# Understanding safety data sheets as a strategy to protect humans and the environment at the laboratory

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**Abstract.** Safety Data Sheet (SDS) gave important information for safe chemicals handling and widely used in communicating chemical hazards. Laboratory as one of the places associated with the consumption of a number of chemicals, then the worker in laboratory have to know the information chemicals used. The purpose of this research is to know the perception and understanding of workers in a laboratory toward SDS. The quantitative research was used and the collect data by questionnaire using Likert scale, then analyzed descriptively. The total sample of data was twenty-seven of laboratory worker people. The finding from this study showed that a great majority of people agree SDS has benefits for workers in the laboratory, agree the SDS should be available in the workplace, feel the need to know the contents of the SDS, but not so many people agree 'I access SDS while working using chemicals' and great majority of people feel 'I obtained chemical information other than SDS'.

## 1. Introduction

Although it involves the use of a number of chemicals that may be harmful in their activities, the laboratory is considered a safe workplace because it consumes only a small amount of chemicals [1]. However, the existence of a laboratory can have a negative impact on the environment, thus having an obligation to reduce the impact it poses as a consequence of its activities [2] Because laboratory activity contributes to waste generation in quantity but contains many types of chemicals, many of which are toxic and unknown composition [3]. Cleaner Production (CP) promotion in sustainable development becomes a holistic and integrated strategy for primary prevention due to injury, illness and casualties related to environmental pollution and unhealthy and unsafe working environment conditions [4]. CP is often used interchangeably with pollution prevention including reducing, preventing and reducing waste generation from its source [5]. Waste reduction at the source is implemented through good management when acquiring materials, replacing toxic materials with other materials at lower hazard levels and with good laboratory practice [3] In which chemical information in Safety Data Sheet (SDS) is used to inventory the chemicals used and identify the possibility of replacement of materials with lower toxicity. The study of inventory and evaluation through SDS in a cotton / polyester fabric dyeing textile mill in Turkey found 74 of 291 chemicals can be replaced with other materials that are more biodegradable and lower toxicity levels [6]. In a study on the evaluation of Cleaner Production-Pollution Prevention in the form of Toxic Use Reduction in Massachusset, using SDS from suppliers, managers and team companies work together to assess and consider chemical hazards including toxicity, cost and waste management [4]. Development of the Greenness Index, a tool to provide a thorough assessment to evaluate the impact of reagents on Safety, Health and Environment (EHS), the analysis is based on information from SDS that contains information on the nature of reagents and their impact on SHE from cradle to grave [7], Evaluation of the efficiency and safety of cosmetic products with the availability of LD50 information on SDS found 276 chemicals banned from use and 65 allowed to be used [8], Based on SDS has evaluated 166 commercial cleaning products for washing food processing appliance from various countries including detailed observations of its composition and characteristics [9].

Based on some experiences of SDS utilization above it is known that SDS is an effective system for the management of chemical safety information to protect human (workers and consumers) and the environment. The purpose of this study was to know the perception of workers in a Indonesia chemistry laboratory toward SDS by using survey research.

## 2. Methods

The study adopted quantitative research with descriptive analysis. Data was collected from respondents through a questionnaire with 5 points Likert scale one (1) to five (5) being : (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree. The population was made up of all chemical laboratory workers with a total

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of twenty-seven people. Thus a maximum sample. Their job as analysts of several environmental quality parameters (as such BOD, COD, metals, MBAS, etc.) that use chemicals daily. Questionnaire includes respondents' responses on SDS, SDS's important role for laboratory workers, access to SDS when working on chemicals, obtaining chemical information from other than SDS, SDS availability and the need to know the content of SDS. Data were analyzed by calculating the average answer based on scoring each answer from the respondent.

## 3. Result and Discussion

Research questions given to respondents to identify as follow :
Q1, SDS is very useful for workers in the laboratory for safe handling of chemicals.
Q2, I access SDS when working with chemicals.
Q3, I obtained chemical information other than SDS.
Q4, SDS should be available in the workplace.
Q5, I feel the need to know the contents of SDS

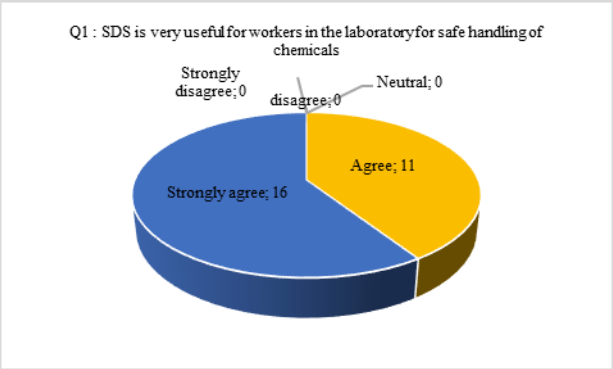


**Fig. 1.** Results of the first questionnaire, n=27

Score calculation results 'SDS is very useful for workers in the laboratory for safe handling of chemicals' (fig.1) It can be concluded all respondents agree SDS has benefits for laboratory workers for safety in handling chemicals with approval rating 92%.

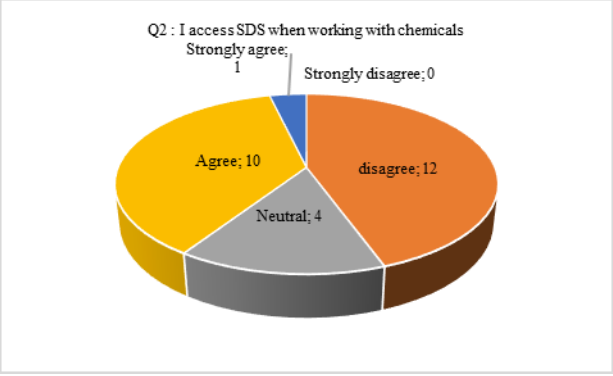


**Fig. 2.** Results of the second questionnaire, n=27

Dari 'I access SDS when working with chemicals' questionnaire (fig. 2) Although having only an 60% approval rating it can be concluded that laboratory workers agree to access SDS while working with chemicals. This is supported by the discovery of the third questionnaire where to 'I obtained chemical information other than SDS' (fig. 3) With an 79% approval rating, most workers agreed to feel that obtaining chemical information could be obtained other than SDS. From interviews that have been conducted, in daily work, respondents use hazardous chemicals, among others, sulfuric acid, nitric acid, chloroform, mercury (II) sulfate, silver (II) sulfate, nitrate reagent, sodium sulfate, potassium dichromate and hexane. They also feel able to obtain chemical information from other than SDS, ie from labels, TOK (transfer of knowledge) from colleagues, books, reference work instructions and internet.

The new culture of laboratory security and safety emphasizes experimental planning that includes regular attention to risk assessment and hazard considerations for yourself and others. Every worker in the laboratory should be aware of potential hazards and should reduce their numbers to a minimum. The dangers of exposure to toxic chemicals include acute toxicants, irritants, corrosive substances, allergens and sensitizers, asphyxiants, neurotoxins, reproductive toxins, developmental toxins, toxic substances, and carcinogens. A laboratory is exposed to various risks, both from within and outside the facility. Some of the risks can affect especially the laboratory itself as the dangers of flammable, explosive, and reactive chemicals pose a great risk to laboratory personnel, which if not handled properly will have an effect on the environment. In addition, almost all laboratory activities produce waste, including chemical spills. Laboratory waste includes chemical containers, filter media, aqueous solutions, and hazardous chemicals. This waste is potentially hazardous by having one or more properties of ignitability, corrosivity, reactivity, or toxicity [10]. Therefore, the knowledge and information of chemicals contained in SDS is helpful to minimize the various risks faced by workers and the environment around the laboratory.

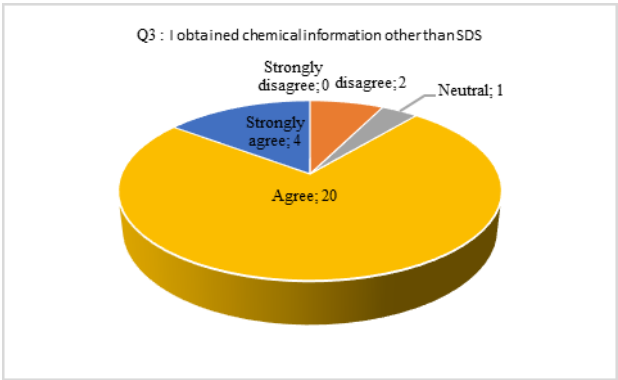


**Fig. 3.** Results of the third questionnaire, n=27

Among the current resources, SDS remains one of the best sources of information for evaluating hazards and assessing chemical risks [11] including the security measures that the user should follow [10].

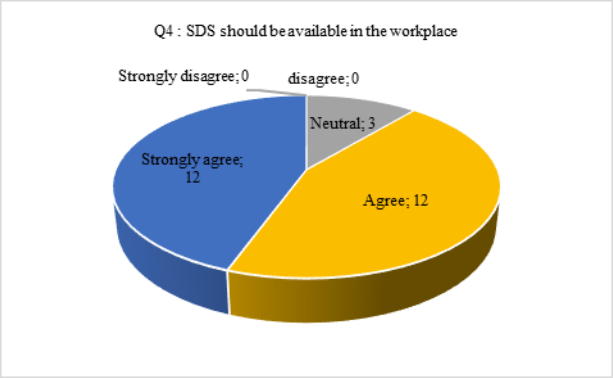


**Fig. 4.** Results of the fourth questionnaire, n=27

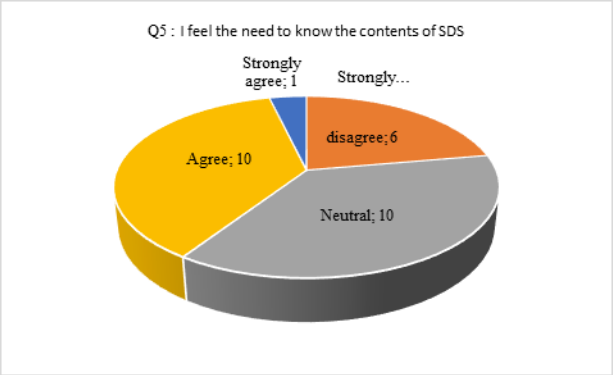


**Fig. 5.** Results of the fifth questionnaire, n=27

Nevertheless, with an 87% approval rating indicating the majority of workers agree that SDS should be available in the workplace (fig. 4). And feel the need to know the contents of SDS with approval rating 67% (fig. 5).

OSHA standards require manufacturers, distributors and importers of hazardous chemicals to provide SDS that explains potential hazards and other information, whereas business owners are required to provide SDS for any hazardous chemicals used including maintenance, distribution and accessibility of workers [12], Many labs now access SDS files electronically either from disk, internet or computer networks [11]. No matter what format MSDS is provided, the ability to understand its content or message is essential in protecting occupational health and safety, in fact by looking at several SDS n-Hexane from several countries: America, Korea, China and Persia interesting fact that internationally and in any language SDS has a section label that is very similar to the same 16 main sections [13] (1) Chemical product and company identification, (2) Hazard Identification, (3) Composition, information on ingredients, (4) First aid measures, (5) Fire-fighting measures, (6) Accidental release measures, (7) Handling and storage, (8) Exposure controls / personal protection, (9) Physical and chemical properties, (10) Stability and reactivity, (11) Toxicological information, (12) Ecological information, (13) Disposal consideration, (14) Information, (15) Regulatory information and (16) Other information.

## 4. Conclusion

The findings from this study showed that, (Q1) SDS is very useful for workers in the laboratory for safe handling of chemicals, approval rating 92%, (Q2) I access SDS when working with chemicals, approval rating 60%, (Q3) I obtained chemical information other than SDS, approval rating 79%, (Q4) SDS should be available in the workplace, 87%, (Q5) I feel the need to know the contents of SDS, approval rating 67%.

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