

Awareness of Kathon-based Biocide Substance Handling and Application of Chemical Industrial Workers

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ABSTRACT

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Kathon-based biocides used in controlling and mitigate the growth of microorganism that can cause problems in cooling water systems resulted hazardous skin problems such as allergic contact dermatitis, irritant dermatitis or dyshidrotic eczema. Symptoms of skin sensitization were found on the employees handling Kathon-based biocide in a local chemical company. A preliminary survey revealed only ten percent of the employees aware and received proper training in handling Kathon; regrettably such training only available abroad. Obtained findings suggested Kathon-based chemical supply companies in Malaysia to exercise regularly safe handling, risk assessment and medical examination. Feedbacks from these exercises would be beneficial to the company in better predicting the associated risks and positively affected the well-being of the employees thus reducing turnovers.

Keywords:

Kathon, biocide, awareness, sensitizing, skin, handling

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1. Introduction

In Biocides plays an important role as additives in the manufacturing of water-based products due to its ability to inhibit the overgrowth of microorganisms. Low price and high efficacy at low concentrations widened its usage in cosmetics, household cleaning products and products of industrial use. However, biocides substance can cause hazardous skin problems such as allergic contact dermatitis (ACD), irritant dermatitis and dyshidrotic eczema which resulting from skin sensitization [1, 2, 3, 4].

Tokunaga *et al.* [5] reported in their study, a painter developed a contact dermatitis just after two years handling paint with Kathon. This study showed that even with airborne exposure, the sensitized painter had developed painful rash and skin eczema and irritation. Kathon having more potent sensitizer even with low concentration. The value of 10 to 20 ppm is already considered a potential sensitization [6, 7]. Eczema and papules can be seen on the face, trunk, hand and fingers. Some parts

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were having scale and desquamation. Some area at the face such as eye-lid and nose were more noticeable area [8, 9].

Scherrer et al. [10] conducted a study Kathon sensitization in Hospital das Clinicas Brazil from 2006 to 2012. This study showed an increment of positive sensitizing patient from 2006 to 2009 by 3.35% and the number rapidly increased to 11.14% from 2006 to 2012. This study agreed that the increment of patient sensitized Kathon was due their exposure to the industrial product, household and cosmetic. It also disclosed that the global sensitization to Kathon remains around 2.1% from the period of 1998 to 2009, however the number has doubled to 3.9 % in 2011.

Another Kathon sensitizing trend study conducted in Spain in 2014 [11] also agreed that the number of patient sensitized to Kathon was significantly increased. In 2013 approximate 15% of dermatology related patient sensitized to Kathon compared to 5.12% only in 2005. This study believed that number of people concludes a high frequency of Kathon sensitization in Spain and significantly increase after 2010.

A recent study conducted in Malaysia [12], represent adults mainly health care worker was detected to have allergic contact dermatitis. The study allows 5 years data collection and it was found in year 2011 about 8.6% respondent have contact sensitization by Kathon base biocide. The percentage increased by year 2015 when 12.9% had been sensitized. Although the global trend of Kathon sensitized gradually increase, however the awareness or the related workers deal with this chemical is not thoroughly discussed. The present study aims to determine the awareness level worker to deal with Kathon-based product and to identify factors to improve the awareness level of handling Kathon-based product in Malaysian chemical industry.

This study focuses a particular biocide named Kathon which contains two isothiazolinones as active ingredients identified by the IUPAC system of nomenclature as: 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one. Kathon is yellowish to greenish coloured liquid that is corrosive to skin. Initial exposure would result mild erythema (redness) on the skin but if it is left untreated within 12 to 24 hours, blister and bullous will developed as shown in Figure 1. Previous studies [13, 14, 15] revealed individuals experienced ongoing exposure to Kathon-based product will continue to become sensitized to the product for a long time.

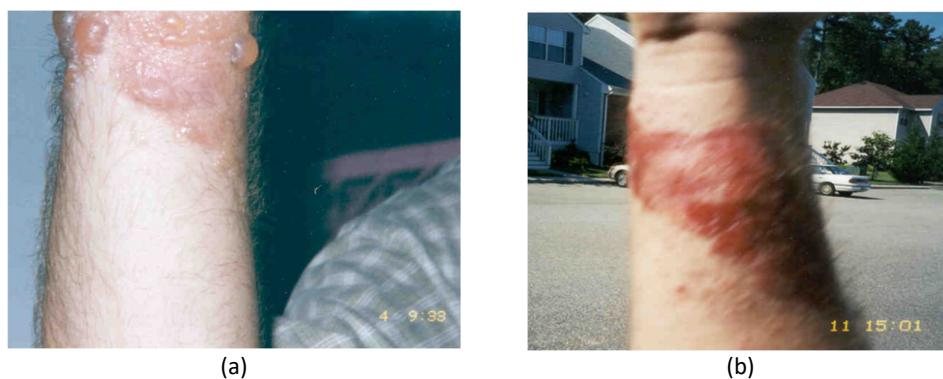


Fig. 1. Skin sensitization resulted from improper handling of Kathon (a) Two days exposure and (b) Ten days exposure

2. Methodology

A set of questionnaires was developed to identify the awareness level of worker that deals with biocide substance. First, a Likert Scale questionnaire specifically designed to study the level of

knowledge of the worker about Kathon-based biocide products, the protocol and procedure on how the substance to be handled, and the understanding level of worker to the impact of the substance to the skin with regards to allergic and sensitization. The respondent has been selected from five branches of a Kathon-based biocide supplier in Malaysia.

In the second part, a closed type questionnaire has been included to investigate the effectiveness of training program attended by the respondent during or prior their service. Due the limit number of respondent, a small sample size of 28 respondents used [6] in this study. A pilot survey was initially conducted for reliability test, gave an acceptable Cronbach's Alpha value of 0.7.

3. Results and Discussion

Figure 2 shows the involvement of employees in handling of biocide substances recognized using commercial codes and Kathon-based in the studied company. Almost half of employees of this chemical company involved in handling Kathon-based biocide which convey a clear message to the company that any mishap would bring significant impact in economic sense.

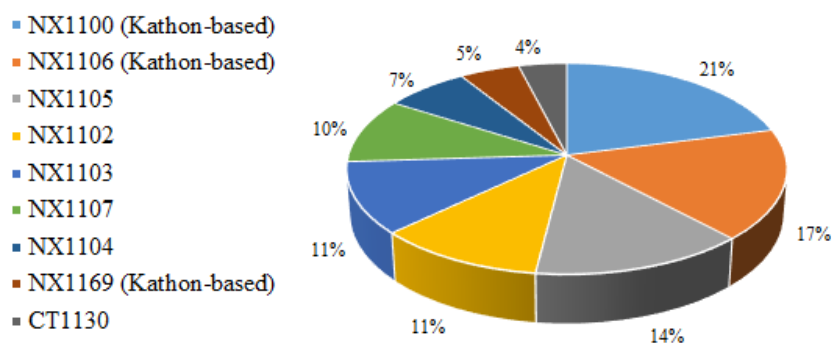


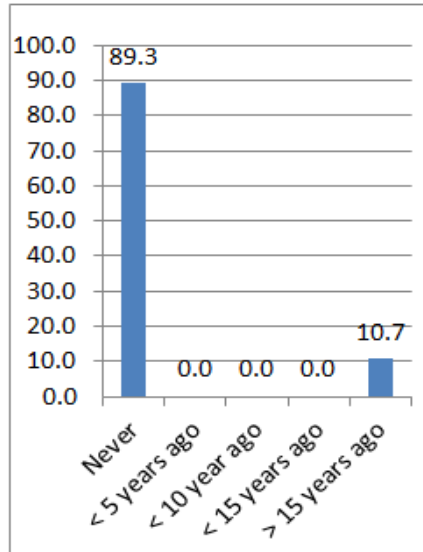
Fig. 2. Percentage of employees involved in handling coded biocide substances in the studied chemical company

In the first part of survey, three awareness related categories have been investigated as shown in Figure 3. Figure 3(a) shows the last time training attended by respondent. Most respondent have not attend any official training of Kathon-based substance handling. Only 10% respondent had attended the training after 15 years ago. Most of the respondent also admitted that they are not familiar to handle this hazardous chemical.

Table 1 shows the result of closed type survey conducted using nine related training questions of Kathon-based biocide substance handling worker. It is recorded that about 90% respondent know about Kathon from abroad training. Most workers aware about the danger of this substance exposure i.e. skin contact. However, they have not acknowledged the effect of Kathon to skin sensitization. Only 3.5 % respondent has done skin test and 10% understand the effect of this chemical to their skin.

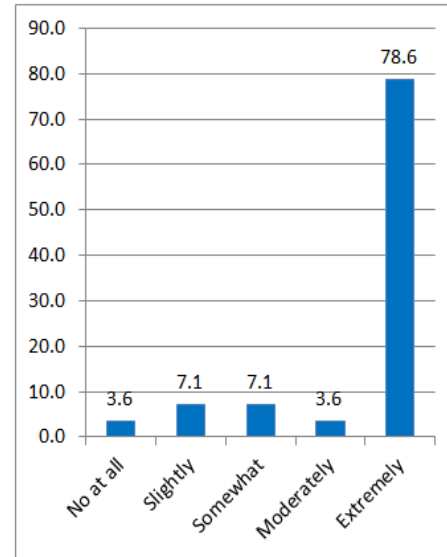
Surprisingly, only 10% respondent know about to conduct early treatment although around 32% of them are exposing to Kathon-based biocide. The results also suggest that the labelling system used in the related industry is not effective to alert the existing of this substance when more than 96% respondent did not aware the presence of Kathon in the biocide.

The last time trained for Kathon



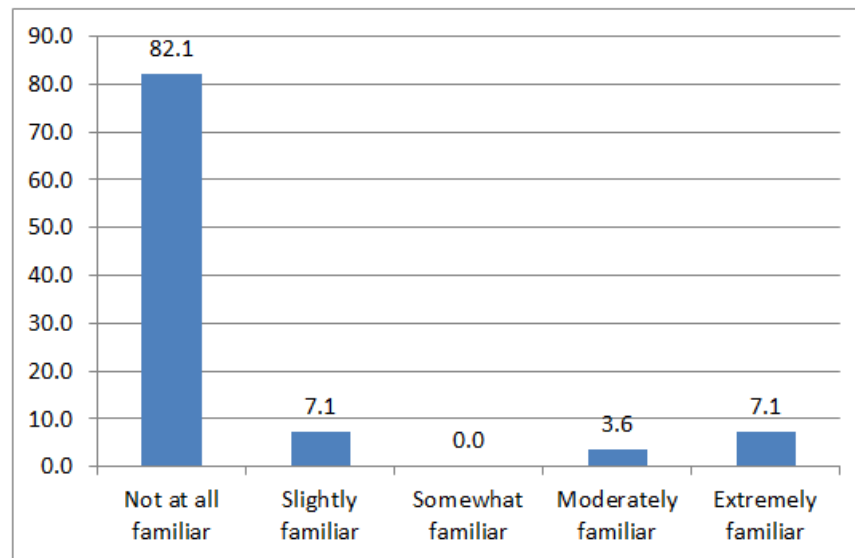
(a)

Risk of Kathon



(b)

Familiar with Kathon



(c)

Fig. 3. Kathon-based biocide awareness. (a) Last time trained of Kathon, (b) Perception on Kathon risk, and (c) Familiarity with Kathon

Table 1

Awareness level of employees in handling Kathon-based biocide chemical in the studied chemical company

Item	Questions	Answer = 'NO'		Answer = 'YES'	
		Freq	%	Freq	%
1	I know about Kathon from Company Training.	25	89.3%	3	10.7%
2	I never heard about Kathon.	5	17.9 %	23	82.1 %
3	There is Kathon labelling at the product I am dealing with.	27	96.4 %	1	3.5 %
4	I have done allergic patch skin test under dermatologist.	27	96.4 %	1	3.5 %
5	I have been trained handling Kathon.	25	89.3%	3	10.7%
6	I know the effect of Kathon to skin.	25	89.3%	3	10.7%
7	I know early treatment if exposed to Kathon.	25	89.3%	3	10.7%
8	Have you ever exposed to biocide product i.e. direct skin contact?	19	67.9 %	9	32.1 %
9	Do you have any working experience within the company in other country?	25	89.3%	3	10.7%

The current study indicates that the awareness of Kathon-based chemical among workers considerably low. It is believed that one of the reasons that contributes to this low awareness level is due to high turnover rate of worker in the chemical industry. The employer should provide a proper training such as industrial hygiene program to their new worker before they can be allowed to deal with the hazardous chemicals.

The employer also required to conduct a medical screening for their worker periodically to identify whether the worker has sensitized to Kathon, and this could suggest the worker to seek a proper treatment.

A special rule and regulation regarding the labelling system should be imposed so that the label used clearly showing the Kathon content in the biocide product. Protocols and procedure how to handle this material also need to be clearly spelled out in the labelling system. First aid procedure may need to be included in the label to reduce the risk of sanitizing due to Kathon-based biocide misconduct at the beginning.

4. Conclusion

The study on the safety awareness when handling biocide substance particularly Kathon is alarming. Skin sensitization developed among employees handling Kathon-based biocide revealed ineffective implementation of training, enforcement and safety measures by the studied company. Subsequent adverse effect extended to high turnover of employees and difficulties of implementing effective training. Unfortunately, only a handful of local personnel received certified training abroad despite the wide usage of Kathon in chemical industries applications in Malaysia. Obtained results of

this study signify proactive measures should be exercised by Malaysian companies dealing with biocide material to prevent costly mishap

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