

The Influence of Wooden Dust Exposure to the Lung Function and Design of Local Exhaust Ventilation at Furniture Company Ud. Suro Lestari in Sidomulyo - Kediri

Susmiati¹, Samik Munawar², Y. Denny Ardyanto², Lilis Sulistyorini³

¹(Program Doctoral of Public Health Department, Airlangga University, Surabaya, Indonesia)

²(Safety and Health occupational Department, Airlangga University, Surabaya, Indonesia)

³(Environmental Health Department, Airlangga University, Surabaya, Indonesia)

Abstract:- The aims of this study were analyze the factor influencing the lung function to the furniture company workers at UD. Suro Lestari and making the Local Exhaust Ventilation design. This research was conducted with the use of observational method with cross-sectional research design. This research used simple random sampling technique by the sample size were 28 workers. The data was collected by interview, observation and measuring of height and weight, the dust degree and the lung function. Data was analyzed by *chi square* and *logistic regression* test. The results showed that the dust degree in the finishing location was 17,45 mg/Nm³ and 3,02 mg/Nm³ in other locations of workplace. The lung function was measured use spirolab III ver. 2,7 showed that 11 workers (39,3%) had abnormal lung function and 17 workers (60,7%) had normal lung function. The Fisher's test showed there was correlation between the wooden dust degree (p=0,008), work duration (p=0,019) and the use of masker (p=0,003) to the lung function. The logistic regression test showed that the wooden dust exposure, work duration, and the use of masker influenced to the lung function. Using local exhaust ventilation in the workplace can reduce the wooden dust concentration.

Keywords:- employee, dust, local exhaust ventilation, lung function

I. INTRODUCTION

The air which contains wooden dust particle may cause pneumoconiosis when inhaled. This disease was caused by working. The workers who work with the wooden dust inhaling will take a risk of getting the decrease of the lung function and will feel some disturbances in the respiration channel. Based on the interview results to 15 workers at furniture company UD Suro Lestari, there were 40% of the workers who got the disturbance in their health such as cough, asphyxia, and sneezing when inhaling the wooden dust and 20% of them often got cough every time they finish working. There has never been the medical treatment done in relation to those disturbances in the worker's health. Because of those disturbances in the worker's health, 30% of the workers are often absent from working in a week. This shows a very high level of the health problems caused by working factors. The prevention and control can be done by using or making the local exhaust ventilation.

II. MATERIALS AND METHODS

This research was used observational method collaborated with cross-sectional design. The sample of participants was done by Simple Random Sampling technique. There were 28 workers who participated in this research. The data were collected by doing the interview, observation in the workplace, height and weight measuring, the total of dust degree, and the lung function measuring. The independent variables in this research were wooden dust exposure, work duration, age, nutrition status, personal working history, personal respiration disease history, smoking habit, physical exercise habit, and the use of masker. The dependent variable was the lung function. The data analysis involved bivariat analysis use Fisher's test and multivariate analysis using logistic regression test. The design of the local exhaust ventilation was based on the observation conducted in the workplace and the measurement to the tools with most causing the emerge of wooden dust.

III. RESULTS AND DISCUSSION

The degree of dust measuring in this furniture company was done in two different locations – the finishing area/location and other common locations. It was found that the degree of dust in the finishing area was about 17,45 mg/Nm³ and 3,02 mg/Nm³ in other common locations. The lung function measuring showed that there were 11 workers who got abnormal lung function and 17 workers who had normal lung function (see table 1).

Table 1. Distribution of worker’s lung function conditions in 2013

Lung Function	Locations	
	Common Locations N (%)	Finishing location N (%)
Normal	13 (76,5%)	4 (23,5%)
Abnormal	2 (18,2%)	9 (81,8%)
Total	15 (100%)	13 (100%)

The bivariate analysis between dependent and independent variabel showed that variables the wooden dust exposure, work duration and masker usage were correlate with the lung function. It can see on table 2.

Table 2. The result of bivariate analysis between wooden dust exposure, work duration, work hours, age, nutritional status, working history, history of disease, smoking history, Physical Exercise Habit and Masker usage with the lung function.

Variables	p- value
Wooden Dust exposure	0,008
Work Duration	1,000
Work Hours	0,019
Age	0,638
Nutritional status	0,543
Working History	1,000
History of disease	0,393
Smoking History	0,062
Physical Exercise Habit	0,701
Masker usage	0,003

Meanwhile, the multivariate analysis was aimed at knowing the influence of the independent variables to the dependent variable by using logistic regression test. It was found that there was an influence between wooden dust inhaling (p= 0,040) and the masker usage (p= 0,014) to the Lung function (see table 3).

Table 3. The Result of logistic regression analysis

Variable	Koefisien	p-value
Wooden Dust exposure	3,253	0,040
Work duration	2,953	0,056
Masker usage	3,280	0,027
Constant	-5,125	0,014

So the equation was $y = -5,125 + 3,280 (\text{Masker usage}) + 2,953 (\text{work duration}) + 3,253 (\text{wooden dust exposure})$.

The observation conducted in the research location showed that the finishing location had more degree of dust those other common locations in the workplace. The degree of dust in the finishing location was 17,45 mg/Nm³ and could be controlled by decreasing the degree of the dust in that location. The decrease of the dust degree in the finishing location was useful to reduce the risk of the abnormal lung function. The control of the high dust degree could be done by making the Local Exhaust Ventilation the system of Local Exhaust Ventilation consists of hood, duct, filter, fan and receptacle. In the finishing location, there were many working tools that can produce much wooden dust such as sandpaper machine and grindstone. The result of measuring the dust degree to the workers using grindstone machine showed 23,57 mg/Nm³ with the use of Personal Dust sample. One of the hoods that was specifically used by the workers with the use of sandpaper and grindstone machine had the function to avoid the spread of the wooden dust resulted from the working process of wood.

IV. DISCUSSION

The wooden dust inhaling could influence the worker’s lung function. The higher wooden dust inhaling the workers had, the more abnormal the worker’s lung function got. This was cause by most of the workers who had abnormal lung function worked in the finishing location with the degree of dust 17,45 mg/Nm³. That wooden dust inhaling was supposed to be the most influencing factor that could cause the abnormal lung function disturbances. It was about 14 times higher than the worker who worked in the location having the

degree of dust under NAB³. The dust with less than 2,5 mm is more influencing to the health than those with bigger size. The dust with smaller or similar to 1 mm will precipitate in the Sacus Alveolaris and those with 2-5 mm will precipitate in the Tracheo Bronchiolar.

There was an influence between the use of masker to the lung function in the workplace location of UD Suro Lestari. The workers who worked in the dusted location needed the masker to reduce the dust particle inhaled into the respiration channel. There were 8 workers who did not wear masker when working and had abnormal lung function, and there were 3 workers wearing masker when working and had abnormal lung function. the wearing masker workers who had abnormal lung function could be caused by the low quality of the masker worn by the workers and the wrong time of wearing the masker by the workers – most of the workers above liked to wear the masker in the middle of working. The workers who wore the maskers before starting to work could minimize the number of wooden dust particle inhaled.

Design of Local Exhaust Ventilation

The control which was done to reduce the high concentrate of the wooden dust degree in the finishing location needed the Local Exhaust Ventilation for certain works such as grinding. An effort to control the risk at the workplace could be done by making the ventilation.

The design of the Local Exhaust Ventilation for the furniture company consists of four components namely hood, duct, fan, air cleaner, and receptacle.

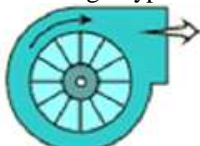
Hood was divided into two parts – permanent hood and portable hood. Hood was supposed to be the wooden dust catcher tool resulted from grinding machine process. The design of the hood has the function to arrange the air movement.

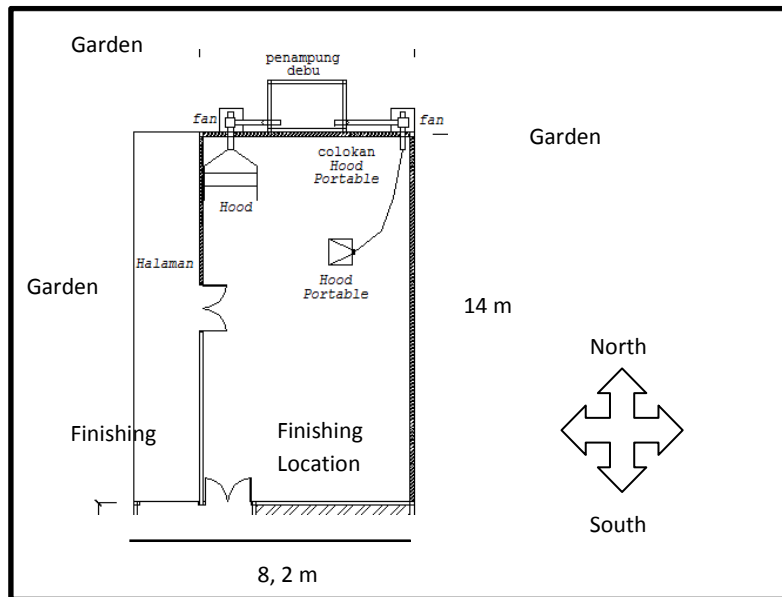
Duct was the connector way between the hood and fan or air cleaner. Through this duct the contaminant was moved from the working area to wooden dust receptacle. The speed of the air flow in the duct must be high to avoid getting the precipitation of the wooden dust inside the duct. Based the regulation of LEV design by OSH Division of Ministry of Man Power of Singapore year 2006, it was decided that the duct must have diameters about 100 – 200 mm with the speed of air flow around 10-12,5 m/s for the class 2 wooden dust classification. Hence, there are six pipes used in this duct design.

Fan has the function to absorb the contaminant fro hood through the duct. This fan must have enough pressure to bring the wooden dust to the receptacle. The type of fan used in this design is centrifugal fan. In this type, the fan motor is located or covered in the fan house to make it more comfortable and avoid the sparks of flame that may cause fire. Based on the wind speed in the duct, it can be decided that the fan capacity in supplying the air is about 656,3 cmh (Cubic per Hours).

Receptacle was used to accommodate the contaminant from the hood. The design of this receptacle or drip cup may contain about the dust filter as the place for the clean air to come out from the wind force. The system of this receptacle or drip cup uses settling chamber where the dust will be precipitated inside this receptacle, and the coming out air will be sieved by the dust filter around the receptacle. The detail materials about the design of the local exhaust ventilation are showed as follows:.

Table 3. The design location of Local Exhaust Ventilation.

Part	Materials	Usage
Hood	Aluminum Plat with 0,2 mm thick	The cover of hood frame
	Aluminum Box Pipe	Hood frame
	Aluminum Filter with 2 mm diameters	The dust filter is fixed inside the hood to avoid the bigger dust coming into the fan
Duct	PVC materials with 6 size	The connector to the pipe turn
	PVC pipe with 6 size	
Fan	Centrifugal type fan with radial inside	The dust absorber
	 Radial	
	Paired/Fixed brick	Fan place
Receptacle – Drip Cup	Wall	The dust filter
	Clothe	The air filter coming out from receptacle



V. CONCLUSION

The finishing area in the workplace had more degree of dust than other locations in the workplace. The number of workers who had the lung function was not normal to work in the finishing area. The factor influencing to the lung function to the furniture workers at UD Lestari was the spread of wooden dust and the masker usage.

ACKNOWLEDGEMENTS

The use of Local Exhaust Ventilation in the finishing area of workplace could reduce the degree of the dust there. So that, the decrease of the lung function to the workers could be prevented. The use of masker in a short time before beginning to work could reduce the number of dust particle inhaled in the respiration channel.

REFERENCES

- [1]. Soeripto, *Higiene Industri*. Jakarta: Fakultas Kedokteran Universitas Indonesia; 2008).
- [2]. Suma'mur, *Higiene Perusahaan Dan kesehatan Kerja (Hiperkes)*. Jakarta: SagungSeto; 2009.
- [3]. Triatmo. W., M.Sakundarno A.,Yusniar H.D.,) *Paparan Debu Kayu dan Gangguan Fungsi Paru Pada Pekerja Mebel (Studi di PT. Alis Jaya Ciptatama)*.www.ejournal.Undip.ac.id; 2006..
- [4]. Aji, S. D., Maywati, S., Faturahman, Y., Siliwangi, K. U., Keselamatan, D. P. B., Ilmu, K. K. K. F., & Siliwangi, K. U. *Dampak Paparan Debu Kayu Terhadap Keluhan Kesehatan Pekerja Mebel Sektor Informal* Disindang Galih Kelurahan Kahuripan Kecamatan Tawang Kota Tasikmalaya Tahun 2012. Jurnal FKM Univ. Siliwangi; 2012.
- [5]. Hughes.Phil, Ferret.Ed, *Introduction to Health And Safety At Work Fourth Edition*. NEBOSH: Elsevier; 2009.
- [6]. Hodgson. Ernest., *A Textbook Of Modern Toxicology Fourth Edition*, New Jersey John Wiley & Sons, inc., publication, 2010.
- [7]. Mukono. H.J, *Toksikologi Lingkungan*.Surabaya: Airlangga University Press;2005
- [8]. Levy, Stuart A, *Introduction to occupational pulmonary disease*. In : Carl Zens. *Occupational Medicine*, 3th ed. London : Mosby; 1994.