticides, insecticides and fungicides. We know that nowadays the variety of substances produced to combat various types of pests and insects is vast, this leads to serious environmental problems, so the students achieved success, and however some were unable to understand the main types of pesticides.51.61% of students claim that rural workers are more exposed to pesticides. Almost 50% of the data is good for both, both those who consume and those who work are susceptible to contamination. What happens is that rural workers are in direct contact with these substances with a higher degree of risk (BRAIBANTE and ZAPPE, 2012).67.74% of students stated that pesticides cause poisoning, nausea and heart problems and that they can transmit cancer. Since more than half of the class understood the risks to human health if the correct precautions on the use of these chemical components are not taken.Recalling that during classes that the environmental problems caused by the indiscriminate use of pesticides were worked on a lot. The unanimity states that farmers must have equipment such as gloves, mask, boots, among others to work and handle pesticides. 70.96% believe that the best way to sanitize food is through bleach and vinegar.

Conclusion

The results obtained were satisfactory, as the students were able to understand that the excesses of pesticides in food can bring serious health risks, in addition to contaminating the soil and groundwater, as some pesticides may contain the presence of heavy metals. Pesticides can cause serious diseases such as cancer and intoxications to those who handle the products, as the objective was to raise students' awareness and develop their criticism about the indiscriminate use of pesticides in agriculture and the consequences for the environment. We conclude that the didactic sequence was very successful, because the students involved had a very significant use during classes and the questionnaire proves that there was a satisfactory performance, the study aims to investigate the students' conceptions about the use of pesticides in their daily lives.

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