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Review Article

OCCUPATIONAL INJURIES AND ILLNESSES IN RUBBER FACTORY: PROFILE, POTENTIAL, HAZARDS AND POSSIBLE PREVENTION

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ABSTRACT

Rubber is one of the important commodities in the world**.** In Indonesia, there are several data of occupational problems such as respiratory diseases, muscle and skeletal diseases, gastrointestinal, skin and skin tissue diseases, and diseases of the teeth and oral cavity. In Iranian rubber factory, Iran, workers had suffered from some kind of musculoskeletal symptoms. Stomach and liver cancers in workers are having in Shanghai tire factory. In addition, Germany has been facing of cancer problem of their workers who work in rubber factory. Most of the rubber process in the factory can cause some hazards of the workers. In unloading area and area that operator is taking the dirt manually, they are facing ergonomic problems. The possible control is reduce weight of load, team lift the object with two or more workers and use mechanical assist. Machine safeguarding is essential for protecting from Cutting process that can make workers amputation. In bale process, workers are also facing with amputation problem. To manage that, It must be designed as a standard which has interlocking guards to prevent access to the cutting area. When wrapped using plastic, workers use a heated iron and sticked in plastic so that it blends neatly. The risks are fingers can cut accidently and can get contamination from polyvinyl chloride (PVC). The possible preventions are use an automatic plastic wrapping machine with palletized product sitting on a turntable and respirator. Contact dermatitis has been reported frequently and the prevention for that problem is using the gloves. The aim of researcher is to provide the profile of occupational injuries and illnesses, potential hazards in rubber factory to prevent the workers.

Key words : Occupational Injuries, Occupational illnesses, rubber factory

INTRODUCTION

Currently, the number of rubber used is increasing in around the world. In 2010, It was used about 9,2 million tons per year. In fact, in 2011, It was increasing into 10,6 tons per year. Moreover, Indonesia has the highest number of area that can grow the rubber tree which is about 3.4 hectares and its followed by Thailand and Malaysia which have 2.6 million and 1 millions hectares area.[1]

Factory is able to process rubber into crumb rubber. In this process, It might have some hazards that can bear the workers. The previous study had mentioned about effect of rubber in the factory such as allergic and musculoskeletal disease in the form of

ergonomic problems.[2,3,4] Furthermore, crumb rubber can be processed into a product such as tire. Researcher had approved that in the tire company, workers exposed with a lot of hazards such as aerosol, nitrosamines, carbon black, asbestos, and talc.[5,6] In addition, those chemicals exposure can lead workers into some health problems such as cancer.[7,8]

Even though some research had conducted, the number of cases of occupational injuries and illnesses are still high,[9] Hopefully, by reducing the number of working injuries and illnesses in rubber factory, It can reduce the number of workers dead. So, due to that reason, the aim of researcher is to provide the profile of occupational injuries and illnesses and pin rubber factory in order to prevent the workers from those hazards.

METHODS

Secondary data that had searched from various databases such as Scopus, science direct, PubMed, Google scholar and research gate will be applied in this paper. Another reports will be getting from the report of Ministry of Health Indonesia, World Health Organization, International Labour Organization, Ministry of Labour of Indonesia, Occupational Health and Safety Administration (OSHA), Indonesian Public Health Association (IPHA), and Statistic of Indonesia.

RESULTS AND DISCUSSION

Profile of Injuries, death, and disease

Generally, in Indonesia, It has a few researches which had mentioned occupational injuries in Rubber Company. Work accident in *PT H*, Kalimatan, which is one of the biggest rubber companies in Indonesia. It is the crumb rubber company processing rubber raw materials nature into semi-finished materials called crumb rubber. The number of occupational accidents in this company as many as 23 cases.[10] *PT L* which is one of the national private industry that having 300 workers is processing and producing crude rubber into rubber crumb (crumb rubber). During the period of 5 years from 2009 to 2013, It mentioned that occurred 74 work accidents because of unsafe work behavior of workers themselves.[11] Based on case data, accident that occur in the *PT. S* is mostly occurred in production section (32.22%) due to the behavior of the workers are not safe.[12]

A research that conducted in *PT. B* in Kalimantan, Indonesia, explained that respiratory diseases, muscle and skeletal diseases, gastrointestinal diseases, diseases of the teeth and oral cavity, skin diseases and skin tissue is the main causes of that rubber company.[13] In Iranian rubber factory, Iran, from total 454 workers, 73.6% had suffered from some kind of musculoskeletal symptoms during the last 12 months. The highest prevalence was reported in the lower back (50.2%), knees (48.5%) and upper back (38.1%).[4]

Reported accident data for a period of 11 years (2002 - 2012), In Nigeria, manufacturers of rubber products accounted for the highest number of injuries at 53.8% and 63% for death; the total case fatality rate was 49.5.[14] Another report was from shanghai where 8,316 subjects, who had been employed in three tire factories in Shanghai for more than 1 year before December 31, 1972 had shown that several sites of cancer in the digestive system were associated with some main jobs in factories for both sexes. For example, stomach and liver cancers in workers, inner tube curing, and material handling in males; pancreatic cancer in tire curing in males and in inner tube and tire buildings in females; esophageal cancer in the production of non-tire products in males; and rectal cancer in Building and Multiple jobs for non-tire work in males and females [15].

A cohort study of 8933 rubber workers in Germany (hired after 1 January 1950, still active or retired on 1 January 1981 and employed for at least 1 year in one of five study factories) was followed up for mortality from 1 January 1981 to 31 December 1991. The result was the workers that had been exposed to high concentrations of nitrosamines is associated with increased mortality from cancers of the esophagus, oral cavity, and pharynx.[8]

Potential hazards and possible preventions or controls

Raw rubber needs to process into high quality product that can lead workers into health hazards such as in unloading area and area that operator is taking the dirt that pass filtering in screw conveyor I manually, workers are facing ergonomic problems where they have to lift up raw rubber with approximately weight 50kg each. This is supported by a research that conducted by Mohammadi in Iran that from total 100 males who work in rubber company had suffered with musculoskeletal symptoms such as 65% of lower leg, 45% of lower back, 38% and 38% in upper back and neck respectively.[16]The possible control is Reduce weight of load, team lift the object with two or more workers, and Use mechanical assist such as overhead hoist, manipulator, vacuum lift, pneumatic balancer, and forklift.[17]

Cutting process is using manually used saw cutter and automatic cutting machine. In this process, the workers had highly risk for amputation organs such as hands, and fingers. A research that conducted OSHA (Occupational Safety & Health Administration) mentioned that machine safeguarding is essential for protecting employees from needless and preventable injury. Second is Awareness device which is a barrier, signal or sign that warns individuals of an impending, approaching or present hazard. The last is safe work procedures that formal written instructions developed by the user which describe how a task is to be performed.[18]

Next hazard in Rubber Company comes from bale process. In this process, workers need to cut raw rubber into bale in bale cutting. Furthermore, workers are facing with amputation problem. To manage that, it must be designed as a standard which has interlocking guards to prevent access to the cutting area.[19]After bale has cut, it will be moved and will be wrapped using plastic. In this process, workers use a heated iron and sticked in plastic so that it blends neatly. The possible injuries in this process are increases the risk of cuts to the fingers and workers get contamination from polyvinyl chloride (PVC) that can harmful to the body because it will be causing cancer.[20,21]

The possible preventions are use an automatic plastic wrapping machine with palletized product sitting on a turntable. This ensures the employee will not have to bend at the waist to wrap the pallet. If manual wrapping must be performed, use rolls that weigh as little as possible to minimize the lifting hazard. A handle will prevent employees from placing their fingers into the tube, thus decreasing the risk of cuts.[21]on the other hand, according to OSHA, Vinyl Chloride can be protected by using respirator. In addition, it depends on how much airborne concentration. As an example, concentration less than or equal to 25 ppm, OSHA is recommending to use powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm; or using gas mask with front- or back-mounted canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm.[22]

Bale that has been packaged with plastic will be transfer into warehouse before delivery. In order to transfer, workers need to use bale handling to prevent potential hazard such as musculoskeletal diseases. Most of the rubber industry use mechanical handling such as the vacuum bale lifter. These are a reliable and low cost option for handling the standard 33.3kg bales.[19]

Another potential hazards for workers who work in Rubber Company is dermatologic effect. Contact dermatitis has been reported frequently among rubber workers and even more frequently among users of rubber products.[23]The prevention for that problem is using Gloves that can protect the individual from contact with irritants and allergens.[24, 25]

A lot of researches mentioned that workers who work in rubber manufacturing company had cancer due to expose to some chemical used. One of the researches is A case cohort study nested in a cohort of 267 400 female textile workers in Shanghai, China was conducted among 180 incident pancreatic cancer cases and an age stratified randomly selected comparison sub cohort. Scientifically, the problem came from occupational exposure to cotton dust and endotoxin.[26,27] According to OSHA, to prevent cotton dust can use cotton dust regulation like monitoring, control of exposure, and medical surveillance which can be implemented by using respirator and engineering controls.[28]

Leukemia has been becoming one of major problems for workers in rubber factory. The results supported with conclusion that the excess risk for leukemia was attributable to exposure to solvents from natural rubber and synthetic polymers combined with chemicals, for example, carbon black, certain whiting's, [29] and particularly benzene as the most. The authors indicated that a variety of solvent mixtures, with or without benzene, had been used in rubber cements, glues, binding agents, and release agents.[30] WHO recommends a few steps in order to reduce exposure of benzene such as eliminate use which is promote the use of alternative solvents in industrial processes, glues and paints. Develop and implement policies and legislation to remove benzene from consumer products. In fact, reduce the exposure of benzene itself.[31]

The respiratory effects of dust from rubber processing is also potential hazard for the workers in rubber wood factory. The results from one study identified naphthalene diisocyanate (NDI) as the cause of respiratory irritation among workers in a Swedish tire plant.[32] Recurrent bronchitis with loss of lung function, or peripheral eosinophilia among 30 workers involved in a synthetic chloroprene rubber thermo injection process.[33, 34] Controlling the risk of dust from rubber is ensuring exposures to dust which is kept as far below the Workplace Exposure Limits (WELs) as reasonably practicable. The current WEL for rubber process dust is 6mg/m^3 8 hour time weighted average. The current WEL for rubber fume is 0.6mg/m^3 8 hour time weighted average. In addition, use standard respirator depending on level of dust to prevent dust inhale inside the body.[35]

CONCLUSION

A lot of potential hazards can cause health effect to worker such as musculoskeletal problems, amputation organs, cancers, leukimia, skin diseases, and respiratory health problems. It needs a better prevention in order to prevent the workers from those problems.

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