

A STUDY ON NOISE LEVELS OF MACHINERY USED IN LUMBER INDUSTRY ENTERPRISES

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ABSTRACT

The aim of this study is to help to create a healthier environment by measuring the noise levels in the furniture and lumber sectors of forest products industry. In this study, noise measurement for approximately 3 min has been conducted in 4 measurement spots in the side of the machinery, in the factory entrance and in full and empty state for each machinery; from 3 different chosen spots in enterprises producing lumber. Measurements have been recorded as 720, from each machine as 36 measurements, with the condition to be recorded every 5 sec for 3 min. For this purpose, noise measurements have been carried out in 17 workplaces producing lumber and results have been compared statistically. As a result of the obtained findings, it is understood that the noise levels of thickness machinery don't exceed the value for the upper limit stated in the regulations. However, vertical wood band sawmill and band saw machines have been observed to go over this limit. Besides, some factors of planning and multi slitting machine don't exceed this limit, some of them exceed. As a result, it has been conducted that when noise levels of machinery used in the lumber industry enterprises exceed the upper limit stated in the regulations, they can pose a serious threat to human health.

KEYWORDS: Lumber, noise, machinery, work environment, forest products industry.

INTRODUCTION

Mechanical vibrations caused by a pressure change in unpleasant and unwanted gas, liquid and solids are called noise. The sound is the changes occurred in air pressure which reaches in waves to sensorial organs. The intensity and frequency are expressions for characteristics of a vibration (Akan 2002). An oscillation, expressed as the number of cycles, determines the low

pitch (low frequency) or the high pitch (high frequency) of the sound with respect to noise. Hertz indicated with "Hz" symbol is the frequency unit. A young and healthy person can hear the sounds between 20000 Hz and 20 Hz (Passchier-Vermeer and Passchier 2000, Muzet 2007). Noise is called as sounds which people dislike and leaves a negative impact on them. Especially our large cities have a noise level that is above measurements determined by the World Health Organization (WHO). Noise, which is generally defined as irritating and unwanted noise, affect human health and body health adversely (Krilek et al. 2016). The noise concept in the industry is the sound that leaves psychological and physiological effects on employees in workplaces and affects the work efficiency, perception and auditory health adversely (Güvercin and Aybek 2003, Durcan and Burdurlu 2018). It is known that the noise level in the woodworking enterprises is high (Lučić et al. 2007, Mandić et al. 2015). For this reason, it is recommended to use ear protectors for those working in such enterprises (Kopecký and Rousek 2012). It is deduced from the studies that the noise has effects varying between individuals and its effects on human health can be listed as following (Güner 2000): (1) Noise has negative effects on people such as loss of concentration, irritability, insomnia and uneasiness. (2) Noise reduces work efficiency along with hindering reasoning. Studies on vocabulary learning and memory are affected by noise. Especially learning experiences in schools are seen to be affected adversely. Its effect of reducing the effectiveness of learning is observed in schools which are close to the noisy areas. Noise; is also important in terms of school health for reasons such as reducing reading, understanding and the level of learning. (3) It can cause problems, increase in depressions and rapid irritation and anger, and may cause problems and depressions and character changes in people who have a tendency towards this direction. (4) Sudden noise can cause adrenal discharges in people, in parallel with this, increase in heart rate and respiratory rate, as well as a rise in blood pressure, disturbed sleep patterns, and attention deficit. The heart rate increasing with sudden noise also causes pupil constriction. The impacts of different noise ranges on humans are described as (Stansfeld and Matheson 2003, Yost 2007, Kasprzak 2014, Erol and Su 2015) 0-35 dB: Non-destructive noise, 36-65 dB: Irritating noise that can disturb sleep and rest, 66-85 dB: Irritating, mentally detrimental noise causing hearing problems, 86-115 dB: Noise damaging mentally and physically, causing psychosomatic diseases, 116-130 dB: Hazardous noise, deafness and suchlike cases, 131-150 dB: Highly hazardous noise cannot be heard without a protective tool. Noise damaging instantly.

It is known that the noise, of which impacts on human health differs among the people, bothers the employees differently with a severity of over 60 dB (A) and spreading through the workplace. A rise in sound intensity increases the adverse impacts on the employee health. The reason why enterprises do not pay much attention to the noise issue is that expression of emerged harmful effect takes a long time. This explains why noise originated occupational diseases are most encountered in our national industry. Hearing loss formed in people who are exposed to severe noise above 90 dB (A) for long periods of time, can occur temporarily or permanently. Temporary hearing loss, arising from being present in a noisy environment for a certain period of time disappears after resting for a given period. However, this duration which should be passed far away from this environment is rather long (Güner 2000). For instance; for a person who is exposed to the noise above 90 dB (A) for 100 min, that person should stand back of this noisy environment for 1000 minutes to restore this hearing loss. The required time for recovery from this temporary hearing loss is 10 times of noise exposure time. The rise in hearing losses also depends on the increase in noise level. This causes an increase in the time required for recovery (Demir 2012).

It has been reported that the noise and dust produced by many machines and systems used in the forest products industry is threatening human health (Ratnasingam and Ioras 2010, Hlášková et al. 2015, Robinson et al. 2015, Durcan and Burdurlu 2018). Machinery and cutter types used in wood-processing industries are among the most important factors that increase the noise level (Kvietková et al. 2015). The noise level in the workplace environment is not only directly caused by hearing loss, but also as an important cause of work accidents (Cooper 2000, Clarke 2006, Das et al. 2008, Ratnasingam et al. 2016).

MATERIAL AND METHODS

In this study, enterprises producing timber in Gümüşhane province at the Eastern Black Sea Region of Turkey has been monitored. In this research, 17 enterprises in lumber sector manufacturing in the forest products industry were studied. The necessary interviews were carried out with enterprises manufacturing limber and furniture in Gümüşhane province; before analyses, required permits were obtained for the determination of noise, measurements were conducted for approximately 3 min from 3 different selected points; machines running in idle and loaded state for each machinery, and in the 4 measuring locations at the factory entrance and near the machine. Measurements were recorded as 36 from each machinery, with the condition to be recorded every 5 sec of 3 min (Tab. 1). Noise level measurements were made according to PN-EN ISO 9612 (2011) standards (Bilski 2017, Dudarewicz et al. 2018, Pleban 2019).

In this study, the noise levels of the band saw, vertical wood band sawmill machine, thickness machine, planing machine and multi drilling machines, which are available in furniture and timber manufacturing enterprises in Gümüşhane province, were measured.

Tab. 1: Number of noise measurements made by companies engaged in small scale forest products production.

| | Machine is running in empty condition | Machine is running in full condition | Introduction of the business | Next to the machine | Total number of measurements |
|-------------------------|---------------------------------------|--------------------------------------|------------------------------|---------------------|------------------------------|
| Band saw machines | 36 | 36 | 36 | 36 | 144 |
| Table saw machines | 36 | 36 | 36 | 36 | 144 |
| Wood thickness machines | 36 | 36 | 36 | 36 | 144 |
| Wood planer machines | 36 | 36 | 36 | 36 | 144 |
| Multi rip saw machines | 36 | 36 | 36 | 36 | 144 |
| Total | | | | | 720 |

Measurements were carried out in such a manner that there aren't reflections from the employees' location. Other machines were assumed not to operate in the measurements. The constant noise limit value was determined as 85 dB (A) by the international labour organization (ILO) and as in the study. In the measurements of machinery and other equipment, measurement position was one meter away from machinery and other equipment and at the hearing level of the employee (Çakır 2010). TESTO 815 device has been used to measure the noise level in the enterprises manufacturing furniture and timber.

The batteries of the noise measuring device have been checked beforehand. Before and after the measurement, the device was calibrated to determine the atmospheric properties (ambient temperature and relative humidity) of the environment where measurements take place. Noise level measurement has been conducted by choosing correct settings according to properties of the device to be used and type of noise to be measured.

The obtained results of the questionnaire forms were entered into Excel, Word program and then coded for evaluation in SPSS package program and a database was created in the computer environment. For each machine separately, one way variance analysis (One Way Anova) was applied to the created database to determine whether or not there was a significant difference between noise levels on the basis of variables of operation input, machine side, loaded and idle running machine. As a result of this analysis, homogeneity test (Post Hoc) has been conducted to determine the statistical analysis method which will be used to determinate among which variables of this contrast occurred. For cases where homogeneity of variance result was $p > 0.05$, variances distributed in a uniform and for cases where it was $P < 0.05$, the distribution of variances was not in a uniform. In the conducted homogeneity test, the statistical significance level was measured as $p < 0.05$ and Dunnett T3 test was used for the tests under the title of Equal Variances Not Assumed. On the other hand, descriptive statistics like frequency, %, mean, standard deviation and standard error were used in the data evaluation.

RESULTS AND DISCUSSION

The results of the homogeneity test of the obtained findings were determined as a result of the measurements conducted for the band saws, vertical wood band sawmill, thickness, planing and multi-slitting machineries utilized in the enterprises (Tab. 2).

Tab. 2: Homogeneity test results for machines used in enterprises.

| Name of machines | Stt. | df1 | df2 | Sig. |
|-------------------------|---------|-----|------|-------|
| Table saw machines | 856.832 | 3 | 3164 | 0.000 |
| Band saw machines | 42.842 | 3 | 2444 | 0.000 |
| Wood thickness machines | 165.491 | 3 | 2444 | 0.000 |
| Wood planer machines | 248.064 | 3 | 2444 | 0.000 |
| Multi rip saw machines | 291.662 | 3 | 2444 | 0.000 |

It has been determined that there are statistically significant differences with a significance level of 1% between the measurement location and machine status factors in terms of noise levels in band saws, vertical wood band sawmill saws, thickness, planing and multi-slitting machines used in enterprises (Tab. 3).

Tab. 3: Variance analysis results of noise levels of machines used in enterprises.

| Variation source | Degrees of freedom | Sum of squares | Mean squares | F- value | Sig. |
|--------------------|--------------------|----------------|--------------|----------|-------|
| Table saw machines | | | | | |
| Between Groups | 1234.310 | 3 | 411.437 | 533.559* | 0.000 |
| Within Groups | 2439.815 | 3164 | 0.771 | | |
| Total | 3674.124 | 3167 | | | |
| Band saw machines | | | | | |
| Between Groups | 48.850 | 3 | 16.283 | 238.695* | 0.000 |
| Within Groups | 166.725 | 2444 | 0.068 | | |
| Total | 215.575 | 2447 | | | |

| Wood thickness machines | | | | | |
|-------------------------|-----------|------|----------|-----------|-------|
| Between Groups | 1675.765 | 3 | 558.588 | 276.072* | 0.000 |
| Within Groups | 4945.043 | 2444 | 2.023 | | |
| Total | 6620.808 | 2447 | | | |
| Wood planer machines | | | | | |
| Between Groups | 6690.819 | 3 | 2230.273 | 6092.754* | 0.000 |
| Within Groups | 894.634 | 2444 | 0.366 | | |
| Total | 7585.453 | 2447 | | | |
| Multi rip saw machines | | | | | |
| Between Groups | 28786.236 | 3 | 9595.412 | 1822.66* | 0.000 |
| Within Groups | 12866.460 | 2444 | 5.265 | | |
| Total | 41652.696 | 2447 | | | |

As shown in Tab. 4, the distribution and statistical analysis of the band saws, vertical wood band sawmill, thickness, planing and multi-slitting machines used in the enterprises concerning their noise levels have been given according to the measurement location and machine status in the scope of the study. The highest noise level for the band saw machinery was determined as 87.31 dB in the machine side measurement location and loaded machine condition. On the other hand, the lowest value was determined as 85.80 dB in the factory entrance measurement location and the idle machine status (Tab. 4). The highest noise level in the vertical wood band sawmill machine was 87.55 dB in the workshop entrance and loaded machine status. But, the lowest level was 87.22 dB in the side of machine and idle machine status (Tab. 4). According to this result, the noise levels of the band saw machine and vertical wood band sawmill machine have been found to go over the upper limit of 85 dB (A) specified in the regulations. The highest noise level in the thickness machine was found out as 84.44 dB in the machine side measurement location and the loaded machine. On the other hand, the lowest level was 82.23 dB in the side of machine measurement location and idle machine. And so, the noise levels of the thickness machine were determined not to exceed the upper limit of 85 dB (A) specified in the regulations (Tab. 4). The highest noise level in the planing machine in the side of machine and loaded machine status was identified as 86.43 dB. Furthermore, the lowest level was 82.43 dB in the workshop entrance measurement location and idle machine status. In this case, it was observed that the noise levels of the planing machine for the machine side measurement location and loaded machine status exceeded the upper limit value of 85 dB (A) stated in the regulations, this limit wasn't exceeded in other factors (Tab. 4). The highest noise level in the multi-slitting machine was 85.93 dB in the machine side measurement location and the loaded machine status. On the other hand, the lowest was 76.30 dB in the workshop entrance measurement location and idle machine status. Then, the noise level of the multi-slitting machine for the machine side measurement location and loaded status was discovered to go over the upper limit of 85 dB (A) stated in the regulations, the other factors did not exceed this limit (Tab. 4).

Tab. 4: Average values of noise levels of machines used in enterprises.

| | Measurement location | Machine status | Min (dB) | Max (dB) | Average (dB) | Standart deviation | Std. error | Average-Boundary value difference | Momentary Max.-Boundary value difference | Idle / Load change rate (% by average) |
|-------------------------|----------------------|----------------|----------|----------|--------------|--------------------|------------|-----------------------------------|--|--|
| Table saw machines | Workshop entrance | Idled | 83.30 | 87.00 | 85.80 | 0.80542 | 0.02862 | 0.80 | 2.00 | 1.7 |
| | | Load | 84.90 | 88.60 | 87.24 | 1.31273 | 0.04665 | 2.24 | 3.60 | |
| | Next to the machine | Idled | 84.80 | 88.10 | 87.23 | 0.75383 | 0.02679 | 2.23 | 3.10 | 0.1 |
| | | Load | 86.10 | 88.10 | 87.31 | 0.37981 | 0.01350 | 2.31 | 3.10 | |
| Band saw machines | Workshop entrance | Idled | 86.60 | 87.80 | 87.25 | 0.27128 | 0.01097 | 2.25 | 2.80 | 0.3 |
| | | Load | 87.10 | 87.90 | 87.55 | 0.22028 | 0.00890 | 2.55 | 2.90 | |
| | Next to the machine | Idled | 86.60 | 87.60 | 87.22 | 0.22545 | 0.00911 | 2.22 | 2.60 | 0.3 |
| | | Load | 86.80 | 88.10 | 87.48 | 0.31611 | 0.01278 | 2.48 | 3.10 | |
| Wood thickness machines | Workshop entrance | Idled | 78.00 | 86.50 | 82.93 | 1.62782 | 0.06580 | -2.07 | 1.5 | -0.3 |
| | | Load | 79.20 | 85.90 | 82.71 | 1.37010 | 0.05538 | -2.29 | 0.9 | |
| | Next to the machine | Idled | 81.30 | 83.90 | 82.23 | 0.61964 | 0.02505 | -2.77 | -1.1 | 2.7 |
| | | Load | 81.10 | 87.60 | 84.44 | 1.78394 | 0.07211 | -0.56 | 2.6 | |
| Wood planer machines | Workshop entrance | Idled | 81.40 | 83.80 | 82.43 | 0.38768 | 0.01567 | -2.57 | -1.2 | 4.4 |
| | | Load | 85.20 | 87.20 | 86.02 | 0.51602 | 0.02086 | 1.02 | 2.2 | |
| | Next to the machine | Idled | 82.60 | 84.20 | 83.67 | 0.26958 | 0.01090 | -1.33 | -0.8 | 3.3 |
| | | Load | 84.10 | 88.30 | 86.43 | 0.9874 | 0.03991 | 1.43 | 3.3 | |
| Multi rip saw machines | Workshop entrance | Idled | 71.10 | 79.50 | 76.30 | 2.86981 | 0.11601 | -8.70 | -5.50 | 7.1 |
| | | Load | 75.50 | 87.30 | 81.69 | 2.92006 | 0.11804 | -3.31 | 2.30 | |
| | Next to the machine | Idled | 77.40 | 83.00 | 80.72 | 1.27753 | 0.05164 | -4.28 | -2.00 | 6.5 |
| | | Load | 81.40 | 88.10 | 85.93 | 1.63200 | 0.06597 | 0.93 | 3.10 | |

Accordingly, since the significance level was calculated below 0.05 ($p < 0.05$), it was detected that the data were not distributed homogeneously. Hence, (Post Hoc) Dunnett T3 test was carried out to determine between which groups the statistically significant difference in noise level measurement occurred and the obtained results were detected as in Tab. 5. In Tab. 5, for the Post Hoc analysis conducted by using the Dunnett T3 test, there were no statistically significant differences between the loaded status of the workshop entrance and the idle status in the side of the machine; idle state in the side of the machine and loaded status in the workshop entrance; the loaded and idle status in the side of the machine; statistically significant differences were observed in other comparative cases. Furthermore, statistically significant differences were found to be formed at all comparative cases of vertical wood band sawmill, planing and multi-slitting machinery measurements. On the other hand, there were no statistically significant differences in terms of the noise level between in idle state and workshop entrance; in loaded state and workshop entrance; in idle state and workplace entrance (Tab. 5).

Tab. 5: Groups formed according to Dunnett T3 test for noise levels of machines used in enterprises.

| Measurement location - Machine status | | Mean difference (I-J) | Standard error | Sig. | Mean difference (I-J) | Standard error | Sig. |
|---------------------------------------|----------------------------|-----------------------|----------------|-------|-----------------------|----------------|-------|
| Workshop entrance- Idled | Workshop entrance- Load | -1.34369* | 0.05473 | 0.000 | -0.29216* | 0.01413 | 0.000 |
| | Next to the machine- Idled | -1.45530* | 0.03920 | 0.000 | 0.04003* | 0.01426 | 0.030 |
| | Next to the machine- Load | -1.50631* | 0.03164 | 0.000 | -0.22092* | 0.01684 | 0.000 |
| Workshop entrance- Load | Workshop entrance- Idled | 1.34369* | 0.05473 | 0.000 | 0.29216* | 0.01413 | 0.000 |
| | Next to the machine- Idled | -0.11162 | 0.05379 | 0.208 | 0.33219* | 0.01274 | 0.000 |
| | Next to the machine- Load | -0.16263* | 0.04856 | 0.005 | 0.07124* | 0.01557 | 0.000 |
| Next to the machine- Idled | Workshop entrance- Idled | 1.45530* | 0.03920 | 0.000 | -0.04003* | 0.01426 | 0.030 |
| | Workshop entrance- Load | 0.11162 | 0.05379 | 0.208 | -0.33219* | 0.01274 | 0.000 |
| | Next to the machine- Load | -0.05101 | 0.02999 | 0.429 | -0.26095* | 0.01569 | 0.000 |
| Next to the Machine- Load | Workshop entrance- Idled | 1.50631* | 0.03164 | 0.000 | 0.22092* | 0.01684 | 0.000 |
| | Workshop entrance- Load | 0.16263* | 0.04856 | 0.005 | -0.07124* | 0.01557 | 0.000 |
| | Next to the machine- Idled | 0.05101 | 0.02999 | 0.429 | 0.26095* | 0.01569 | 0.000 |
| Workshop entrance- Idled | Workshop entrance- Load | 0.21993 | 0.08601 | 0.062 | -3.58824* | 0.02609 | 0.000 |
| | Next to the machine- Idled | 0.70114* | 0.07041 | 0.000 | -1.23546* | 0.01909 | 0.000 |
| | Next to the machine- Load | -1.51176* | 0.09762 | 0.000 | -3.99869* | 0.04288 | 0.000 |
| Workshop entrance- Load | Workshop entrance- Idled | -0.2199 | 0.08601 | 0.062 | 3.58824* | 0.02609 | 0.000 |
| | Next to the machine- Idled | 0.48121* | 0.06078 | 0.000 | 2.35278* | 0.02353 | 0.000 |
| | Next to the machine- Load | -1.73170* | 0.09092 | 0.000 | -0.41046* | 0.04504 | 0.000 |
| Next to the machine- Idled | Workshop entrance- Idled | -0.70114* | 0.07041 | 0.000 | 1.23546* | 0.01909 | 0.000 |
| | Workshop entrance- Load | -0.48121* | 0.06078 | 0.000 | -2.35278* | 0.02353 | 0.000 |
| | Next to the machine- Load | -2.21291* | 0.07634 | 0.000 | -2.76324* | 0.04137 | 0.000 |
| Next to the machine- Load | Workshop entrance- Idled | 1.51176* | 0.09762 | 0.000 | 3.99869* | 0.04288 | 0.000 |
| | Workshop entrance- Load | 1.73170* | 0.09092 | 0.000 | 0.41046* | 0.04504 | 0.000 |
| | Next to the machine- Idled | 2.21291* | 0.07634 | 0.000 | 2.76324* | 0.04137 | 0.000 |
| Workshop entrance- Idled | Workshop entrance- Load | -5.34559* | 0.1655 | 0.000 | | | |
| | Next to the machine- Idled | -4.41699* | 0.12698 | 0.000 | | | |
| | Next to the machine- Load | -9.65425* | 0.13345 | 0.000 | | | |
| Workshop entrance- Load | Workshop entrance- Idled | 5.34559* | 0.1655 | 0.000 | | | |
| | Next to the machine- Idled | 0.92859* | 0.12884 | 0.000 | | | |
| | Next to the machine- Load | -4.30866* | 0.13522 | 0.000 | | | |
| Next to the machine- Idled | Workshop entrance- Idled | 4.41699* | 0.12698 | 0.000 | | | |
| | Workshop entrance- Load | -0.92859* | 0.12884 | 0.000 | | | |
| | Next to the machine- Load | -5.23725* | 0.08378 | 0.000 | | | |
| Next to the machine- Load | Workshop entrance- Idled | 9.65425* | 0.13345 | 0.000 | | | |
| | Workshop entrance- Load | 4.30866* | 0.13522 | 0.000 | | | |
| | Next to the machine- Idled | 5.23725* | 0.08378 | 0.000 | | | |

It was observed that the noise levels of the vertical wood band sawmill machines operating in the enterprises came out in values rather different from each other according to cases of idle and loaded states at the workshop entrance and side of the machine (Fig. 1). On the other hand, it turned out quite different from each other at workshop entrance and the machine side (Fig. 2). As seen in Fig. 3, it was detected that noise levels of the thickness machine operating in the enterprises came out close to each other at the workshop entrance and the machine side. It was found out that the noise levels of the planing machines operating in the enterprises are different were rather different from each other according to cases of idle & loaded status and workshop entrance & the machine sides (Fig. 4). As it can be seen in Fig. 5, it has been detected that the noise levels of the multi-slitting machines operating in the enterprises are in quite different values from each other with respect to cases of idle & loaded status and workshop entrance & the machine sides.

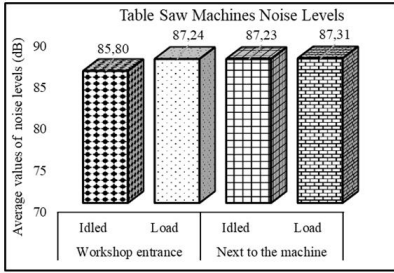


Fig. 1: Average values of noise levels of table saw machines.

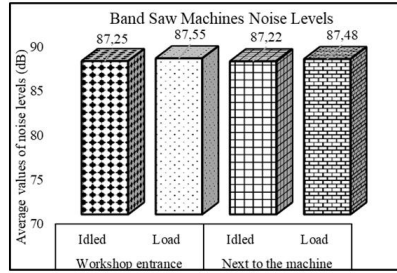


Fig. 2: Average values of noise levels of band saw machine.

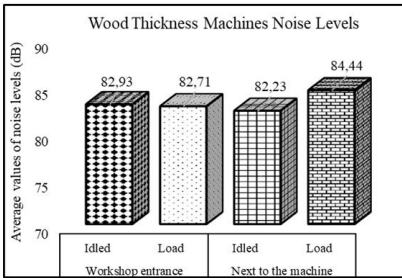


Fig. 3: Average values of noise levels of wood thickness machines.

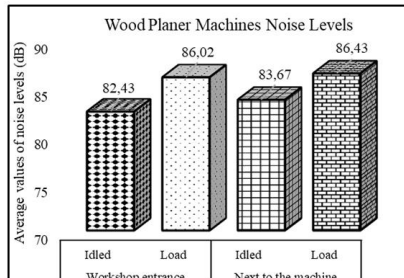


Fig. 4: Average values of noise levels of wood planer machines.

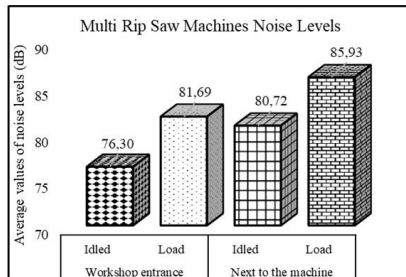


Fig. 5: Average values of noise levels of multi rip saw machines.

Many scientific studies have been conducted to report that the noise generated by the machines used in the timber industry within the scope of different factors such as wood type processed, number of blades, depth of cut and width has reached a level that may adversely affect employee health (Ntalos and Papadopoulas 2005, Ratnasingam et al. 2010, Durcan and Burdurlu 2018). The findings obtained in the study are similar to the results of these studies. On the other hand, it has been reported that high noise levels may cause psychological disorders and motivation losses in addition to physiological disorders in employees (Muzet 2007, Leventhall 2009).

CONCLUSIONS

The highest noise levels of machineries utilized in enterprises in the woodworking and furniture industries were observed as following; for thickness machine in loaded machine and the machine side position; for band saw machineries in the side of machine and the loaded machine status; for the planing machines in loaded machine status and the machine side; for vertical wood band sawmill in the workshop entrance and the loaded machine status; and for the multi slitting machines in loaded status and machine side status. The lowest noise levels of machineries used in enterprises in woodworking and furniture industries were found out as following; for thickness machine in machine side measurement location and idle machine status; for band saw machineries in workshop entrance and idle status; for planing machineries in the workshop entrance and idle status; for vertical wood band sawmill machineries in idle status and side of the machine; and for multi slitting machineries in workshop entrance and idle status.

As a result of these; the noise level of the thickness machine does not exceed 85 dB (A), which is the upper limit value stated in the regulations; the noise levels of the band saw machine exceeds the upper limit of 85 dB (A) specified in the regulations; the noise level of the planing machine exceeds the upper limit of 85 dB (A) stated in the regulations for the machine side measurement location and loaded machine status, it doesn't exceed this limit for other factors; the noise levels of the vertical wood band sawmill machinery exceeds the upper limit of 85 dB (A) specified in the regulations; the noise level of the multi-slitting machinery exceeds the upper limit of 85 dB (A) stated in the regulations for the machine side measurement location and loaded machine status, and it doesn't exceed this limit for other factors. As a consequence of these; it has been determined that the noise levels of the thickness machine do not exceed the upper limit of 85 dB (A) specified in the regulations. However, the vertical wood band sawmill machine and band saw machineries have been observed to go over this limit. Besides; some factors of the planing machine and multi-slitting machines don't exceed this limit, and some of them seem to exceed.

In conclusion, it has been deduced that the noise levels of the machineries used in enterprises in the woodworking and furniture industries can pose a serious danger to human health when they exceed this upper limit specified in the regulations.

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