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Assessment of Occupational Health due to Wood Dust Exposure among the Sawmill Workers in the State of Kerala

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Abstract: ***Introduction: Sawmill workers are continuously exposed to various hazards and subsequent health problems. A workplace hazard identification, risk assessment and risk control measures will reduce the rate of morbidity and mortality. Risk assessment of the prevailing hazards and theunsafe behavior among workers is a significant approach to identify risk source and reduce occupational injuries and even accidents in the workplace. Objectives: This study was aimed at evaluating the effects of dust exposure to the occupational health of Sawmill workers in State of Kerala. Methods: A descriptive cross-sectional study was carried out to determine the level of knowledge and health and safety practices in the context of dust exposure among ninesaw mill workers in the saw mills located in Kochuveli and Kilippalam in Trivandrum, Kerala, India. Data was collected using structured interviewer-administered questionnaire, key informant interviews and walk-through survey between March 2021 and November 2021. Findings: The results revealed that the wood dust exposures of workers in urban areas are more prone to dust hazards in comparison with coastal areas. Conclusions: The study concluded that sawmill workers have higher prevalence of respiratory symptoms and reduced pulmonary function due to exposure to wood dust compared with non-exposed population.This study also concluded that sawmill workers awareness about wood dust as hazards was high but usage of PPE was very low.***

Keywords: Hazard, Occupational exposure, Sawmill industries, Safety, Health, Wood Dust

1. Introduction

The continuous deepening of "Industrialization 4.0" and the great many benefits on the economy and society have greatly promoted the vigorous development of various industries[17]. Industrial activities are important to the economy of a nation as; they support and service rural activities as while it also provides employment opportunities for the general populace [10]. Small business industries account for a large proportion of our jobs and play a very vital role in most countries economic growth and prosperity[8]. Also, the timber industry has been a major source of employment and income all over the world [2 and 19]. Wood processing activities involve various procedures which convert raw wood into usable forms. Work locations where such processing is carried out include sawmills, wood furniture industry, and door manufacturing industry [14]. A sawmill is a place where timbers are sawn into different sizes of plank.But the nature of the work while handling the type of equipment and material by workers in these occupations are prone to hazards [5 and 13].

On the other hand, rapid urbanization and industrialization have been known to cause major health problems among the population, especially when it is unplanned. The nature of the work while handling the type of equipment and material by workers in these occupations are prone to hazards [5 and 13]. These hazards and injuries resulting from such incidents includes being caught-in or struck by machinery, falling from a height, heavy lifting or repetitive movements, twisting or while reaching, and breathing in noxious or toxic chemicals while working for wood processing to increase productivity [2, 18]. Also, to carry out these activities (Figure 1), workers frequently have to adopt uncomfortable and sustained static postures, lift or carry heavy loads, make repetitive motions of the wrist during machine operations and hammering and many other hazardous tasks [2]. All of these activities may result in pain or discomfort feelings in different body parts of the sawmill workers [1].

Air pollution is a major environmental problem affecting both the developing and the developed countries of the world with suspended particulate matter affecting more people globally than any other pollutant on a continuous basis[11, 16and22]. Besides the hazards inherent in this profession are the unfavorable weather conditions and noise pollution that is injurious to human health [2, 18 and 20]. The main reasons for their vulnerability are lack of education, insufficient knowledge and dearth of awareness of OSH hazards and non-availability or use of personal protective equipment's (PPEs)[8]. With more than 1.2 billion population and rapid industrialization, needs much more attention toward occupational health [21 and 22].

The Occupational Safety and Health Administration (OSHA) call for all possible measures to be adopted for OSH of workers from workplace hazards and risks [6, 19]. In order to fully assess the safety environment in the saw mill sites, an overview of the wood processing industry activities and associated hazards are necessary [18]. Many authors

addressed that the PPEs can play a vital role in minimizing occupational injuries and accidents which otherwise result in substantial human sufferings and financial losses due to lowered production, hefty fines, health and insurance claims and absenteeism in the past research works [8, 9 and 15]. But the researchers also recommended that the detailed investigation is needed [16 and 19].This study has been conducted to assess the Occupational Health, Safety & Environmental exposure to wood dust in the Saw Mill Industries.

2. Materials and Methods

2.1 Study Area

A cross-sectional descriptive study carried out among workers in a sawmill situated in Kochuveli (Coastal Zone) and Kilippalam (Urban Zone) in Trivandrum, Kerala, India. Both coastal and urban areas were considered for this study.Information's were obtained among the 100 saw mill workers using an interviewer-administered questionnaire was used to assess the socio-demographic characteristics such as worker's skills, Perception, Knowledge, Hygiene & Safety Practices, Beliefs, Attitude towards Hazardous Occupational Exposures & the Willingness/ Preparedness to use PPE & the willingness to invest and to provide PPE by the Employer in preventing the work-related illness and disability. The age, work experience, height, weight and BMI status of workers has also been included in this study.Mass concentration of emitted wood dust was measured using Intelligent Air Detector. Data were analysed with IBM SPSS Statistics 20 software.

2.2 Study Population

The various categories of workers in the factories consisting of machine operators, carpenters, cleaners and wood traders working in same general area were considered in this study. The workers working in different sections of sawmill such as Band sawing machine, Resawing machine, planer mill and sanding are also considered for this study.

2.3 Study Participants

The male workers of age group more than 18 years having worked five years and above gave their consent to answer the questionnaire [1 and 21].

2.4 Exclusion Criteria

Non-Consenting workers and workers below the age of 18 were not considered in this study[1].

2.5 Survey Instrument

A high precision real time Air detection personal dust particle counter was used to monitor the onsite concentration of dust in micrograms per cubic meter. In the questionnaire survey, structured interviewer administered questionnaire (31 questions) was used to collect the data on occupational safety and health problems.

3. Results and Discussion

3.1 Sociodemographic Characteristics of Saw Mill Workers

The sociodemographic characteristics of sawmill workers in Kochuveli and Kilippalam were assessed through survey study[1 and 8].A total of 100 workers of different zones (coastal and urban zones) particularly involved in sawing of woodwere engaged for this study[5 and 13]. The 20-40 years age group was the most frequent age group (66.67 %). An informal worker of small-scale industries policies and measures for delivery of occupational safety and health services is limited and deficient. Even though the laws and regulation are there but their implementation, inspection and audits for proper adherence to regulations need to be improved[8].

3.2 Occupational Dust Exposures Among Sawmill Workers

The general information's about the dust concentration levels at Kochuveli and Kilippalam Sawmill is presented **(Table 1 and 2)**.The effects of dust concentration levels during band sawing operation, re sawing operations and planer milling operation in both the sawmill with the particulate matter (PM) of size 2.5 and 10 µg/m3were investigated and presented (Figs. 5 to 10).The mass concentration of emitted wood dust levels was measured through aerosol intelligent air detector. The result revealed that the size of the particulate matter plays a significant role in the health of sawmill workers. The particulate matter of 2.5 µg/m3 prone to more hazards than 10 µg/m3 particulate matter. This means a reduction in size shows an increase in health hazards[1 and 3]. Also, the emission of wood dust levels is more in the Kilippalam saw mill in comparison with Kochuveli saw mill. This means that the wood dust exposures prone to more hazards in urban areas in comparison with coastal areas.

The results also proved that during sanding, most wood dust generated is breathable, and, if sander is not equipped with particle removal system, the level of dust particle concentration in the air becomes higher than the threshold set under the regulations[11]. It was also reported that to reduce particle emissions at the source, it is necessary not only to understand how dust particles are formed, but also to be able to predict their emission.

The results of this study confirm that the total amount of airborne dust produced is a function of the total amount of wood removed during the sanding process.Real-time measurements demonstrated that softwood species generated higher dust concentrations than hardwood species due to difference in abrasion durability[11].

The study also demonstrated thatstatistically significant association existed between exposure to wood dust and respiratory symptoms, thereby contributing to the observed manifestation of respiratory symptoms such as chronic cough, corrhiza, breathlessness and wheezing among wood dust exposed workers[4, 5, 12 and 21].

4. Conclusions

Sawmill workers are commonly exposed to many occupational hazards. This study describes the assessment of occupational exposures on wood dust among sawmill workers in Kerala. The location of sawmills play a significant role in the occupational exposures of hazards. So, this study recommended that the establishment of sawmills in the urban areas should be avoided. The study also exhibited that sawmill workers have higher prevalence of respiratory symptoms and reduced pulmonary function due to exposure to wood dust compared with non-exposed population. The most common injuries and illnesses in sawmills workers observed were bruises, lacerations, cough, conjunctivitis and sneezing. This study also concluded that sawmill workers awareness about wood dust as hazards was high, but usage of PPE was very low. Measures should therefore be put in place to mitigate against these hazards in sawmills, especially by the employers. There should be dust control at the milling sites as well as provision of PPE for workers. Last but not least occupational hazards are preventable. Prevention of occupational hazards depends on the understanding that workers' safety is not only the responsibility of the workers but is the primary responsibility of the employer. The employers need to train all their employees on the appropriate safety procedures and maintain safe working environment so that hazards are less likely to occur.

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Table 1: General Information about the Dust Concentration Levels at Kochuveli Sawmill

S. No.	Occupational Workstation	COASTAL ZONE Sawmill -1 (Kochuveli- Trivandrum) Wood Dust Concentration Levels in µg/m3									
		No. of Observations		Geometric Mean		Arithmetic Mean		Median		No. of Observations above Permissible Standards.	
		PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5 >60µg/m3	PM10 > 100 µg/m3
1.	Band Sawing Machine	21	17	38.90	49.30	39.80	50.70	40.00	48.00	NIL	NIL
2.	Resawing Machine	41	55	60.90	76.10	61.80	77.80	64.00	76.00	23	5
3.	Planer Mill	55	54	49.30	56.50	51.20	58.70	48.00	55.00	15	1

Table 2: General Information about the Wood Dust Concentration Levels at Kilippalam Saw Mill

S.No.	Occupational Workstation	URBAN ZONE Sawmill -2 (Kilippalam - Trivandrum) Wood Dust Concentration Levels in µg/m3									
		No. of Observations		Geometric Mean		Arithmetic Mean		Median		No. of Observations above Permissible Standards.	
		PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5	PM 10	PM 2.5 >60µg/m3	PM10 > 100 µg/m3
1.	Band Sawing Machine	66	63	183.40	231.30	191.70	246.60	182.00	224.00	66	62
2.	Resawing Machine	101	98	193.30	242.30	201.40	250.70	202.50	248.00	101	98
3.	Planer Mill	33	36	170.70	184.90	232.80	250.20	270.00	279.50	29	26

Figure 1: Worker Performing Resawing Operations

Figure 2: Worker Undertaking Heavy Lifting

Figure 3: Worker under Exposure of Wood Dust

Figure 4: Worker performing the Bandsaw Operation

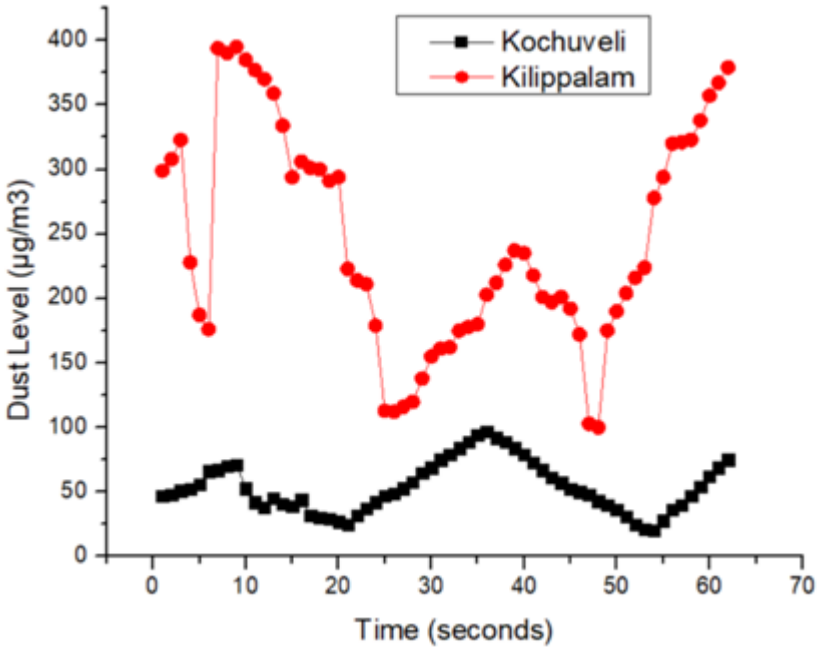

Figure 5: Dust Concentration Levels during Band Sawing Operation (PM = 10 µg/m3)

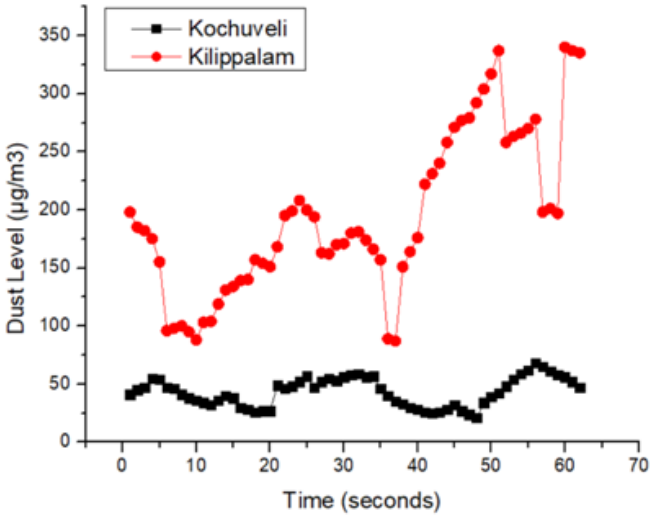

Figure 6: Dust Concentration Levels during Band Sawing Operation (PM = 2.5 µg/m3)

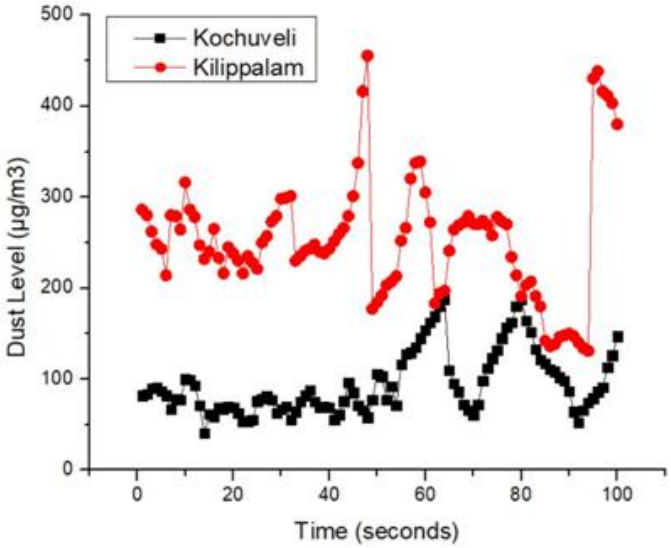

Figure 7: Dust Concentration Levels during Re Sawing Operation (PM = 10 µg/m3)

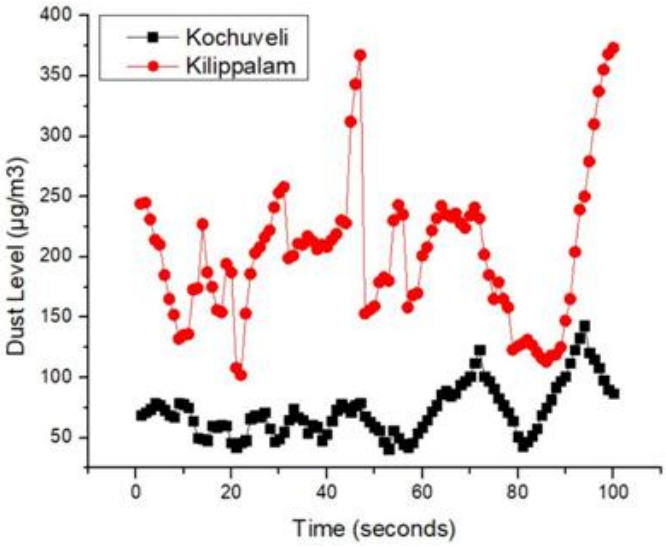

Figure 8: Dust Concentration Levels during Re Sawing Operation (PM = 2.5 µg/m3)

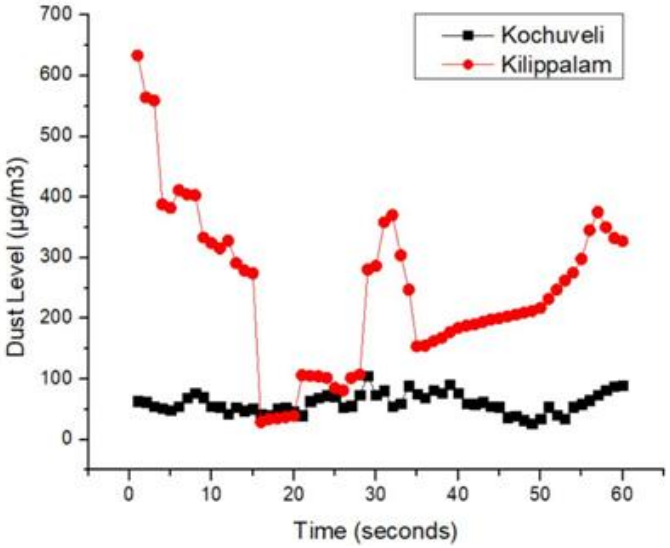

Figure 9: Dust Concentration Levels during Planer Milling Operation (PM = 10 µg/m3)

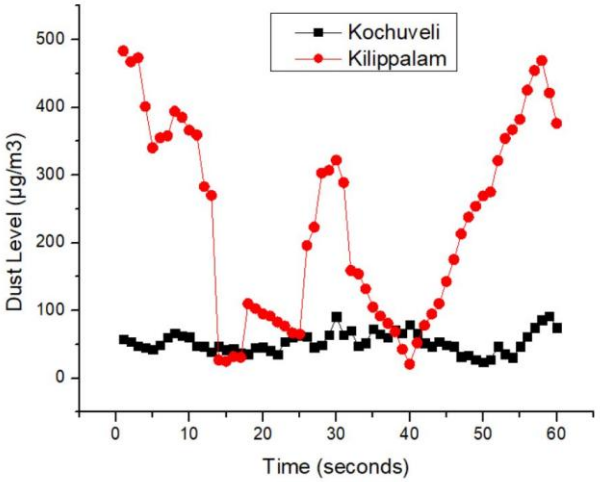

Figure 10: Dust Concentration Levels during Planer Milling Operation (PM = 2.5 µg/m3)