POLLUTING FACTORS IN RUBBER PLANTS
THAT INTERFERE WITH HEALTH

[1]Ferly Oktriyedi, [2]Irfannuddin, [3]Ngudiantoro, [4]M. Hatta Dahlan

[1]Ilmu Lingkungan Universitas Sriwijaya
[2]Fakultas Kedokteran Universitas Sriwijaya
[3]Fakultas MIPA Universitas Sriwijaya
[4]Jurusan Tehnik Kimia Universitas Sriwijaya

Email:irfan.md@unsri.ac.id

ABSTRACT

Production of natural rubber can have a detrimental effect on health. Hazardous pollution products from natural rubber industry are ammonia and sulfides which can be in the form of gas, solid/rubber crump, and liquid waste. These pollutants occur due to sub-standard PRPM management processes and the use of non-recommended clotting agents such as sulfuric acid, alum potassium, and Triple Super Phosphate (TSP) fertilizer. The natural rubber management process also uses machines that cause noise pollution. The impact of health problems that can occur contact dermatitis, hearing loss, respiratory diseases, and pulmonary parenchyma, and eye irritation.

Keywords: Management of natural rubber, waste, health problems

INTRODUCTION

The main source of air and water pollution is the industrial sector (Singh, M. Remeo; Gupta, 2017). One of the polluting industries is the natural rubber industry (Tekasakul & Tekasakul, 2006). South Sumatra is one of the provinces that produce the largest natural rubber in Indonesia. South Sumatra has 31 natural rubber industries. Most of these industries are located in Palembang City (Gapkindo, 2020). Natural rubber from Indonesia is generally still exported in the form of low-quality primary products processed through lumps which are not recommended. The product is in the form of Standard Indonesian Rubber 20 (SIR 20) (Suwardin,

2016). High-quality products are processed in the form of Ribbed Smoked Sheet (RSS) and concentrated latex. However, only a few industries produce this form of rubber, as can be seen in table 1. The processing of natural rubber causes impacts on the environment, workers, and society. These impacts are in the form of air pollution, water, odors (Tekasakul & Tekasakul, 2006), solid waste (Supraptiningsih and Sarengat 2014), and noise (Nofriza & Sepriantoni, 2015). This manuscript aims to describe the sources of risk and disease impact that can be caused by the rubber industry.

Types of Rubber Products in Indonesia

Rubber Products	Percentage
Concentrated Latex	0.5%
Ribbed Smoked Sheet (RSS)	2.6%
Standard Indonesian Rubber (SIR)	
SIR 3L	0.5%
SIR 3CV	1.5%
SIR 10	2.8%
SIR 20	95.0%

Source : (Suwardin & Purbaya, 2015).

Sources of Pollution from the Natural Rubber Industry

The main problems in the rubber processing industry in Indonesia are low-quality raw materials and poor handling of People's Rubber Processed Materials (PRPM) (Syarifa, Agustina, & Nancy, 2013). PRPM which comes from farmers is low quality with a Dry Rubber Content (DRC) of less than 45% and composited by contaminants. PRPM is also produced from a mixture of coagulants that are not recommended such as sulfuric acid or *cukapara* (66%), alum (10%), TSP fertilizer (8%), a combination of sulfuric acid and alum (7%), and other mixtures such as cassava and water remaining food washing such as tempeh (1%) (Suwardin & Purbaya, 2015; Syarifa, Agustina, Alamsyah, & Nugraha, 2016; Vachlepi, 2017; Vachlepi, Nugraha, & Alamsyah, 2016). PRPM should be produced from high-quality mixed materials such as Deurub K or liquid smoke, which only uses about 1% of farmers. Another recommended mixture is formic acid, which is only used by 7% of farmers (Laoli, Magdalena, & Ali, 2013; Purbaya & Suwardin, 2018; Suwardin & Purbaya, 2015; Syarifa et al., 2013; Ulfah, Sari, & Puspita, 2017; Vachlepi, 2017; Vachlepi & Suwardin, 2016; Vachlepi, Suwardin, & Purbaya, 2015)

Air Pollutants in the Natural Rubber Industry

Sulfuric acid (HSO) is a strong acid chemical compound that is corrosive to metals. The use of sulfuric acid as a latex coagulant causes corrosion in steel or iron rubber processing equipment. With this corrosive nature, sulfuric acid will have a bad effect on the health of farmers and crumb rubber factory workers (Vachlepi & Suwardin, 2016). HSO, TSP fertilizer, alum, and juice of yam/pineapple as coagulants, do not have antibacterial and antioxidant properties, thus spurring the development of natural antioxidant-destroying bacteria in PRPM. The growth of spoilage bacteria causes the biodegradation of proteins in PRPM into ammonia and sulfides which smell bad and cause air pollution (Balittri, 2014; Solichin & Anwar, 2006; Tekasakul & Tekasakul, 2006; Towaha, Aunillah, & Purwanto, 2013). Sources of air pollution also come from other chemical compounds such as organic acids (acetic, propionic, butyric, valerate), sulfide compounds, and methyl mercaptan (Indrawati, Mulyadi, & Kusuma, 2016). Many sources of foul odor have accumulated in the PRPM storage area, pre-drying, and dryer machine rooms (Eriska et al., 2019).

Hoven V. P. et al (2003) have determined the volatile organic components of various grades of solid rubber by gas chromatography (GC) and gas chromatography-mass spectroscopy (GC-MS). The pollutant components found were about fifty components, with molecular weights in the range of 40-200 amu. They are classified into four groups: (1) compounds of low polarity; aliphatic and aromatic hydrocarbons; (2) compounds of moderate polarity; aldehydes, ketones; (3) compounds that have high polarity; volatile fatty acids; and (4) derivatives containing nitrogen or sulfur; ammonia and sulfide (Hoven, 2004; Hoven, Rattanakarun, & Tanaka, 2003; Sakdapipanich & Rojruthai, 2012).

Liquid Waste in Natural Rubber Industry

The moisture content of PRPM is 40-50%, so the potential for microbiological activity is greater (Indrawati et al., 2016). The source of rubber mill liquid waste comes from the process of washing, seeding, milling, remaking, drying, and pressing PRPM. Waste contains high organic matter, carbon, nitrogen, phosphorus, and ammonia compounds (Susilawati &Daud, 2018; Sari Dewi, Eko Prasetyo, &Karnadeli, 2020). The volume produced from the wastewater is 26.6 m3/ton or ± 400 m3 per day (Sari Dewi, Eko Prasetyo, &Karnadeli, 2020; Sutyasmi, Setyorini, &Prayitno, 2019).

Besides the source of pollution that comes from clotting materials, liquid waste also comes from latex. The contents of rubber components in wastewater are protein, lipids, carotenoids, and inorganic salts. Liquid waste is still sterile when it comes out of the latex vessel, but latex is a suitable medium for microorganisms, so it is very easily contaminated (Dahlan, Sitaggang, & Sinambela, 2016). (Sutyasmi et al., 2019).

Solid Waste/Rubber Crumb

The waste product from natural rubber is rubber crump. This solid waste contains sand, rubberwood chips, rubber leaves, and dangerous coagulants (Ali, Utami, & Komala, 2018; Alinda, Sampoerna, & Anom, 2012). Processing around 100 kg of latex will produce a rubber crumb of around 3-5 kg (Rahmaniar & Susilawati, 2018b). The high quantity of mud, rubber crumb, and sand is caused by dirty raw materials (Hakim, Pinem, & Saputra, 2016). The waste contains elements of N, P, and K. (Supraptiningsih & Sarengat, 2014a). The availability of rubber crumbs in Indonesia is quite abundant and has not been handled properly. Waste is only piled up at the factory site and is sometimes requested by residents for crop fertilizer. Only about 18.3% of rubber crumb is used by industry as a medium for planting in their factory environment (Mutiara & Hakimi, 2012; Supraptiningsih & Sarengat, 2014).

Noise

Rubber factories use machines that make loud noises continuously. Some areas that are equipped with machines are breakers, hammermills, creepers, cutters, and combustion engines (Nofriza & Sepriantoni, 2015). There are five sections in the management industry that have the risk of being exposed to high-intensity noise well Above the Threshold Value (ATV). The parts are the dry production section, the wet production section, the packing section, the raw material purchasing section, and the workshop section. The risk of noise will be higher if the machine does not use a silencer, or workers do not use noise protection equipment (Marisdayana, Suhartono, & Nurjazuli, 2016).

Environmental Impacts of The Rubber Industry on Public Health

The waste from the natural rubber processing industry can cause disturbance to the community and factory workers. The local community complains of smells, respiratory problems, and they have difficulty finding clean water (Ferosandi, 2018). Some workers experience eye irritation during working hours due to exposure to H2S (Songkrit, Somkiat, & Amorn, 2014). Besides, a heavy workload can cause accidents (Jawawi, 2008).

Diseases caused by rubber factories are respiratory diseases, muscle and bone diseases, digestive diseases, dental and oral cavity diseases, skin diseases, and leukemia (Irfani, 2015). Some workers reported suffering from several types of symptoms of musculoskeletal disorders, namely pain in the lower back, knees, and upper back (Choobineh, Alireza; Sayed Hamidreza, Tabatabaeii; Abbas, Mokhtarzadeh; Maryam, 2007). Also, they reported hearing loss (Marisdayana et al., 2016). Respiratory system disorders also occur, such as shortness of breath, dry cough, cough with phlegm, and chest pain (Saragih, 2018). Contact dermatitis is also widely reported among workers (Heviana, 2018). The most common skin disorders are itching, redness and dry skin, and scaly skin. The body parts most affected are the palms, arms, legs, neck, back, and between the fingers (Ahyanti & Purwono, 2019).

Chemical waste from rubber processing is also at risk of causing liver function problems. Ammonia can affect the increase in levels of Serum Glutamic Oxalo-acetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT) and reduce levels of malondialdehyde (MDA) (Pahrul, Irfannuddin, & Swanny, 2017; Saputra, Irfannuddin, & Swanny, 2018). Excessive noise results in loss of hearing ability and inhibits the communication skills of workers. This condition results in physiological and psychological effects including neurological disorders, mental disorders, heart problems, high blood pressure, dizziness, inefficiency, and insomnia (Nofriza & Sepriantoni, 2015; Savale, 2014) (Putra & Hanggara, 2019).

CONCLUSION

Indonesian natural rubber is generally still exported in the form of primary products such as Standard Indonesian Rubber (SIR), Ribbed Smoked Sheet (RSS), and concentrated latex. Each form of natural rubber production has an impact on the environment. Common impacts are air pollution, water, odors, noise, and rubber crumb / solid waste. This pollution causes several diseases, such as communication problems, dizziness and fatigue, and contact dermatitis. Besides, workers may be at risk for respiratory system diseases, impaired bodily functions.

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