ASSESSMENT OF SOUND LEVELS IN SOME SELECTED SMALL SCALE MILLS IN GBAKO LOCAL GOVERNMENT AREA, NIGER STATE

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Abstract

Large quantity of grains and tubers are produced from Gbako Local Government Area of Niger State. These produce need to be processed for human needs. The processing of grains to flour has received considerable attention through the introduction of various types and sizes of mills in the market. However the noise produced, the comfort of the operators(s) and the environment in which these mills are operated are yet to be specified according to ergonomics standard. The functional mills in Lemu and Edozhigi Metropolis of Gbako Local Government were number and ten mills that are operated regularly were selected from each metropolis randomly. The study was carried out through the used of sound level meter. The study revealed that the maximum sound level recorded was 119.3 dB during maize grinding. This value exceeds the recommended noise level use in factories. Mill operators (s) in Gbako Local Government may need ear protective devices where the noise can not be reduced from the source or along its path for effective operation and without having adverse effect on the operator (s)

The present trend in mechanization of agriculture has focused attention on the need to consider human beings in the design and modification of machines and devices to make mechanization goals achievable. In line with the goals of mechanization, efforts have been made to make the machines and environment in which they are operated to suit human health, safely and comfort. Farm produce have to be processed for immediate use, storage or transportation through the use of machines. A machine consist of virtually any type of physical object, devices, equipment facility, things or equipments that people use in carrying out some activities that is directed towards achieving some desired purpose. The man and the machine must be compactable so that the desired goals can be achieved.

The machines used in processing of grains to flour are called mills. They are of different types and sizes; the most common is the Burr mills. The Burr mills produce and sound, sound is defined as the sensation of hearing perceived by the ear (Mc Cormick and Sandars 1982). It is originated by vibrations from some sources and such vibrations can be transmitted through various media. The primary concern is on those transmitted through the atmosphere to the ear. Two primary attributes of sound are frequency and intensity (McCormick and Sanders, 1982).

The frequency of sound can be visualized if we think of a simple sound generating source such as a tuning fork. When it is struck, the tuning fork is caused to vibrate at its "natural" frequency. In so doing, it causes the air

molecules to be moved back and forth. This alteration creates corresponding increase and decrease in the air pressure. Sound intensity is associated with the human sensation of loudness. Sound intensity is defined in terms of power per units area for examples, watts per square meter (W/m). Because the range of power values for common sounds is so tremendous, it is convenient to use a logarithm scale to characterize sound intensity. The bel (B) (named after Alexander Graham bell) is the basic units of measurement used. The number of bels is the logarithm (to base 10) of the ratio of two sound intensities. The most convenient and most commonly used measure of sound intensity is the decibel (dB). A decibel is 1/10 of a bel. When a sound bears no information relationship to the presence or completion of the immediate task, it is termed a noise. Noise is any unwanted sound generated by the vibration of surface or by turbulence in an air stream which sets up rapid pressure vibration in the surrounding air. The rate at which vibration occurs is expressed as a frequency (Witney.1988). The simplest vibration is a pure tone which may be represented by a sinusoidal curve with the frequency F=1/tp. Frequency (Hz) is also expressed as 1/periods. Noise is measured using sound levels meters. Hancock (1982) recommends noise criteria for various uses as follows.

Table 1. Recommended Noise for Various Uses

Types of Space	Permitted Noise Criteria (PNC) (Range or Maximum)	Approximate sound level in dBA
Broadcast and recording studios, concert halls	15	25
Legitimate theaters recording (no amplification) churches	20	30
Large conference rooms (for 50 or so) small auditorium music rehearsal rooms motion Picture theaters.	25	33
Bedroom (hotels, apartment houses, hospitals, residences)	25-40	34-47
Private or semi private offices, living rooms, libraries	30-40	38-47
Sport coliseum (amplification)	35-45	42-52
Restaurants, stores	35-45	47-56
General offices (typing etc)	40-50	47-56
Factories	50-75	56-80

Source: Hancock (1982)

Hancock (1982) recommended that, the permitted noise criteria for human ear should not exceed 85db and must not exceed duration of 4 hours per

day. Where the noise levels are higher and for longer duration, ear protective devices should be used (Shiru, 2001).

The Objectives of the study is to assess the noise level in the selected mills, identify the causes and recommend ways of reducing the noise in the mills

Materials and Methods

The two major instruments used are sound level meter and stop clock.

Sound Level Meter: This is an instrument used to measure sound close to the operators' ear. The type used has the following information.

Make CELL 593
Production company = CELL instrument limited England
Serial number = C.065525

Stop Clock – This was used taking the time

The functional mills in each metropolis (Edozhigi and Lemu) were numbered and ten mills that are operated regularly were selected from each metropolis randomly. The sounds produced were measured using sound level meter placed close to the operators' ear for a period of five minutes.

The sound level was taken three times as follows

i. When the mill was not in operation this is to know the sound of the environment
ii. When the mill is in operation without load (idle running)
iii. When the mill is in operation with full load

The above was done for three days and maximum values recorded.

Results and Discussion

The result obtained from Edozhigi and Lemu metropolises are tabulated in Tables 2a and 2b. The result of the analysis is shown on table 3

Table 2 (A) Sound Level (dB) Measured close to Operators ear for Edozhigi Metropolis

Mill number	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
Environment	66.80	67.60	66.20	68.20	80.10	66.70	67.30	67.90	68.40	66.20
	65.70	66.70	65.70	66.20	81.40	66.30	66.30	66.40	67.30	67.10
	66.30	65.80	64.90	65.70	79.60	65.20	66.00	65.60	66.40	66.70
Idle	78.30	79.30	77.40	78.80	88.40	76.30	78.30	76.30	78.30	77.40
	76.80	78.40	76.50	77.20	86.40	77.40	76.70	77.40	77.80	75.60
	78.10	76.70	77.20	76.40	85.40	75.60	77.20	76.80	77.30	76.40
Load	85.40	82.60	90.20	80.20	119.30	90.40	85.60	90.10	93.20	81.90
	86.40	83.40	88.70	81.30	109.50	92.30	86.70	88.40	90.60	82.60
	87.40	83.80	89.30	84.20	102.50	91.60	85.20	91.20	91.40	82.90

Source: field survey by Shiru (2011)

Table 2 (b) Sound Levels (dB) Measured Close to Operator Ear for Lemu Metropolis

Mill number	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10
Environment	66.10	67.20	66.30	68.10	68.20	67.10	67.30	66.70	69.20	68.20
	65.70	66.30	66.20	66.50	64.90	65.60	65.20	64.70	67.40	68.70
	64.80	65.90	64.70	65.20	65.40	65.30	66.50	65.20	68.20	66.90
Idle	71.20	79.10	72.40	78.10	79.20	78.30	76.90	78.20	79.40	80.20
	70.30	78.50	71.80	76.50	78.10	76.40	77.60	76.70	77.80	76.60
	72.50	76.40	70.40	77.20	76.80	75.30	75.80	77.40	76.50	77.30
Load	83.20	84.40	82.60	84.70	86.40	84.50	89.40	82.60	83.40	91.20
	85.30	86.30	83.40	83.60	83.40	85.30	87.60	83.40	82.60	89.60
	84.30	85.20	82.40	85.70	85.90	84.80	88.20	84.00	83.20	88.90

Source: field survey by Shiru (2011)

Table 3 Analyses of Data on Sound Level of Table 2

Source	DF	SS	MS	F-Calculated
replication	2	29.342	14.671	12.696
treatment	59	14763.54	250.23	216.528
factor (a)	1	250.253	250.253	216.548
factor (b)	9	1021.653	113.517	98.228
factor (axb)	9	1015.858	112.873	97.671
factor ©	2	11846.81	5923.404	5125.617
factor (axc)	2	48.68	24.34	21.062
factor (bxc)	18	197.164	10.954	9.478
factor (axbxc)	18	383.126	21.285	8.418
erro	118	136.366	1.156	
total	179	14929.25		

Grand mean 77.17833 cv 1.392891
LSD 5% 1.55219 LSD 1% 2.19477

The result on tables 2(a) and 2(b) was analyze using Analysis of Variance (ANOVA) (Gomez and Gomez 1984). The sound levels can be treated as 2 X 3 X 10 factorial experimental design. The mean recorded from statistic analysis was 77.1783dB with coefficient of variation of 1.392891. (See table 3). The computed F value was 18.418. F obtained from table F1= Treatment difference 59, F2 error difference 118. The computed value of 18.418 is larger than the tubular F value at the 5% level of significance of 1.68. Hence the sound produce from the mills is said to be highly significant. This was practically evident because during milling, it was not possible for the operator (s) to comprehend exactly what customers are saying. Therefore, customers resort to the use of sign language to communicate during operation.

The high noise level is contributed to from various sources which include the following

i. Noise from electric motor seat vibration
ii. Noise from belt wobbling
iii. Noise due to friction
iv. Noise due to broken bearings
v. Noise due to little clearance from the plates

Conclusions

From the survey of working environment of grains mills in Edozhigi and Lemu metropolis of Gbako Local Government Area of Niger state, the following conclusions were drawn.

i. Engine conditions monitored showed a minimum sand level of 65.70dB and maximum of 119.30dB
ii. Vibrations, damaged bearings contribute to the noise in the mills
iii. Lack of alignment between the electric motor and the milling huller contribute to the noise in the mills
iv. Lack of proper lubrication causes damage to bearing thereby, increasing vibration which in turn, contribute to noise in the mills
v. Little clearance between the plates contribute to the noise in the mills when operated idle (without load)
vi. Grinding of maize grain generate more noise than sorghum and millet

Recommendations

1. The belt should be properly aligned before operating the mills
2. Lubrication should be done daily before operating the mills and at intervals during operations
3. Damaged bearings should be changed before operating the machine
4. There should be enough cross ventilation in the mills for operators comfort

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