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Analysis of Benzene Concentration Effects at Workplace to the Phenol Concentration in Urine of Painting Workshop Labors in Makassar, Indonesia

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Abstract

Benzene in the body can cause central nervous system disorder, hematology disorder and the target is bone marrow. Benzene is used widely at the painting workshop as dissolvent since it is easily dissolved in paint. Workers who work at the workshop using spray paint have a high risk to benzene. The aim of the study was to analyze factors such as work experience, duration of spraying, ventilation, respirator and the most dominant factor affecting the Phenol level in the urine of the workers. The study was conducted at Painting workshop In Makassar and taking urine samples workers in the Occupational and Health Safety (OHS) laboratory. The study is done using a cross sectional design. The selection of samples was done by proportional random sampling with the Chi square analyses. The study benzene concentration in phenol level urine result that: (1) the employment duration ≤ 1 year (new) have poisoning 0%, normal 6,7% and the employment > 1 year (old) have poisoning 30%, normal 63,3%, (2) duration of spraying > 8 jam (long time) have poisoning 30%, normal 26,7% and spraying < 8 jam (short time) have poisoning 0%, normal 43,3%, (3) mild poisoning 26,6%, moderate poisoning 3,33%. The study indicates that benzene concentration have an effect Phenol levels in the urine are duration of employment and duration of spraying. It is recommended that control in working environment be done and use personal protective equipment for the workers. Related institution is hoped to control, guide and enforce rulers and legislation on matters pertaining to manpower especially occupational health and safety.

Keywords: Benzene Concentration; Phenol; Labors Urine.

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1. Introduction

The existence of the industry in a country can improve the economy and the welfare of society characterized by an increase in employment, but on the other hand may incur losses caused by the process in the industry. If the material use and processing for industrial is not quite right to be materially and adversely affected the labors form of exposure by hazardous materials and can damage the health of workers. The use of various types of materials will be adversely affected workers concerned the effects of chemicals on the health of workers if not controlled properly in the workplace. The amount of chemicals used is not accompanied by efforts to control chemicals in the workplace because of the lack of knowledge of the effects of chemicals on workers. One of the types of chemicals that have an influence on the health of workers and that are often found in industrial processes is benzene. Benzene is one of the pollutants that are known to have toxic properties good for the environment or labors. Benzene is an organic chemical compound which is an aromatic hydrocarbon compounds that are insoluble in water, soluble in alcohol and ether both. Benzene is an organic solvent which is good for paint, ink, rubber, resins, and varnish. In industry, benzene is used as a fuel as a chemical reagent and as a solvent. In Indonesia, data on the number of cases of benzene poisoning in 1980 on male labor force ages 18-55 have been exposed to benzene average of 26.7 ppm, work period of more than 2 years. Obtained significant changes in hemoglobin cadres, leucosis number, and the number of platelets [1].

Based on the test results of a large hall Occupational Safety and Health Makassar in 2000, levels of benzene in the working space of 4 companies with 7 number of measurement sites, 100% has exceeded the threshold value and the results of phenol in urine benzene-exposed workers from 58 people workers who examined 18 people (31.03%) of them have suffered poisoning. Based on the research results mentioned above, most labor is labor poisoned at painting workshop as much as 40% were poisoned. Painting is a car body repair shop that uses benzene as a solvent paint. Chemicals for paint solvents are widely used in industry; especially painting workshop that uses nonpolar organic compound is benzene. These chemicals are very nice used as a solvent paint, because it is volatile and fast drying. One concern is the negative impact of the workshop workers (labor) painting workshop premises every day struggle in chemicals, so it could be expected to pose a health hazard to workers labor painting workshop especially if it accumulates in the body. Benzene in the body supposedly transformed into phenol which may endanger the health of the human body, especially labor painting workshop especially in Makassar. According to the United States Environmental Protection Agency (USEPA), benzene, coupled with formaldehyde are the main pollutants contributions to the general cancer risk [2].

To prove the existence of a correlation of benzene to phenol content in the body repair shop workers painting research needs to be done to measure the concentration of phenol in urine labor painting workshop. This study aims to determine the effect of the concentration of benzene in the workplace on levels of phenol in urine based on years of service, length of exposure, the state of ventilation in the workplace and the use of PPE. Information obtained from this study can be used as an input and a reference development of public health sciences related to health and safety (OHS) and the input materials companies and agencies to conduct control benzene in the workplace so that no negative impact on the workers [2,3].

2. Materials and Method

This study is an observational study with cross sectional approach that intends to assess the effect of the concentration of benzene in the workplace of the phenol content in the urine of workers. This research was conducted at the workshop painting "Rumbia Jaya" Makassar as one of the largest painting company in Makassar and labor has representative as respondents. Sampling is purposive sampling with a sample (respondents) as many as 30 people and each unit represents an inclusive according to criteria that have worked for ≥ 1 year on parts repair continuously, workers aged between 18-56 years at the time of the study and are willing to participate as well as in research.

Data processing using SPSS version 14 to determine the effect of concentration of benzene to phenol by tenure, long exposure, ventilation and personal protective equipment. The statistical test used is the Chi-square test with 95% confidence level ($\alpha = 0.05$). Data analysis included univariate and bivariate to see the strength of the effect of the concentration of benzene to phenol.

3. Results and Discussion

3.1 The concentration of benzene in the Work Environment

Based on measurements in this study, the concentration of benzene was excess NAB namely Polishing Putty (25 mg / m3), putty (10 mg / m3), weld (5 mg / m3) and finishing (5 mg / m3).

Table 1: Results of measurement of benzene Concentration in painting workshop, 2009

No	Working Place	Benzene Concentration (mg/m^3)	Standard
1	Painting	45	> NAB
2	Putty Polishing	25	< NAB
3	Putty	10	< NAB
4	Weld	5	< NAB
5	Finishing	5	< NAB

Benzene Standard = 32 mg / m3 Circular Labour Minister SE.01 / MEN / 1997

The concentration of benzene is the air density in the working environment where workers are doing work that is calculated in part a million or mg / m3. The results of measurements at five working parts, namely the Painting, Polishing Putty, Putty, Welding and Finishing. Working conditions in general have been contaminated with benzene concentration, although at the time of the research results obtained Painting location is quite high due to the location of mixing paint, while the location of putty has a short distance to the workshop where the work is performed in a closed space conditions without ventilation can suck contaminants are inhaled by workers.

We observe a correlation between the concentration of benzene which exceeds the NAV of the phenol content in

the urine of p <0.05. Working environment contaminated with benzene concentrations high enough will affect the productivity of the labor force due to the anemic with the physical condition of the body will be weakened, so the ability to work decreased. Evident from the results obtained interviews were the most frequent complaints of dizziness, fatigue and weak.

3.2 Phenol Concentration in Urine labor

Based on the examination of the results of this study indicate that benzene concentrations below the TLV on levels of phenol in urine were 21 (70%) of benzene concentrations above normal and NAB were 9 people (30%) positive poisoning. The analysis showed a significant association between the concentration of benzene in the workplace against phenol in urine.

Table 2: Effect of Phenol Concentration to the Benzene Levels in Urine of Respondents of Painting workshop, Makassar Year 2009

Benzene Concentration	Phenol Concentration				Total	
	Normal		Poisoned			
	n	%	n	%	n	%
< NAB	21	70	0	0	70	70,0
> NAB	0	0	9	30	30	30,0
Total	21	70	9	30	100	100

Increased levels of phenol in urine of labor due to several factors: physical factors agent, factors associated with exposure, human factors and environmental factors [1, 3]. Based on the results of the study found 9 people (30%) were exposed to benzene in the workplace exceeds TLV. The concentration of benzene in the workplace affect the levels of phenol in urine, this is due to the more exposure through inhalation (breathing) approximately 40-60% of the inhaled and limited absorption through intact skin can occur through direct contact.

3.3 Correlation long exposure to phenol in urine

Exposure time > 8 hours (long) to the phenol content in urine of 8 people (26.7%) of normal and 9 people (30.0%) positive poisoning. Long exposure ≤8 hours (not for long) as many as 13 people (43.3%) of normal and there is no poisoning.

Direct relationship between the level of exposure and concentration of benzene in the air respiration. Toxicity of chemicals affect the exposure itself. Benzene-exposed workforce > 8 hours a day would affect the levels of phenol in urine, compared to the unexposed < 8 hours a day [4,5]. Long exposure is the amount of time spent in

the labor force work during exposure to benzene. The results were obtained in which the value of p = 0.002 p <0.05. Labor much to complain of symptoms of leukemia allegedly caused by the concentration of Benzene, this is due to long exposure affects the concentration of benzene with an average service life of 2-5 years.

Table 3: Effect of Phenol Concentration to the Benzene Levels in Urine of Based on the exposure duration among respondents of painting workshop, Makassar Year 2009

Exposure duration	Phenol Concentration				Total	
	Normal		Poisoned			
	n	%	n	%	n	%
≤8 hours (Not Long)	13	43,3	0	0	13	43,3
>8 hours (Long)	8	26,7	9	30	17	56,7
Total	21	70,0	9	30,0	30	100

3.4 Correlation of ventilation on levels of phenol in urine

Good ventilation state against phenol levels in the urine were 18 people (60.0%) of normal and poorly ventilated state were 9 people (30.0%) positive poisoning, where three were people (10.0%) normal.

Table 4: Effect of Phenol Concentration to the Benzene Levels in Urine Based on Ventilation at painting Workshop, Makassar 2009

Ventilation	Phenol Concentration				Total	
	Normal		Poisoned			
	n	%	n	%	n	%
Good	18	60,0	0	0	18	60,0
Poor	3	10,0	9	30	12	40,0
Total	21	70,0	9	30,0	30	100

Flow process, air change and air quality there is a relationship with a hole ventilation, the incoming air quality, temperature, humidity, good ventilation, the air temperature is not greater than 300C with a wind speed of 0.5 m / sec [6,7]. The results of the study (Table 4) that workers who work with poor ventilation conditions tend to be poisoned were 9 people (30%), while those with good ventilation conditions, there are no benzene poisoning. This study is in line with research on the shoe factory workers in Turkey (1992), workers exposed to benzene, ventilation does not meet the standards and levels of 210-650 ppm benzene for 1-15 years have a risk of

leukemia.

3.5 Correlation of Personal Protective Equipment against Phenol Levels in Urine

The number of respondents to the phenol content in the urine results with the use of personal protective equipment were 21 people (70%) of normal and 9 (30%) poisoning. This is due to no respondents wear personal protective equipment such as respirators, so the opportunity for the phenol poisoning due to benzene concentration has exceeded the threshold limit value. Personal protective equipment is a device used to reduce the level of exposure to benzene into the body of workers. But the reality on the ground there is no labor use PPE (respirators) in part mixing paint, polishing and putty. The results of interviews with workers that the company does not provide PPE, ignorance types of PPE and not know the impact of the chemical benzene. In general it can be said that the use of PPE is supported by knowledge management companies and labor as well as awareness of the impact caused by the benzene [7,8,9]. Although industrial sources promote significant occupational exposure and emission to the environment, emissions from painting, automobile tailpipe exhaust account for the largest source of benzene in the environment [10, 11].

4. Conclusion and recommendation

4.1 Conclusions

4.1.1 The concentration of benzene in the workplace affect the levels of phenol in urine of painting workshop workers "Rumbia Jaya", the higher the concentration of benzene in the workplace, the greater the risk of accidental poisoning.

4.1.2 The tenure of the effect on the levels of phenol in urine of painting workshop workers "Rumbia Jaya", the longer the service life of the greater risk of accidental poisoning in workers.

4.1.3 Long exposure effect on levels of phenol in urine painting workshop workers "Rumbia Jaya", the longer the exposure time, the greater the risk of accidental poisoning in workers.

4.1.4 The state of ventilation did not affect the levels of phenol in urine of painting workshop workers "Rumbia Jaya".

4.1.5 The use of personal protective equipment had no effect on levels of phenol in urine of painting workshop workers "Rumbia Jaya".

4.2 Suggestions

4.2.1 The company is expected to exercise control over the work environment particularly the work with benzene concentrations that exceed the threshold limit value.

4.2.2 Manpower with long exposures> 8 hours at the location of painting offered a break twice a day during working hours ie every 4 hours worked to reduce exposure to benzene in a relatively long time.

4.2.3 The need to increase knowledge and awareness of all the workers at the work unit especially the painting of the importance of the use of personal protective equipment. The type of personal protective equipment that can be used is the respirator.

4.2.4 It is expected to management especially K3 unit can execute a program plan that is real in order to prevent employees experience Benzene poisoning, such as monitoring health conditions of employees in particular physical conditions of labor.

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