

Brief Virtual Observation Revealed the Possibility of Trade in Organophosphate-based Pesticides through E-commerce

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ABSTRACT

Reactive organophosphates (OPs) could be utilized as deadly pesticides due to their nerve agent properties for several organisms. Although

the utilization of these compounds has been strictly regulated, monitoring its trading activities, particularly through e-commerce, could be quite challenging. More information is needed on whether pesticide products containing OPs or slightly featured with similar phosphate groups exist or are nonexistent in online stores in Indonesia. This community service aims to briefly report the possibility of trade in phosphorous-based pesticides through online stores in Indonesia. We demonstrated virtual observation to obtain the list of phosphorous-based pesticides from some of the e-commerce in Indonesia. We detected 24 pesticides displayed on some popular e-commerce with phosphate groups in the active substance, i.e., Acephate, Chlorpyrifos, Dimethoate, Diazinon, Profenofos, and Triazofos. The finding could provide insight for those online stores to establish rules to monitor and control trading activities of agrochemicals that could be illegally used or further processed for any activities related to Chemical, Biological, Radiological, and Nuclear and Explosives (CBRN-E) threats.

INTRODUCTION

The utilization of organophosphates (OPs) has been strictly controlled or may be prohibited, for several activities. In addition to being widely recognized as the main component of several deadly nerve agents during World War II, many OPs have severe impacts on human health. For instance, in the form of pesticides, OP exposure could be associated with neuropsychological effects (Muñoz-Quezada et al., 2016) respiratory diseases of wheezing and asthma (Zhao et al., 2023) hematologic malignancies (de Moura et al., 2020) and neurodevelopmental disorders of children (Hertz-Picciotto et al., 2018).

Moreover, the neurotoxicity of OP pesticides has been reported in some cases of poisoning and deaths, especially in developing countries (Hertz-Picciotto et al., 2018). Considerably, there is still a lack of information regarding the current trade-in of OP products in the pesticide form, especially in Indonesia.

Meanwhile, virtual trading is one of the busiest activities in Industry 4.0. Almost all industrially processed products could be marketed through the related online platform. In Indonesia, there are several e-commerce with abundant consumers who are routinely looking for their needs. However, exploration or investigation

concerning potentially harmful items is still limited since there are probably restricted chemical products that could be easily obtained from many online stores. For instance, OPs that could still proceed into pesticides should be known by both the government and consumers since they could be harmful as an environmental exposure and illegally employed as the threat of chemical warfare or terrorism (Jag & Dharman, 2003). In addition to farmers, who may be supposed to be people with direct pesticide exposure, it is also quite important to anticipate consumers' preferences regarding health aspects, risks, and benefit-cost analysis of pesticides (Andersson et al., 2014). The public should be educated about the hazards of OP pesticides, particularly for children. It could be performed by implementing this knowledge through the school curriculum (Hertz-Picciotto et al., 2018). Through this short communication, we showed our brief work to provide information regarding OPs-based pesticide products traded in e-commerce in Indonesia.

METHODOLOGY

The virtual observation was conducted toward several e-commerce by applying several keywords that might be input by agricultural workers in terms of pest removal, e.g., powerful pesticide, strong pesticide, etc. Thorough exploration was virtually conducted by three persons, i.e., university students with chemistry backgrounds, toward selected popular e-commerce to collect information regarding pesticide products. The data based on a virtual screening of two popular e-commerce in Indonesia and confirmation about displayed product information and related websites from the manufacturers or distributors, subsequently.

RESULT AND DISCUSSION

After examining the active ingredients listed in the displayed product information, we found that 24 items have phosphate or phosphorus functional groups in their chemical structures. Figure 1 displays those 24 pesticide products obtained for a couple of days in the 2nd week of October 2023 (detailed data were not shown for confidential reasons).

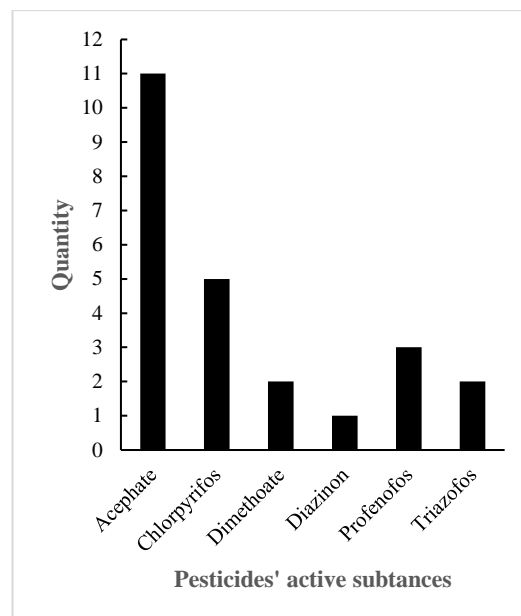


Figure 1. Pesticide products with phosphate and phosphorous functional groups found in several online stores during virtual observation

Based on a virtual screening of two popular e-commerce in Indonesia and confirmation about displayed product information and related websites from the manufacturers or distributors, subsequently, the three dedicated virtual observers listed six OPs being used as the main ingredient of some pesticide products. The pesticide products' initials were R, V, A, J, Y, D, M, Z, I, C, K, B, and S from various manufacturers. Although Acephate, Chlorpyrifos, Dimethoate, Diazinon, Profenofos, and Triazofos contain phosphate/phosphorous groups with essential roles in attacking the tissue of targeted insects, i.e. refer to PubChem Compound Summary for CID 1982, 2730, 3082, 3017, 38779, and 32184, respectively, the detected products from the studied e-commerce were displayed in the diverse formulation of ingredients and varied suggested dosages of preparation before use in agricultural purposes. Accordingly, further comprehensive studies should assess the lethal dose of certain OP substance levels within the products after being mixed in the other product components.

Regarding safety, the negative effects of those six OP active pesticide substances should be carefully assessed after being formulated as a final product. Interestingly, based on a particular assessment of the U.S. Environmental Protection Agency (EPA), Acephate is being proposed to be strictly used considering its impact on human health condition (Louden et al., 2023). Meanwhile, the safety aspect of remaining OP active ingredients is supposed to be thoroughly checked and properly assessed, subsequently, in further studies.

CONCLUSION

Our brief work concluded that the activity of trade in OP-based pesticides occurred in popular e-commerce in Indonesia. However, although several OP-based pesticide products were displayed and easily obtained from popular e-commerce in Indonesia, the severity level of either occasion or regular exposure of those products were considered in the range of low or medium risk, exclude Acephate. Hence, collaboration with other authorities is encouraged to be generated, such as health authorities or agricultural products inspectors.

This brief report has a limitation regarding exposing our results for several reasons. We suppose that our findings may influence the reputation of e-commerce. However, this concern also suggests subsequent activities that could be conducted in further studies in designing a similar investigation to gain comprehensive findings without compromising confidential aspects of the online stores.

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- Furthermore, based on several pesticides with chemical ingredients that could be illegally utilized for unintended purposes, both defense and health authorities in Indonesia could design plans and establish programs to anticipate chemical threats accordingly. It is also suggested to generate a study or further action to deal with the issue, such as developing a bioremediation technique to neutralize the phosphate-based compound within the pesticide products.

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CONFLICT OF INTEREST

We declare no conflicts of interest to disclose regarding this article.

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