

## Effect of Exposure to Benzene Vapor against Immunoglobulin G And Worker Health Complaints at Gas Stations in Surabaya Through Phenol Levels in Urine

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**Abstract:-** This study aims to analyse the effect of exposure to benzene vapor against immunoglobulin G and worker health complaints at gas stations in Surabaya through phenol levels in urine. The research methods of this study is Analytic observational with cross-sectional study. The sample in the study group of 11 people exposed to the gas station operator and unexposed groups of 11 administrative officers gas stations. Data collection techniques with interviews, measurement of the levels of benzene in the air, the measurement of phenol in urine, blood sampling and questionnaires. Independent variable is the concentration of benzene in the air. Dependent Variable is the concentration of immunoglobulin G and health complaints. Variable between is the phenol content in the urine. Age, nutritional status, length of service and length of employment is confounding variable. Result: The mean levels of benzene where the operator of 1.4454 ppm and administrative space for 0.1234 ppm. Mean urine levels of phenol in the exposed group is 36, and the 6064 ppm group was not exposed to 2.9773 ppm. Mean levels of immunoglobulin G in the exposed group was 1518.7 mg/dl and non-exposed groups at 1048.8 mg/dl. Most health complaints in the group is exposed and unexposed nervous system disorders. By using linear regression, the levels of benzene in the air significantly affect the levels of phenol in urine ( $p > 0.05$ ) and phenol in urine affect the increase in immunoglobulin G ( $p < 0.05$ ). Whereas phenol in urine no effect the health complaints using logistic regression. Conclusion: exposure to benzene vapor affect the increase in immunoglobulin G and no effect health complaints.

**Keyword:-** exposure to benzene vapor, gas stations, phenol content in urine, immunoglobulin G, health complaints.

### I. INTRODUCTION

Product gas station which consists of a premium, pertamax, and solar are crude oil processing results that have hydrocarbon compound. One of substance in gas that lead to cancer is benzene [1,2,13,10,11,12].

Benzene has a volatile nature and slightly soluble in water [1,3]. Benzene that enters the body will undergo metabolism, into *benzene epoxide* in the liver which is a compound that is not stable and will soon experience a change in the phenol form will be issued through urine. Therefore, the levels of phenol in urine is used as a biological indicator of exposure benzene in the workforce. more high phenol content in urine indicates more the high degree of poisoning benzene [8,9]

The clinical effects of systemically benzene causes disorders of the cardiovascular, respiratory, neurological, gastrointestinal, liver, renal, endocrine and reproductive systems, dermatology, local effects, haematological, immunological, metabolic and allergic reactions. In chronic exposure to benzene show an effect on cellular and humoral immunity. Previous research suggests that exposure to benzene 3-49 ppm at 35 painters and a higher concentration in *toluene* and *xylene*, increase of serum IgM and IgG and IgA lowers serum [3,15,7,10].

Research shows the results of measurements of benzene in the gas station 5 point Surabaya exceeds the NAV is 9.6085 ppm, 9.7215 ppm, ppm 11.7375, 10.4705 and 10.2975 ppm. Measurement of urine phenol in the gas station workers showed that 6 of the 28 respondents, phenol content  $> 10$  mg / l (not normal) [14].

City of Surabaya is a big city in East Java with considerable number of gas stations. Gas stations with considerable sales are retail outlets in st. Sisingamangaraja, st. Kenjeran and st. Sumatra, Surabaya. Sales at gas station on average 35,000 liters per day with 8 hours of exposure to each worker per day. Exposure continues - constantly on the product gas stations can affect the health of workers resulting in lower labor productivity and increases morbidity and cost of treatment.

#### 1. Methods

By type, this study was an observational analytic study with cross-sectional study *cross-sectional study* were performed on 2 populations is exposed population (studies group) and unexposed populations (comparison group).

The study population, the study group was all operators of gas stations and a comparison group is all gas stations administrative officer. The study sample for the study and comparison groups were 11 operators and administrative personnel after the inclusion criteria were randomized simplistic.

The independent variable of this research that the levels of benzene in the air. The dependent variable of this study is immunoglobulin G and health complaints. Variable between this research that the levels of phenol in urine. To potentially confounding variables such as age, nutritional status, length of service and length of employment.

Data was collected by measuring benzene in the air using GC / FID & HC analyser, measurement of phenol in urine using spectrophotometry, the concentration of immunoglobulin G obtained by blood sampling then in a centrifuge to take the serum and then used the ELISA technique. The data collection of health complaints, age, nutritional status, length of service and length of work is obtained by interviews using questionnaires. Linier regression and logistic regression was used to assess the influence between variables.

## II. RESULTS AND DISCUSSION

### a. Levels of Benzene in the Air

**Table 1. DistributionOf Benzene Based On Workplace at gas station Surabaya**

Levels of Benzene	Workplace	
	the operator (ppm)	Officer (ppm)
<b>Minimum</b>	0.9446	0.0569
<b>Maximum</b>	2.0714	0.2495
<b>Mean / SD</b>	0 1.4454 / 0.5737	0.1234 / 0, 1092

Levels of benzene in the air have a concentration of between 0.002 to 34 ppb. People who live in cities or industrial environment can generally be exposed to benzene at levels greater. People exposed to benzene would be even greater if he worked in the petroleum industry such as oil processing unit, gas stations and petrochemical industry [3].

Based on the results of the study showed levels of benzene vapor at a higher operator works even exceed NAB stated in the Decree of the Minister of Manpower and Transmigration No.Per.13 / MEN / X / 2011 on the Threshold Value Factor Physical and Chemical Factors in the Workplace 0,5 ppm for benzene. This means that exposure to benzene in the carrier (average of 1.4454 ppm) as the exposed group larger than the space administration (average of 0.1234 ppm) as the non-exposed group. Research also showed levels of benzene in place the operator exceeding the threshold limit value [14].

### b. Phenol Levels In Urine

**Table 2. Distribution of Phenol Levels in Urine Based the Workers ‘ Group in gas station Surabaya**

Phenol Levels In Urine	Exposed group (ppm)	Unexposed group (ppm)
<b>Minimum</b>	18.04	0
<b>Maximum</b>	64.06	16.34
<b>Mean / SD</b>	36.6064 / 15.6671	2.9773 / 5.1084

**p = 0.000**

**P <0.05 (significant)**

Benzene that enters the body will have become the primary metabolism is benzene epoxide in the liver which is a compound that is not stable and will soon experience a change in the phenol form will be issued through the urine, so that phenol is used as a biological indicator of exposure over benzene on labor[16].

Based on the research showed that urinary levels of phenol in the exposed group is higher than the unexposed group. Average urine levels of phenol in the exposed group were 36.6064 ppm whereas the unexposed group was 2.9778 ppm. According to WHO levels of phenol in urine exceeds 10 ppm indicate the presence of benzene exposure [17]. The mean urinary levels of phenol in the exposed group, exceeding normal limits. Research previously also showed that levels of phenol in urine were higher in people who are exposed to benzene than people who are not exposed to benzene [14].

**c. The concentration of immunoglobulin G**

**Table 3 Distribution of Concentration Immunoglobulin G Based Workers Group retail outlets Surabaya**

The concentration of IgG	Exposed group (ppm)	Unexposed group (ppm)
Minimum	1254	680
Maximum	2066	1237
Mean / SD	1518.7273 / 322.1745	1048.8182 / 176.8172

**p = 0.001**  
**p <0.05 (significant)**

Increased immunoglobulin G associated with benzene exposure in workers. It was also like benzene metabolites that cause antibody formation during benzene exposure [6]. The results showed that serum IgG exposed group is higher than the group not exposed. Average IgG exposed group was 1518.7 mg / dl while the median IgGof group not exposed to 1048.8 mg / dl.

**d. Analysis of Effects of Benzene Levels In The Air Against Phenol Levels In Urine**

**Table 4 Results of Linear Regression Test Effect of Benzene Levels In The Air, Age, Nutritional Status, Future Work, Old Work Against Phenol Levels In Urine at the pump Surabaya**

	Phenol Levels In Urine
Levels of Benzene	0,000 *
Age	0.779
Nutritional Status	0.671
Work Period	0.471
Older Work	0.390

**\* P <0.05 (significant)**

Levels of benzene in the air has a concentration of between 0.002 to 34 ppb. People who live in cities or industrial environment can generally be exposed to benzene at levels greater. People exposed to benzene would be even greater if he worked in the petroleum industry such as oil processing unit, gas stations and petrochemical industry [3].

Research shows the results of measurements of benzene in the gas station 5 point Surabaya exceeds the NAV is 9.6085 ppm, 9.7215 ppm, ppm 11.7375, 10.4705 and 10.2975 ppm. Measurement of phenol in the gas station workers showed that 6 of the 28 respondents, phenol levels > 10 mg / l (not normal). This study showed benzene levels associated with higher levels of phenol in urine [14].

The analysis shows that there are levels of benzene in the air influence on levels of phenol in urine. Frequency during a refueling allows the exposed group more than the group exposed to benzene vapors are not exposed. It is evident that the levels of benzene in the administration of a small space, then the benzene that enters the body slightly so that the phenol urinecontent in small. And vice versa levels of benzene in the big operators, the benzene that enters the body much so that levels of phenol in urine large. Age, nutritional status, length of employment, length of employment and no effect on levels of phenol in urine.

**e. Influence Analysis of Phenol Levels In Urine Against Serum IgG concentration**

**Table 5 Results of Linear Regression Analysis Test Effect Of Phenol Levels In Urine against Serum Immunoglobulin G Concentrations of Gas Station Worker in Surabaya**

	The concentration of IgG
Phenol Levels In Urine	0,000 *
Age	0,005 *
Nutritional Status	0.464
Work Period	0,037 *
Older Work	0.152

**\* P <0.05 (significant)**

Research shows that the immunological system can be easily exposed to chronic exposure at low concentrations, so that the people who live around the area can be exposed to hazardous waste disposal either through the air, contaminated water nor foods that affect the immunological system [3,4].

Research showed increasing immunoglobulin G associated with benzene exposure in workers. It was also like benzene metabolites that cause antibody formation during benzene exposure [6]. Research also showed immunoglobulin G on taxi drivers exposed to benzene greater than the control group. The concentration of benzene in the workplace was significantly correlated with the concentration of immunoglobulin G [5].

The results of the analysis according previous studies showing that there is influence of phenol in urine to serum IgG concentration. Serum IgG concentration greater than the group exposed to serum IgG concentration unexposed group. Greater exposure and more often causes benzene enters the body more, thereby increasing serum IgG concentration. Age and tenure affect the concentration of IgG while the nutritional status and length of employment has no effect.

**f. Influence Analysis of Phenol Levels In Urine Against Health Complaints**

**Table 5 Results of Logistic Regression Analysis of Effect of Levels Phenol In Urine Against Health Complaints of Gas Station Workers in Surabaya**

	<b>Nervous System Disorders</b>	<b>Hematologic Disorders</b>	<b>Kidney Disorders</b>
<b>Phenol Levels In Urine</b>	0,118	0,797	0,309
<b>Age</b>	0,900	0,350	0,273
<b>Nutritional Status</b>	0,138	0,312	0,684
<b>Work Period</b>	0,049*	0,264	0,369
<b>Older Work</b>	0,631	0,476	0,706

**\* P <0.05 (significant)**

The clinical effects of systemically benzene causes disorders of the cardiovascular, respiratory, neurological, gastrointestinal, liver, renal, endocrine and reproductive systems, dermatology, local effects, haematological, immunological, metabolic and allergic reactions [3,15,7,10]. Based on the results of questionnaires obtained at most health complaints the complaints of nervous system disorders. But in this study there was no effect of phenol in the urine of the health complaints nervous system disorders, hematologic disorders, and renal disorders. Causes perceived health complaints respondents can be caused by other factors. And complaints of interference to the nervous system are affected by the respondents working respondents.

**III. CONCLUSION**

Levels of benzene in the air affect significantly the levels of phenol in urine. Exposure to benzene vapor affects the increase in the concentration of immunoglobulin G through the levels of phenol in urine. Age and work period affecting serum IgG concentrations. Exposure to benzene vapor does not affect the health complaints (nervous system disorders, hematologic disorders, renal impairment) through the levels of phenol in urine. However, complaints nervous system disorders are influenced by work period of the respondent.

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