

Relations between Contact Duration, Type of Work Use of Personal Protective Equipment and Contact Dermatitis among Electroplaters

Hubungan antara Lama Kontak, Jenis Pekerjaan dan Penggunaan Alat Pelindung Diri dengan Dermatitis Kontak pada Pekerja Electroplating

Danang Setia Budi

CV. Setia Sari

Sukolilo, Surabaya, East Java, 60111 Indonesia

ABSTRACT

Introduction: Occupational contact dermatitis is defined as a skin disorder that occurs after work and caused by work process. Electroplating is one of the jobs which has high contact dermatitis risk because there are irritant chemicals such as nickel and chromium. This study aimed to identify the relationship between risk factors for occupational-induced contact dermatitis and electroplaters at CV. X and CV. Y, Durungbanjar Village, Sidoarjo District. **Method:** This research was an observational study using cross-sectional approach. The sample was a total population of 28 people, consisting of 13 electroplaters at CV. X and 15 electroplaters at CV. Y in Durungbanjar Village. The study was conducted in November - May 2019. Data were collected using questionnaires, observations and medical record sheets. The variables in this study were contact duration, contact frequency, type of work and the use of personal protective equipment. **Result:** Result showed that 64.3% of electroplaters suffered from contact dermatitis. Contact duration factor had a very strong correlation of $c = 0.764$, contact frequency factor had a strong correlation of $c = 0.710$, type of work had strong correlation of $c = 0.616$, personal hygiene factor had strong correlation of $c = 0.547$ and the use of personal protective equipment also had strong correlation of $c = 0.545$. **Conclusion:** There is a very strong correlation between contact duration and contact dermatitis. Contact frequency, type of work and the use of personal protective equipment had strong correlation to contact dermatitis among electroplaters. The higher contact duration and frequency with irritant substances among the electroplaters, the higher the increase of the risk of contact dermatitis among the electroplaters. Some occupational efforts and recommendations can be made to reduce the risk of contact dermatitis.

Keywords: contact dermatitis, electroplating, risk factors

ABSTRAK

Pendahuluan: Dermatitis kontak akibat kerja dapat diartikan sebagai segala kelainan kulit yang terjadi pada saat setelah bekerja dan disebabkan oleh pekerjaan. Pelapisan logam merupakan salah satu pekerjaan yang memiliki risiko tinggi terhadap kejadian dermatitis kontak akibat kerja dikarenakan terdapat bahan kimia iritan seperti nikel dan kromium. Penelitian ini bertujuan untuk mengidentifikasi hubungan antara faktor risiko kejadian dermatitis kontak akibat kerja pada pekerja pelapisan logam di CV. X dan CV. Y Desa Durungbanjar Kabupaten Sidoarjo. **Metode:** Desain studi yang digunakan yaitu cross sectional dengan pendekatan observasional. Sample penelitian berasal dari total populasi sejumlah 28 orang yang masing-masing terdiri dari 13 pekerja pelapisan logam di CV.X dan 15 pekerja pelapisan logam di CV. Y. Penelitian dilakukan pada November 2018 – Mei 2019 Pengumpulan data menggunakan lembar kuesioner, observasi dan lembar anamnesa dokter. Variabel dalam penelitian ini yaitu lama kontak, frekuensi kontak, jenis pekerjaan, dan penggunaan Alat Pelindung Diri. **Hasil:** Hasil menunjukkan bahwa 64,3% pekerja electroplating menderita dermatitis kontak. Faktor durasi kontak memiliki korelasi yang sangat kuat ($c = 0,764$), faktor frekuensi kontak memiliki korelasi yang kuat ($c = 0,710$), jenis pekerjaan memiliki korelasi kuat ($c = 0,616$), faktor higiene perorangan memiliki korelasi kuat ($c = 0,547$) dan penggunaan alat pelindung diri memiliki korelasi kuat ($c = 0,545$) **Simpulan:** Terdapat korelasi yang sangat kuat antara durasi kontak dan dermatitis kontak. Frekuensi kontak, jenis pekerjaan dan penggunaan peralatan pelindung pribadi memiliki korelasi kuat dengan dermatitis kontak pada pekerja pelapisan logam Semakin lama durasi dan frekuensi kontak dengan zat iritasi pada pekerja, maka akan meningkatkan risiko dermatitis kontak di kalangan pekerja. Beberapa upaya dan rekomendasi pekerjaan dapat dilakukan untuk mengurangi risiko dermatitis kontak.

Kata kunci: dermatitis kontak, electroplating, faktor risiko

Corresponding Author:

Danang Setia Budi

Email: dsetiabudi21@gmail.com

Telephone: +6281236358118

INTRODUCTION

A rapid development occurs on some industries such as electronics, vehicles and various other industries in producing metal goods. Some of these industries require metal coating works on the process and need other industrial services to do metal coatings which are generally in the form of home industry. Metallic coating is a process of putting a thin layer on a metal surface which is usually carried out using electrolyte liquids and chemical reactions where it is expected that the object will experience improvements both in terms of microstructure and resistance on its physical properties (Purwanto and Huda, 2005).

Electroplating is one of the metal finishing processes that uses nickel which aims to beautify and improve the metal properties to prevent corrosion. However, in the process, there are hazardous materials that are harmful to workers, such as nickel and chromium. When nickel as a chemical interacts with human skin, it can result in contact dermatitis (Harrington and Gill, 2005).

The percentage of work-related skin diseases reaches 50-60% of the number of work-related and occupational disease (Soedirman and Suma'mur, 2014). According to the European Agency for Occupational Safety and Health, skin disease is the second largest occupational disease in Europe. The number of skin diseases due to work in Europe is almost 10% of all occupational diseases that have ever been recorded (European Agency for Safety and Health at Work, 2008). According to Indonesian Dermatologist Association in 2009, both irritant and allergic contact dermatitis reached 90% of all skin diseases. Indonesian epidemiological studies show that 97% of 389 cases of skin disease were contact dermatitis, with 66.3% irritant contact numbers and 33.7% for allergic contact dermatitis (Hudyono, 2002).

Occupational dermatitis is a skin disorder that occurs after work or caused by work (Soedirman and Suma'mur, 2014). The skin becomes irritated due to the chemical substances contact which makes the skin damaged and inflamed, thus leads to contact dermatitis (Jeyaratnam and Koh, 2010). From the total cases of occupational contact dermatitis, nearly

three quarters of contact dermatitis is primary irritant contact dermatitis (Harrington and Gill, 2005). Based on previous studies, there were 14 out of 37 electroplaters who had positive irritant contact dermatitis in 17 factories in Singapore (Chew and Maibach, 2006).

According to Rosenstock et al. (2005), factors that can lead to dermatitis are endogenous factors and exogenous factors. Factors that mostly increase the incidence of contact dermatitis are contact with irritant chemical substances, contact duration, non-compliance in using Personal Protective Equipment and the type of work (Lestari and Utomo, 2007).

According to Miaratiska and Azizah (2015), home industry electroplaters who have contact duration of more than 8 hours per day with irritant chemical substances have more cases of skin health disorders than those who experience contact duration of less than 8 hours per day. In addition, as many as 90% of workers are less obedient in using personal protective equipment which can lead to occupational contact dermatitis. In addition, according to Chafidz and Dwiyantri (2017), the type of work also affects the incidence of contact dermatitis, this is caused by the irritant chemical substances in some work processes. Therefore, researcher wanted to carry out research on the relationship between contact duration, contact frequency, type of work, the use of Personal Protective Equipment and the incidence of Contact Dermatitis.

This research was conducted in electroplating home industries because in some of its processes, there is exposure to chemicals that cause occupational contact dermatitis. Home industry is one of informal sector industries which is considered incompetent in handling the aspects of Health and Safety Environment for workers. These conditions can increase workers' risk of accidents and work-related disease.

Durungbanjar Village is located in Sidoarjo District and has two electroplating home industries. Each industry has 15 electroplaters and 13 electroplaters. Based on the observations, there was found that more than half the number of electroplaters at the home industries suffered from contact dermatitis. Based on this, research needs to be carried out regarding the incidence of contact dermatitis and the factors that cause the incidents. The purpose of this study was to analyze the related-factors to contact dermatitis in the electroplating home industry. Those factors are contact duration, contact frequency, type of work and the use of

Personal Protective Equipment. Metal coating or electroplating workers have a greater risk on contact dermatitis because the workers experience prolonged contact with chemicals and are incompliant in using of Personal Protective Equipment.

METHOD

This research was an observational research using cross-sectional approach. Based on the data analysis, this study was a descriptive study that aimed to identify factors related to contact dermatitis in electroplating home industry workers in Durungbanjar. This study was approved by the institutional Ethical Board of Faculty of Public Health of Universitas Airlangga with registered number of 105/EA/KEPK/2019. The population of this study was all electroplaters in CV. X and CV. Y, Durungbanjar Village, Candi Subdistrict, Sidoarjo District. The sample technique used was total population sampling. Those home industries have 28 electroplaters, which consists of 13 electroplaters in the CV. X and 15 electroplaters in CV. Y.

The independent variables in this study were contact duration, contact frequency, type of work, and the use of Personal Protective Equipment. Meanwhile, the dependent variable was the incidence of occupational contact dermatitis. The data used were in the form of primary data that were collected from questionnaires, interviews, observations and doctor's medical record sheets. The determination of skin health disorders was carried out by doctors who were certified as a Health Safety and Environment doctor.

Univariate analysis was used to see the distribution of each variable. Data analysis was done by using chi square test to identify the significance value and contingency coefficient to observe the relationship and correlation value between the variables. The contingency coefficient interpretation of correlation used the opinion proposed by Sarwono (2006) which consist of 5 interpretation correlation values.

RESULT

Electroplating Home industries X and Y are located in Durungbanjar Village, Candi Subdistrict, Sidoarjo District. Each electroplating industry has 13 electroplaters on CV X and 15 electroplaters on CV Y. These home electroplating industries have been registered their legal business permit and are

business that operate legally because they hold a business license.

The electroplating industry X has operating hours between 07.30 and 16.30 Western Indonesia Time for six working days a week from Monday to Saturday. Whereas, the Electroplating industry Y has operating hours between 07.00 and 16.00 WIB on Monday to Saturday. Both of these electroplating industries are serving the production process of electroplating such as chairs, engine spare parts and motorized vehicles. The production process of these two electroplating industries is adjusted to consumer's demand or orders without some specific targets.

Metal coating and electroplating work processes use chemical substances such as nickel, chromium and sulfuric acid. Nickel and chromium are used for coating the metal pieces, while sulfuric acid is used for acidification and cleaning the work process. In general, electroplaters did not take the effect of having a contact with irritant chemical substances in the work process on health seriously. Chromium and nickel used in the coating and rinsing process can cause a variety of serious health problems.

The work processes in the metal coating and electroplating industry are divided into polishing/cleaning, acidification, metal coating and also rinsing workers. The steps of metal coating/

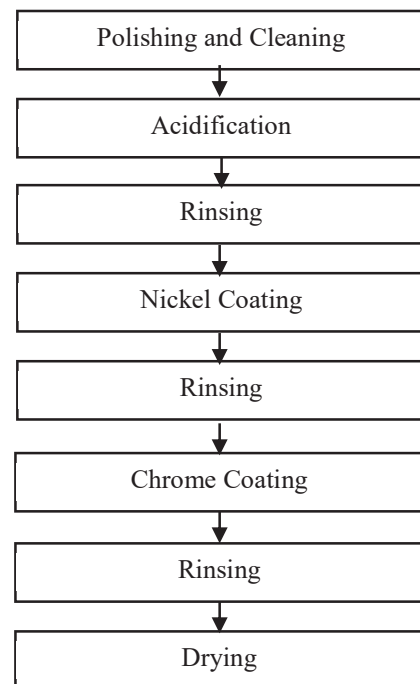


Figure 1. Work Processes on Electroplating Industry

Table 1. The Distribution of Contact Dermatitis on Electroplaters in Durungbanjar Village 2019

Contact Dermatitis	Total	
	n	%
Contact Dermatitis	18	64.3%
No Contact Dermatitis	10	35.7%
Total	28	100

Table 2. The Distribution of Contact Duration on Electroplaters in Durungbanjar Village 2019

Contact Duration	Frequency (n)	Percentage (%)
< 8 hours/day	9	32.1%
≥ 8 hours/day	19	67.9%
Total	28	100

Table 3. The Distribution of Contact Frequency on Electroplaters in Durungbanjar Village 2019

Contact Frequency	Frequency (n)	Percentage (%)
< 100 times/day	12	42.9%
≥ 100 times/day	16	57.1%
Total	28	100

electroplating work processes from those metal coating/electroplating industries begin with polishing to drying work which can be seen in the following figure 1.

Work processes that have the highest risk of experiencing direct contact with irritant chemical substances are in wet metal-working processes such as acidification, coating and rinsing. Whereas, polishing and cleaning work have no risk of having direct contact with irritant chemical substances. The metal coating/ electroplating industry x has 13 workers consisting of 3 polishing and cleaning workers, 2 acidification workers, 6 coating workers and 2 rinsing workers. Meanwhile, metal coating/ electroplating industry Y has 4 polishing and cleaning workers, 2 acidification workers, 4 coating workers and 5 workers in the rinsing process.

The cleaning and polishing work process is responsible for cleaning metal working material before the coating process to make the metal surface clean. The acidification process is carried out for removing rust and dust from the working material.

Table 4. The Distribution of Type of Work Duration on Electroplaters in Durungbanjar Village 2019

Type of Work	Frequency (n)	Percentage (%)
Cleaning and polishing	7	25
Acidification	4	14.3
Coating	10	35.7
Rinsing	7	25
Total	28	100

Table 5. The Distribution of the use of Personal Protective Equipment on Electroplating Workers in Durungbanjar Village 2019

The Use of Personal Protective Equipment	Frequency (n)	Percentage (%)
Use PPE incompletely	19	67.9
Use PPE completely	9	32.1
Total	28	100

The nickel coating process is carried out during immersion in a certain time and frequency. Coating is used by dipping the metal working materials into a tub containing nickel and chromium chemicals and using a hook for the immersion process. There is electricity flowing on the wire lines. In the rinsing process, the metal working material is dipped into a tub of water to remove the remaining unused coating chemicals.

The results of the study on the description of contact dermatitis in metal coating/electroplating home industries in Durungbanjar, Candi Subdistrict, Sidoarjo District can be seen in table 1. The indicator of contact dermatitis illustrates complaints of skin abnormalities in workers' body parts such as hands, chest and abdomen skins, legs and back skin.

Contact dermatitis in electroplating home industry in Durungbanjar Village, Candi Subdistrict, Sidoarjo District had a percentage of 64.3% for positive occupational contact dermatitis. As many as 18 of the 28 electroplaters experienced contact dermatitis and it spread throughout their body. Contact dermatitis in electroplaters mostly occurred on the hands. As much as 35.7% of the electroplaters did not experience contact dermatitis. Factors that influence the incidence of contact dermatitis are exogenous factors and endogenous factors.



Figure 2. Contact Dermatitis in Electroplaters' Hands

The contact duration variable was divided into contacts for less than 8 hours per day and more than 8 hours per day. Based on table 2, it shows that the respondents of metal coating/electroplating home industry workers in Durungbanjar Village who had long contact with irritant chemical substances for more than 8 hours were as much as 67.9%, while electroplaters who had direct contact with irritant chemicals for less than 8 hours per day were 32.1%. The average contact duration with irritant chemical substances for workers was as much as 5.67 hours/day (5 hours 20 minutes/day) and had a contact duration's range from 0 hour/day to 9 hours/day. The contact duration of workers with irritant chemical substances is influenced by the type of work process.

The distribution of contact frequency was obtained from the number of workers who had contact with irritant chemical substances on the work process. The frequency of contact can be calculated when the respondent worked involving chemicals such as chromium and nickel. Based on table 3, it shows that 57.1% of electroplaters experienced more than 100 times a day of contact with irritant chemical substances. The average frequency of contact was as much as 78 times/day and had frequency susceptibility between 0 time/day to 135 times/day.

According to Gautama (2009) and adjusted to the real condition in workplace, electroplating work processes are divided into cleaning and polishing process, acidification process, coating process and rinsing process. The work process involved in metal coating/ electroplating home industry in Durungbanjar Village has the highest frequency in coating work as many as 10 workers with a percentage of 35.7%. As much as 25% of the workers worked in the cleaning and polishing unit,

14.3% in acidification process and 25% in rinsing process.

The frequency distribution of the use of personal protective equipment for electroplaters is based on the answers to the questionnaires with several questions including the use of personal protective equipment such as protective gloves, boots as well as upper and lower work clothes that cover all parts of the body. Based on table 5, it was found that as many as 67.9% of workers did not use personal protective equipment completely. Primary data showed that on the average, electroplaters did not wear complete protective clothing covering the entire body of workers due to some environmental problems such as the hot temperature of workplace.

DISCUSSION

Electroplating is a depositional process by attaching a thin layer to a metal surface which is usually carried out using electrolyte liquids and uses chemical reactions where it is expected that the object will experience improvements in terms of microstructure and resistance on its physical properties (Purwanto and Huda, 2005). Several types of work processes in the metal coating/ electroplating industry use nickel and chromium chemicals. Nickel is used as a catalyst, electrolytic nickel metal coating, textile coloring and printing, coating, ceramic coloring, corrosion resistant metal alloys and chemical reagents (Soedirman and Suma'mur, 2014).

The results showed that there were 64.3% of workers who had contact dermatitis and 35.7% were diagnosed with no contact dermatitis. The occurrence of many contact dermatitis was experienced by workers in the coating and rinsing unit where workers experienced direct contact with irritant chemical substances. Itching and heat occurred on the new workers when they carried out the work and had never made contact with chromium or nickel. In addition to itching and heat, electroplaters also felt scaly and cracked skin, especially on the hands and arms and some parts on the abdomen. Electroplaters only felt symptoms on the skin when electroplaters started their first job in the electroplating industry. According to the electroplaters, they considered it as a normal thing and they did not know that the symptoms were leading to an occupational contact dermatitis. This is also caused by the absence of medical check up on workers and they did not treat

the symptoms because they thought those symptoms were mild.

Exposure to chromium oxide causes skin irritation, allergic reactions or skin ulceration (International Labor Organization, 2015). Chemical factors are the most important hazard factors associated with occupational dermatitis because they are widely used in the industry (Soedirman and Suma'mur, 2014). Contact dermatitis is one of the health effects on electroplaters who have contact with irritant chemical substances.

Risk factors that cause contact dermatitis are contact with chemicals, duration of contact, type of work and the use of personal protective equipment (Lestari and Utomo, 2007).

The Relationship between Contact Duration and Occupational Contact Dermatitis on Electroplating Home Industry, Durungbanjar Village, Sidoarjo District

Based on table 6, it was found that 94.4% of workers with more than 8 hours of contact duration per day had contact dermatitis. Based on the coefficient contingency, it was found that there was a very strong relationship between the duration of contact and the incidence of contact dermatitis ($c = 0.764$). This research is also in line with the research conducted by Miaratiska and Azizah (2015) where there was a significant correlation between the duration of contact with skin health problems due to occupational contact dermatitis in metal workers.

According to Cohen (2019), chemical substances are the main cause of occupational contact dermatitis. The chemicals used in the metal coating/electroplating processes are chromium (CrVI), nickel and hydrochloric acid (HCl) for the acidification process. According to Belsito (2005), exposure to chromium and nickel can cause worse health effects on occupational contact dermatitis. Contact with chemicals can cause health problems including skin ulceration because chemical substances have long contact duration in the outer part of the body which is the skin.

The Relationship between Contact Frequency and Occupational Contact Dermatitis on Electroplating Home Industry, Durungbanjar Village, Sidoarjo District

The contact frequency with dermatitis was determined by how many workers made contact with irritant chemical substances in the units per

day. The frequency of contacts in this study was determined by questionnaire. Contact frequency was calculated when workers first made a contact with irritant chemical substances during the work processes, especially in coating and rinsing work process. Repeated contacts with chemicals cause irritants and sensitization which will lead to contact dermatitis (Cohen, 2019).

Contingency coefficient analysis showed that there was a very strong correlation between the frequency of contact and the incidence of contact dermatitis in electroplating home industry workers in Durungbanjar Village. This research is also in line with research that was conducted by Miaratiska and Azizah (2015) which showed that there was a significant relationship between the frequency of contact and the incidence of occupational contact dermatitis in electroplaters. The work process by frequency of repeated contact with irritant chemicals and sensitization can cause contact dermatitis to occur (Cohen, 2019).

The average frequency of contact among electroplaters reached 78 times per day with a range of 0 time to 135 times per day. Electroplaters who experienced contact frequency of more than 100 times per day were mostly experienced contact dermatitis. The metal coating/ electroplating home industry X and Y can process more than 150 work materials per day. Electroplaters are required to do additional work and work overtime if necessary. Work process is carried out in a traditional operation where electroplaters are required to lift work materials from the coating process manually by using their hands. There are no modern machines or tools in the industry. According to Rosenstock et al., (2005), the metal coating industry generally has a chronic effect on the skin due to the large number of metal coating jobs using manual operation.

The Relationship between Type of Work and Occupational Contact Dermatitis on Electroplating Home Industry, Durungbanjar Village Sidoarjo District

According to Lestari and Utomo (2007), there were a large number of workers suffering from contact dermatitis. This was due to differences in dosage and exposure/ contact status with irritant chemical substances causing occupational contact dermatitis. In electroplating/ metal coating industry, electroplaters were separated into 4 work process units including cleaning and polishing, acidification, coating and rinsing. Skin disorder in the form of

contact dermatitis can occur on electroplaters who often make contact with irritant or toxic chemical substances such as housewives, farmers, and workers related to chemicals (Orton and Wilkinson, 2004).

The strong relationship between the two variables also showed a coefficient contingency value of 0.616 which means that there was a strong correlation between the type of work and the incidence of contact dermatitis. This research is referred to Chafidz and Dwiyanti (2017) that there was a significant relationship between types of work and the incidence of contact dermatitis (p value 0.012). The research performed by Rahma, Setyaningsih and Jayanti (2017) also showed that there was a significant relationship between the work units and the incidence of occupational contact dermatitis.

According to Rosenstock et al., (2005), the metal coating industry generally has a chronic effect on the skin due to the large number of metal coating jobs using manual operation. In the metal coating process, the types of work that are prone to exposure to nickel and chromium chemicals in large doses are coating and rinsing. In addition, the content of chromium and nickel is considered to have more risk of sensitization to workers who have contact with it (Rosenstock et al., (2005). Wet work such as coating and rinsing can increase the moisture of the skin which is susceptible to irritant chemicals to enter the skin and cause irritation and result in acute and chronic contact dermatitis (Belsito, 2005). Unlike the wet work process, cleaning and polishing involve dry process. Dry work on metal coating does not have direct contact with irritant chemical substances.

The Relationship between the Use of PPE and Occupational Contact Dermatitis on Electroplating Home Industry, Durungbanjar Village, Sidoarjo District

According to Nuraga, Lestari and Kurniawidjaja (2008), the use of personal protective equipment (PPE) can protect workers from direct contact due to irritant chemical substances. Personal protective equipment that are commonly used in the metal coating industry to avoid direct contact from irritant chemical substances are latex gloves, as well as protective clothing for hands, body and legs. Based on Table 7, electroplaters who experienced contact dermatitis and use personal protective equipment incompletely were 83.3%, while electroplaters who had contact dermatitis and used complete personal

protective equipment were 16.7%. The results of the bivariate analysis showed that there was a significant relationship between the use of personal protective equipment (PPE) and contact dermatitis among metal electroplaters in Durungbanjar Village, Candi Subdistrict, Sidoarjo District. The strong relationship between the two variables also shows coefficient contingency value of 0.545 which means that there was strong correlation between the use of Personal Protective Equipment and the incidence of contact dermatitis.

This is in line with research conducted by Chafidz and Dwiyanti (2017) that there was a relationship between the use of Personal Protective Equipment (PPE) and the incidence of contact dermatitis with a significance value of 0.001. This study was also identified by Erliana (2008) that there were differences between workers who used Personal Protective Equipment (PPE) and workers who did not use Personal Protective Equipment (PPE) in the incidence of contact dermatitis.

The majority of workers already used gloves, but the use of gloves on workers is considered inappropriate. Workers folded the gloves almost to the palm of the hand because workers felt uncomfortable and it limited their hand movements. Workers felt uncomfortable with the condition of hands that were wet due to sweat when using gloves. Many workers did not wear work clothes that cover all parts of the hand that cause direct contact to irritant chemicals substances. Hands are parts of the body that are widely used during the process of metal coating/electroplating work. The industry owner did not provide special work clothes to cover the body. Many workers are commonly use short-sleeved clothes because the temperature of the work place is high. This causes some workers to suffer from contact dermatitis on the chest and stomach.

Prevention efforts carried out include improving the use of proper and good personal protective equipment (PPE), increasing workers' awareness of the importance of personal hygiene, regulating working hours to avoid excessive exposure to irritant chemicals, and educating workers and business owners of metal coating home industry in Durungbanjar Village, Candi Subdistrict of Sidoarjo District, concerning the importance of Occupational Safety and Health aspect. In addition, efforts to improve the work environment also need to be done through the procurement of local exhaust in the metal coating workspace such as vents and windows that are always opened when work to keep the work temperature and humidity in optimal conditions.

CONCLUSION

Based on the results of research on metal coating home industry in Durungbanjar Village, Candi Subdistrict, Sidoarjo District, it is found that 64.3% of the electroplaters has contact dermatitis. Electroplaters with contacts for more than 8 hours per day had a frequency of 67.9%. The process of work carried out with a frequency of more than 100 times per day is carried out by 57.1% of all electroplaters. Based on the type of work, most electroplaters work on the metal coating and rinsing unit which results in many workers having direct contact with irritant chemicals. As many as 67.9% of workers do not use personal protective equipment completely. Based on the results of statistical analysis, there is a very strong correlation between contact length and contact frequency for occupational contact dermatitis. The types of work and the use of Personal Protective Equipment also show a strong correlation with the incidence of contact dermatitis in electroplating home industry workers in Durungbanjar Village, Candi Subdistrict, Sidoarjo District.

ACKNOWLEDGEMENT

To Whom It May Concern, I want to say thank you because this research is merely nothing without the support of some related-institutions.

REFERENCES

- Belsito, D. V (2005) ‘Occupational Contact Dermatitis: Etiology, Prevalence, and Resultant Impairment/Disability’, *The Journal of the American Academy of Dermatology*, 53(2), pp. 303–313.
- Chafidz, M. and Dwiyantri, E. (2017) ‘Relationship of Long Contact, Type of Work and use of PPE with Dermatitis Cases of Contacts on Tofu Workers, Kediri’, *The Indonesian Journal of Occupational Safety and Health*, 6(2), pp. 156–165.
- Chew, A.-L. and Maibach, H. I. (2006) *Irritant Dermatitis*. Germany: Springer.
- Cohen, D. E. (2019) ‘Occupational Dermatoses’, in Mansdorf, S. Z. (ed.) *Handbook of Occupational Safety and Health*. 3rd edn. Canada: John Wiley & Sons, Inc, pp. 199–230.
- Erliana (2008) *Relationship between Individual Characteristics and the use Personal Protection Equipment (PPE) and the Incidence of Contact Dermatitis in the Paving Block Meker in CV. F Lhokseumawe*. Thesis. Medan: Postgraduate Universitas Sumatera Utara.
- Gautama, P. (2009) *Know How to Coating Metal Parts (Part 1), Infometrik (Situs Informasi Mekanika, Material, dan Manufaktur)*.
- Harrington, J. . and Gill, F. . (2005) *Pocket Consultant Occupational Health*. Edited by S. Kuswaji, A. C. Wijaya, and Y. J. Suyono. Jakarta: EGC.
- Hudyono, J. (2002) ‘Occupational dermatitis’, *Majalah Kedokteran Indonesia*, 49(9), pp. 16–23.
- International Labor Organization (2015) *Global Trends on Occupational Accidents And Diseases*. Geneva: International Labor Organization.
- Jeyaratnam, J. and Koh, D. (2010) *Textbook Of Occupational Medicine Practice*. Edited by R. N. E. Sihombing and Suryadi. Jakarta: EGC.
- Lestari, F. and Utomo, S. H. (2007) ‘Factors Related to Contact Dermatitis on Workers at PT Inti Pantja Press Industri’, *Makara Kesehatan*, 11(2), pp. 61–68.
- Miaratiska, N. and Azizah, R. (2015) ‘Correlation Nickel Exposure and Worker Skin Health Disorders at Metal Plating Home Industry in Sidoarjo’, *Jurnal Kesehatan Lingkungan*, 1(1), pp. 25–36.
- Nuraga, W., Lestari, F. and Kurniawidjaja, L. M. (2008) ‘Factors Related to Occupational Contact Dermatitis on Workers Exposed to Chemicals used at Industrial Automotive Company.’, *Makara Seri Kesehatan*, 12(2), pp. 63–69.
- Orton, D. I. and Wilkinson, J. D. (2004) ‘Cosmetic Allergy: Incidence, Diagnosis, and Management’, *American Journal of Clinical Dermatology*, 5(5), pp. 327–337.
- Purwanto and Huda, S. (2005) *Electroplating Industry Technology*. Semarang: Badan Penerbit Universitas Diponegoro.
- Rahma, G. A., Setyaningsih, Y. and Jayanti, S. (2017) ‘Analysis of the Relationship of Exogenic and Endogenic Factors on Dermatitis Events Due to Work n Leather Tanner Workers PT. Adi Satria Abadi Piyungan, Bantul’, *Jurnal Kesehatan Masyarakat FKM Undip*, 5(5), pp. 173–183.
- Rosenstock, L. et al. (2005) *Textbook of Clinical Occupational and Environmental Medicine*. 2nd edn. Washington: Saunders.
- Sarwono, J. (2006) *Quantitative and Qualitative Research Methods*. Jakarta: Graha Ilmu.
- Soedirman and Suma'mur, P. (2014) *Occupational Health in the Hiperkes & Occupational Safety Perspective*. Jakarta: Erlangga.