

Ammonia Exposure Among Citizen Living Surrounding Fertilizer Factory

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Abstract—Air pollution remains problem around the world. One of dangerous chemical substance is ammonia. Fertilizer factory emission is ammonia that could affect to people health. The purpose of this study was to describe ammonia effect to health among citizen living surrounding fertilizer factory. **Methods:** This study used cross sectional design. The population in this study was all people living surrounding Fertilizer factory with 300 meters, 800 meters and 2600 meter radius from the factory. The sample in this study was 130 samples. The data analysis was analyzed with univariate. **Results:** This study found that everyone living them ever had ammonia effect symptom at least two of symptoms, the highest number symptoms was dizzy and cough. The symptoms obtained consist of cough, nasal irritation, hard to breath, throat irritation, sluggish, dizziness, loss of appetite and itchy eyes. **Conclusion:** supplementation for people living surrounding factory fertilizer should be conducted to prevent more severity of ammonia.

Keywords: ammonia, fertilizer, factory

I. INTRODUCTION

Air is an important factor in life that must be protected for survival. The times have made air quality to change. Therefore, if development in various fields is not accompanied by good environmental management efforts, it can cause air pollution both directly and indirectly [1]. air pollutants are toxic gases and solid particles. These toxic gases come from burning fuel vehicles, from households and also from industry. These air pollutants are dispersed in the air, so that at certain levels air pollution is inevitable [2]. According to World Health Organization [3] air pollution causes respiratory and cardiovascular diseases, respiratory infections, and physiological changes such as lung function and blood pressure. Air pollution is estimated to contribute to 2 million deaths worldwide each year. More than half of these deaths occur in developing countries..

The prevalence of respiratory infections in Palembang in 2017 of 6.8% increasing in 2018 to 13.8% and the prevalence of ARI in settlements around the fertilizer factory was 11.47% in 2018 which showed that the figure still did not reach the specified indicator, namely 10 %[4]. One of the gases that plays a role in causing air pollution is ammonia gas. Air contaminated with ammonia gas can cause respiratory disturbances. At levels of 5-50 ppm ammonia gas causes dry nose, nerve fatigue, at levels of 1000-1500 ppm can cause dyspnea, chest pain, spasms of the respiratory tract and

delayed pulmonary edema which can be fatal [5]. High ammonia levels can be an indication of pollution of inorganic materials originating from domestic waste, agricultural fertilizer runoff and industrial waste [6]

The fertilizer industry production tended to increase every year so that the potential for waste has also increased. The raw material for making ammonia comes from natural gas obtained from oil companies with the main composition of methane (CH₄) around 70% and carbon dioxide (CO₂) around 10%. In the process of making urea fertilizer, the waste released containing ammonia in the form of gas can be dispersed up to 2600 meters from the ammonia tank [7]. If this waste is discharged directly into the ambient air and directly utilized by humans to breathe then this will affect the ambient air quality and reduce the degree of human health, not only will it provide potential hazards to workers, but also to the people who live around the factory. Several studies have shown differences in the intake of ammonia in the air between people who live around the industry and those far from the industry. As in the results of previous studies [8]. This study aim was to describe citizen health disorder as effect of ammonia exposure.

II. METHOD

A community based cross-sectional study was conducted in this study. Data were collected during house visits by face-to-face interviews using a structured interviewer-administered questionnaire to measure the symptoms. This study was conducted on July to November 2019. The subjects in this study were residents who lived around the Palembang City fertilizer factory within a radius of 800 meters, 1300 meters and 2600 meters from the factory. The location of this research is the area around the Palembang City fertilizer factory with a radius of 800 meters, 1300 meters and 2600 meters from the factory. Radius determination was based on previous research by Novrikasari [7].

The sample in this study were residents aged ≥ 18 years who lived around the factory and had lived for at least 3 years. The age criteria of 18 years are based on anthropometric uniformity and the minimum length of stay of

respondents was 3 years based on the previous study by Kilburn and Warshaw [9].

III. RESULTS

Characteristics of respondents by sex, marital status, last education, current employment status, current type of work, previous employment status and type of previous employment can be seen in table 1.

Table 1. Distribution of Demographic Characteristic

Characteristic		N	%
Sex	Male	15	11,5
	Female	115	88,5
Marital Status	Married	100	76,9
	Not married	26	20
	Widow	1	0,8
	Widower	3	2,3
Education	Elementary graduated	15	11,5
	Junior graduated	15	11,5
	Senior graduated	64	49,2
	Under graduated	36	27,7
Current Occupation	Working	52	40
	Not working	78	60
Type of current occupation	Trader	20	38,5
	Employee	19	36,5
	Labor	1	1,9
	Others	12	23,1
Previous occupation	Working	30	23,1
	Not working	100	76,9
Type of previous occupation	Trader	3	10
	Employee	7	23,3
	Labor	1	3,3
	Others	19	63,3

Participants in this study were more female as many as 115 (88.5%) with most having marital status as many as 100 (76.9%). Most of the respondents had a high school education of 64 (49.2%) with the most current work status not working as many as 78 (60%), respondents who currently work were mostly traders as many as 20 (38.5%).

Table 2. Distribution of Health Disorder symptoms

Health Disorder	N				%			
	Never	Ever	Always	sometime	Never	Ever	Always	sometime
Cough	3	10	42	75	2,3	7,7	32,3	57,7
Nose irritation	22	17	26	65	16,9	13,	20	50
Breathless	67	22	15	26	51,5	16,9	11,5	20
Throat irritation	27	22	13	68	20,8	16,9	10	52,3
Hot respiratory tract	43	22	6	59	33,1	16,9	4,6	45,4
Lesu	33	27	22	48	25,4	20,8	16,9	36,9
Skin sore	74	40	7	9	56,9	30,8	5,4	6,9
Dizzy	9	7	62	52	6,9	5,4	47,7	40
Loss of appetite	24	30	11	65	18,5	23,	8,5	50
Itchy eyes	47	17	16	50	36,2	13,	12,3	38,5

Based on table 5 it can be seen that the symptoms of health

problems most frequently experienced by respondents are headaches or dizziness by 62 respondents (47.7%) while health problems that most respondents have never experienced were skin sore as much as 74 respondents (56.9%).

Table 3. Distribution of Anthropometry

Type	Cut of Point	N	%
Age	> 34	61	46,9%
	≤ 34	69	53,1%
Weight (Kg)	> 58,28	62	47,7%
	≤ 58,28	68	52,3%
Intake rate (m ³ /hours)	> 0,6071	70	53,8%
	≤ 0,6071	60	46,2%

Anthropometric characteristics of the majority of respondents have age ≤34 years as many as 69 respondents with a percentage of 53.1%. The majority of respondents had body weight ≤58.28 kg, as many as 68 respondents with a percentage of 52.3% and the majority of respondents had an intake rate of > 0.6071 m³ / hour as many as 68 respondents with a percentage of 52.3%.

IV. DISCUSSION

Ammonia is a colorless sharp gas from one nitrogen element and three hydrogen elements with a boiling point of - 33.5° C. Major NH₃ emissions begin to occur from livestock, agriculture, industry sources and are strongly influenced by meteorological conditions, disperse quickly in the atmosphere causing the occurrence good mixing with air. Ammonia enters during breathing. Then, some of it enters the body and is absorbed by the lungs and then binds to the blood in the lungs. Blood from the lungs is then circulated to the heart through pulmonary veins. Then blood is circulated throughout the body through the kidneys through renal artery blood vessels. The effects caused by exposure to ammonia according to Roney and Lladós [10] vary depending on the level.

Ammonia does not only exist as a toxic gas and can cause harm to humans, but can also be used for daily life such as solid fertilizer (urea, ammonium nitrate, ammonium phosphate, ammonium sulfate) by the fertilizer industry and into atoms produced by the chemical industry. An important use of ammonia is to play a role in the process of making plastics and fibers, for example polyamides, melamine resins, urea-formaldehyde-phenol resins, polyurethanes, and polyacrylonitrile. Other uses of ammonia are to produce explosives, hydrazine, solvents, refrigerants, help reduce SO₂ from fossil fuel gas in energy plants with amines, amides, nitriles and other nitrogen compounds that act as dyes and pharmaceuticals. [11]

Acute exposure, increased ammonia concentration in ambient air causes irritation to the eyes and respiratory system, hoarseness, loud cough, shortness of breath, impaired vision, eye damage, blindness, dyspnea, cyanosis, and death. Direct contact with liquid ammonia can cause frostbite and

corrosion of the eyes and skin. Chronic exposure, can cause eye, nose and upper respiratory tract irritation, with coughing and shortness of breath [12].

Previous study conducted by Fedoruk, et al. [13] showed that the most associated with an increase in respiratory distress is ammonia and decreased respiratory disturbance when exposure to ammonia levels ranged from 1.60 mg / m³ and dust 2.63 mg / m³. Respiratory effects such as bronchial reactivity, inflammation, coughing, difficulty breathing, shortness of breath, reduced lung function. People can be exposed to ammonia by inhalation of gas or vapors, swallowed, or contact with the skin, in general it is through breathing (inhaled).

Ammonia in the form of gas is very light, lighter than air so that it can rise, in the form of steam, heavier than air, so that it stays below. The symptoms experienced can include watery and itchy eyes, nasal irritation, itching and tightness, throat irritation, esophagus and respiratory tract feel hot and dry, coughing. In high doses can cause blindness, lung damage, even death, ammonia can also enter the body through the skin [10]. Kilburn and Warshaw [9] found out of 94 cases, there were 20 which were fatal and needed treatment for 1 year or more.

Another cross sectional design study, in male workers in two fertilizer factories in Saudi Arabia, showed an association between ammonia gas exposure and respiratory symptoms including bronchial asthma. Workers at the first factory were exposed at levels of 2.82183.86 ppm having higher respiratory problems than workers at the second factory exposed at levels of 0.03-9.87 ppm [14].

Besides that, the weight of each individual must have different values due to various factors such as nutrition, consumption patterns, culture, hormones and the environment [15]. People with heavier weight will have higher intake rate. It was confirmed by Faisya, et al. [12]. They concluded the more body weight a person will increase the rate of intake received. The greater the respondent's weight the smaller the risk and vice versa the lower the respondent's weight the higher the risk received. Previous research has stated that weight and height can affect the strength of respiratory muscles and lung function. If a person has a tall body and a large body then the function of ventilation of the lungs is higher than people who are small and short. Height and weight can also affect the function of inspiration and expiration because the ability of the chest to inflate and deflate is different in each person with different height and weight. The greater a person's weight, the inhalation rate received will also be even greater [16-18].

IV. CONCLUSION

Most of people living surrounding fertilizer factory ever had the symptoms of health disorder as effect of ammonia exposure. Local government should implement the limitation of time to live surrounding the factory.

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