The Sarawak 'Tar' for Hadrah Performance

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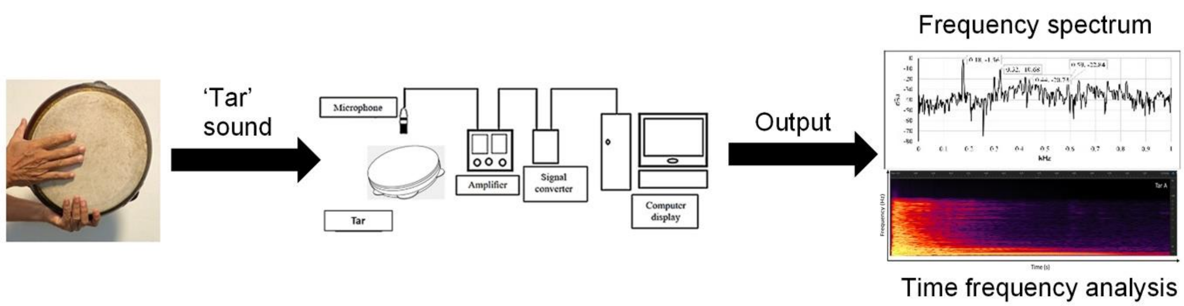
GRAPHICAL ABSTRACT



The Sarawak 'Tar' for Hadrah Performance

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This work was conducted using the PicoScope signal extraction procedure, which revealed remarkable insights regarding the belian wood and its application in Sarawak traditional 'tar' instrument. The 'tar' is a small drum made of wood and attached with goat skin. A hadrah performance is done with the sound of the blow of the 'tar' and reciting poems praising Allah and the Prophet Muhammad by a group of players called the hadrah group. The 'tar' from belian wood had the highest pitch at 180 Hz *i.e.*, F3# compared with the 'tar' from menggeris wood, which had the pitch D3# and A2 that also highlighted their importance in the Western scale. The overtones are not integer multiples of the fundamental frequency except for second and third overtones from 'tar' C (F2/F0 = 3 and F3/F0 = 4). Using Adobe Audition for Time Frequency Analysis (TFA) recordings for the 'tar', the data collection method provided insightful information. The communal efforts of practitioners, who are frequently grouped together, perpetuate the cultural heritage of hadrah. Essentially, by offering a thorough grasp of the intricate melodic details woven in hadrah's cultural fabric, this research adds to the genre's continuing heritage.

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Keywords: Sarawak 'Tar'; Hadrah performance; Belian wood; Menggeris wood

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INTRODUCTION

The Sarawak 'tar' is a traditional musical instrument that is used by the Malay people in Borneo Island, especially in East Malaysia and Brunei. The 'tar' is a shallow, single-headed hand drum having three pairs of metal disks equally space in the rim: It is played by hitting the batter head and bouncing the 'tar'. The 'tar' can be played left-handed as well as right-handed. It is always held with one hand while the other is used to beat it. Figure 1 shows the holding position for beating the 'tar'. Unlike the 'tar', a tambourine is a musical instrument which can be held in the hand and played by tapping, hitting, or shaking the instrument. The tambourine consists of a drum skin on a circular frame with six pairs of small round pieces of metal all around the edge. The kompang instrument unlike the 'tar', is played by the Malay in the Peninsular Malaysia, Singapore, Riau, Sumatra, and Java (Abdullah 2004, 2005). The beating techniques of the 'tar' contrasts with the kompang. Several workers studied the kompang but not the 'tar' (Ismail *et al*. 2015; Siswanto *et al*. 2018). Siswanto *et al*. (2018) studied the effect of humidity on the goat skin membrane of the kompang. Ismail *et al.* (2015) carried out frequency analyses of sounds produced by the kompang.

The 'tar' is used in hadrah performances presented at weddings and other occasions in Sarawak. A hadrah group consists of 10 to 15 players. This study analyzed and exhibited the 'tar' frequency involving the pitch that permeates in the hadrah performances in Sarawak. The data were collected using two methods, namely PicoScope oscilloscope and Adobe Audition. PicoScope oscilloscope records the sound and generates Fast Fourier Transform (FFT) signal. The Time Frequency Analysis (TFA) used Adobe Audition. The hadrah performance was recorded from a professional hadrah player playing the rhythm pattern of the hadrah ensemble (composed of three or more different parts). The hadrah performance features are for wedding occasions and guest entertainment. The song in the performance consists of the aspects of advice especially for newly married couples.

Fig. 1. Holding position for beating the 'tar'

The 'tar' is constructed with diameter from 25.5 cm to 38 cm (~10 to 15 inches). However, the 30.5 cm (~12 inches) and 33 cm (~13 inches) 'tar' are popular and most preferred by adult players. The smaller sizes are normally used by children because they are lighter in weight. The 'tar' is not tuned to any standard pitch, such that each instrument is slightly different in pitch and timbres. The pitch depends on the tautness and thickness of the batter's head skin. The 'tar' needs to be tuned to the acceptable sound before it is played. All the 'tars' used in an ensemble are tuned to a rough pitch as close as possible to each other by the luthier. Before every hadrah performance, a small piece of rattan is inserted inside the 'tar' to tighten the goat skin membrane. The exact pitch is not important to the players, but the acceptable sound of a 'tar' is described as loud, penetrating, sharp, and taut. Any 'tar' with the rough pitch within the acceptable sound can be played together in the hadrah group. The timbre of each acceptable sound is different depending on the thickness and tautness of the head. The beauty of the 'tar' ensemble is derived from the mixture of the various timbres of the 'tar' when performing hadrah.

The 'tar' is held with one bare hand and beat with the other hand while in holding the position. The hand holding the instrument is used to bounce the 'tar' while playing. The instrument is beaten with the palm at the side to produce the 'pung' sound and at the center to produce the 'pak' sound. The playing technique is different with the kompang, which is beaten with only one bare hand while the other hand only holds the instrument without bouncing (Abdullah 2005). The ‘tar’ repertoire is composed of three different timbres, called ‘pung’, ‘pak’, and the rattling sound due to the bouncing of the ‘tar’. The ‘pung’ sound is performed by beating near the edge of the batter head with closed fingers. It is perceived as softer, low, and more settled compared to the ‘pak’ sound. The ‘pak’ sound is produced by beating at the middle of the batter head with open fingers. Unlike the timbre ‘pung’, this timbre ‘pak’ is produced by beating the instrument with a strong and powerful beat. The sound is perceived as loud, high, and penetrating. In the hadrah performance, the ‘tar’ is used to accompany a song (all the players sing together while beating the ‘tar’).

The hadrah performance is an art that is symbolic with the Malay society in Sarawak Malaysia. According to Kassim (2006), the hadrah originated from the Middle East as a medium to spread Islam. The hadrah influence to Sarawak was brought in through Sambas, Kalimantan in 1900. The hadrah performance is used for the wedding procession, the ‘khatamal’ Al-Quran event (recitation of the Al-Quran after completing the whole chapters in the Al-Quran), the ‘berkhatan’ event (circumcision of a boy at the age of 12 years old), and when welcoming a very important person (VIP) to a certain event. The music in hadrah performance reflects elemental Islam with the compulsory songs the ‘Bismillah’ and ‘Solatulminan’ (Daud and Abdul Wahid 2019). The music rhythm plays an important role and influence as a medium for preaching. The beat and rhythm are an important aspect in hadrah performance.

There are various beats in the hadrah performance called ‘tingkat’, ‘pecah’, ‘anak’, and ‘anak sungai’, *etc*. Every beat will follow an individual sequence such as ‘tingkat satu’, ‘tingkat dua’, ‘tingkat tiga’, and ‘tingkat empat’. The same applied to the ‘pecah’ group and ‘anak’ group. ‘Anak sungai’ is another variation of another beat that does not use the term ‘anak satu’, ‘anak dua’, *etc*. There are several types of ‘pukulan’. The most basic ‘pukulan’ is ‘pukulan nadi’, a type of ‘pukulan’ for starting the hadrah. After starting, the players change to ‘pukulan ngakal’. The sound of ‘pukulan ngakal’ or its beats depend on the leader of the hadrah group because every group has a different beat that is unique to that particular group.

EXPERIMENTAL

The acoustic data were obtained through PicoScope oscilloscope and Adobe Audition analysis. The diameter of the tar used was 30.5 cm (see Fig. 2) and is made from belian wood (*Eusideroxylon zwageri*) with a density 850 to 1100 kg/m³.

Fig. 2. The front and back of belian wood ‘tar’, and the copper plate at the side

The artisans have produced 'tar' using whatever accessible method, with the majority of their labor being unrecorded. A lathe machine tool is used in manufacturing to rotate a workpiece around an axis of rotation for a variety of operations, including cutting, sanding, and turning. The workpiece is subjected to tools to create an item with symmetry about that axis (see Fig. 3). Figure 4 shows the belian wood 'tar' in the making. The 60-year-old local manufacturer, Mr. Manap, claimed to have begun the business more than 30 years ago and was the source of all the 'tar' purchased. 'Tar' A is made from belian wood (*Eusideroxylon zwageri*), while 'Tar' B and 'Tar' C are made from menggeris wood (*Koompassia excelsa*). Menggeris is a tropical rainforest wood species in the family *Fabaceae*, a medium hardwood with density 800 to 865 kg/m^3.

Fig. 3. The lathe machine for turning the wood into circular shape

Fig. 4. The front side (batter head), the back side (resonance head), and the batter head fixed with the goat skin membrane

Acoustic spectra were recorded to determine the vibrational overtones for the different 'tar'. This kind of wood causes noticeable variations in the frequency spectrum. The microphone was placed so that it was 20 cm away from the batter head (see Fig. 5).

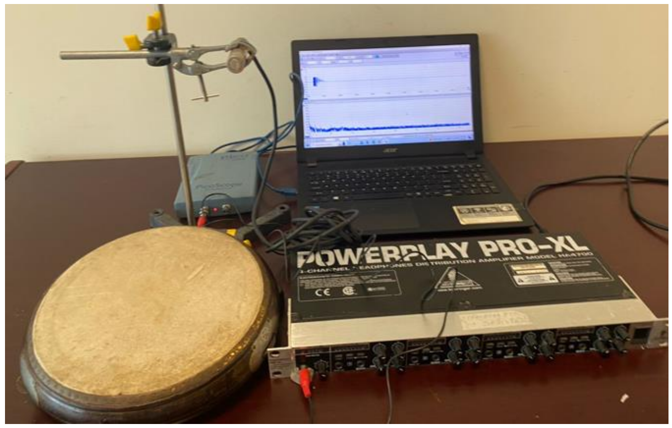


Fig. 5a. Exact photo of the measuring equipment

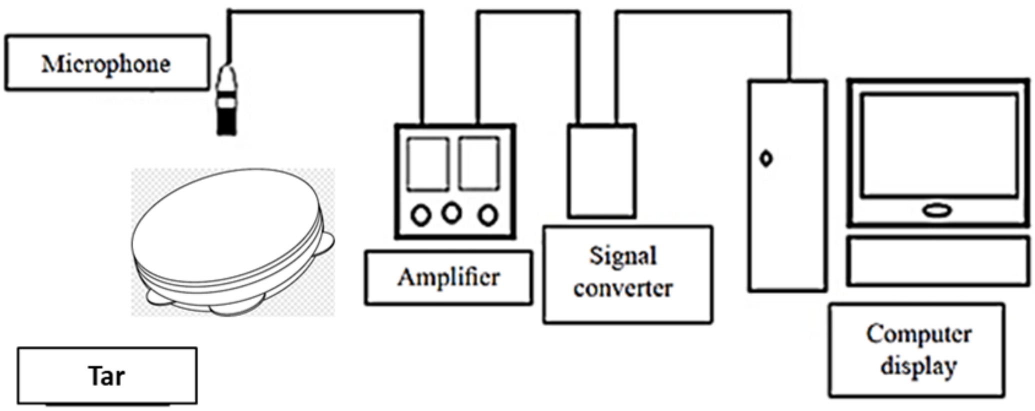


Fig. 5b. The schematic diagram for recording the FFT signal using the PicoScope

The oscilloscopes (Pico Technology, 3000 series, Eaton Socon, UK) performed the Fast Fourier transform (FFT), which was then analyzed using PicoScope software (version 6), with a focus on FFT, voltage-based triggers, and spectrum analysis. The recordings of the sound have a sample rate of 48 kHz. The experiment was conducted in the Music Department of Universiti Malaysia Sarawak (UNIMAS) in an anechoic chamber. Using Adobe Audition, the Time Frequency Analysis (TFA) was performed based on the unique intensity in hertz, which distinguishes the strength of the partial frequencies, with magnitudes measured in seconds. Using this method, tone systems are investigated in the majority of sound analysis and re-synthesis (Hamdan *et al*. 2020, 2023a, 2023b). Only four partials for every ‘tar’ are substantial. To guarantee consistency in the hitting pattern and extreme caution, it is customary to work with a professional ‘tar’ player who is knowledgeable about these subtleties.

The audio signals were recorded in a mono 24-bit resolution format at 48 kHz sampling rate. For additional processing, the audio profile was stored in .wav format. To guarantee ideal settings, the instruments were calibrated before recording the session. The test tone was restricted to a 1.0 kHz sine wave as part of the calibration process, and the European Broadcasting Union (EBU) approach was used. The EBU states that the device's digital recording of 0 VU must be produced at +4 dBu or -18 dBFS in analogue or digital format. There were no other devices nearby that may have increased or decreased the signal amplitude during the calibration process.

RESULTS AND DISCUSSION

Figure 6 shows the FFT signals from ‘tar’ A, ‘tar’ B, and ‘tar’ C. ‘Tar’ A displays the highest frequency (180 Hz) followed by ‘tar’ B (150 Hz) and ‘tar’ C (110 Hz).

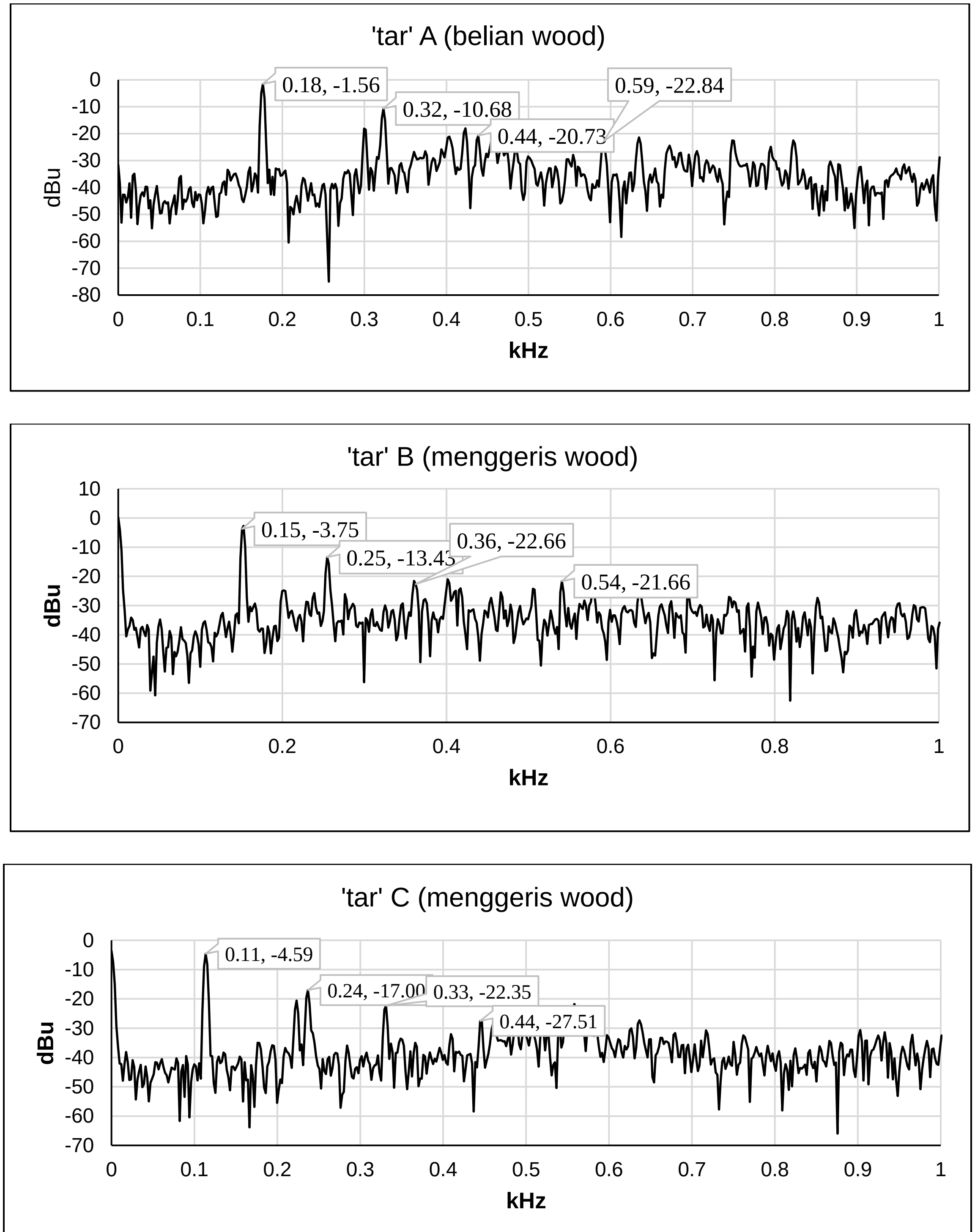


Fig. 6. The PicoScope FFT spectrum for ‘tar’ A, ‘tar’ B, and ‘tar’ C

The audio interfaces (Steinberg UR22mkII), microphone (Audio-Technica AT4050), amplifier (Behringer Powerplay Pro XL, Behringer, China), and cable (XLR) comprised the recording system configuration. The microphone was set up to record at low cut (flat). Figure 6 represents a steady and reproducible spectrum, and a repeat recording session reproduces all the details of what is shown. From the spectrum, the fundamental and overtone are labeled as significant peaks in the figure. For example, 'tar' A had fundamental frequency at 0.18 kHz and intensity -1.56 dBu, with a first overtone frequency at 0.32 kHz and intensity -10.68 dBu. 'Tar' B had fundamental frequency at 0.15 kHz and intensity -3.75 dBu with first overtone frequency at 0.25 kHz and intensity -13.45. 'Tar' C had fundamental frequency at 0.11 kHz and intensity -4.59 dBu with first overtone frequency at 0.24 kHz and intensity 17.00. In Western scale 'tar' A, 'tar' B, and 'tar' C is tuned to F3# (=185 Hz), D3# (=155 Hz), and A2 (=110 Hz), respectively. Table 1 shows the fundamental and overtone frequencies for 'tar' A, 'tar' B, and 'tar' C.

Table 1. Fundamental and Overtone Frequencies for 'Tar' A, 'Tar' B, and 'Tar' C

	F0 (kHz)	Western Scale (Hz)	F1 (kHz)	F1/F0	F2 (kHz)	F2/F0	F3 (kHz)	F3/F0
'Tar' A	0.18	F3# = 185	0.32	1.78	0.44	2.44	0.59	3.28
'Tar' B	0.15	D3# = 155	0.25	1.67	0.36	2.40	0.54	3.60
'Tar' C	0.11	A2 = 110	0.24	2.18	0.33	3.00	0.44	4.00

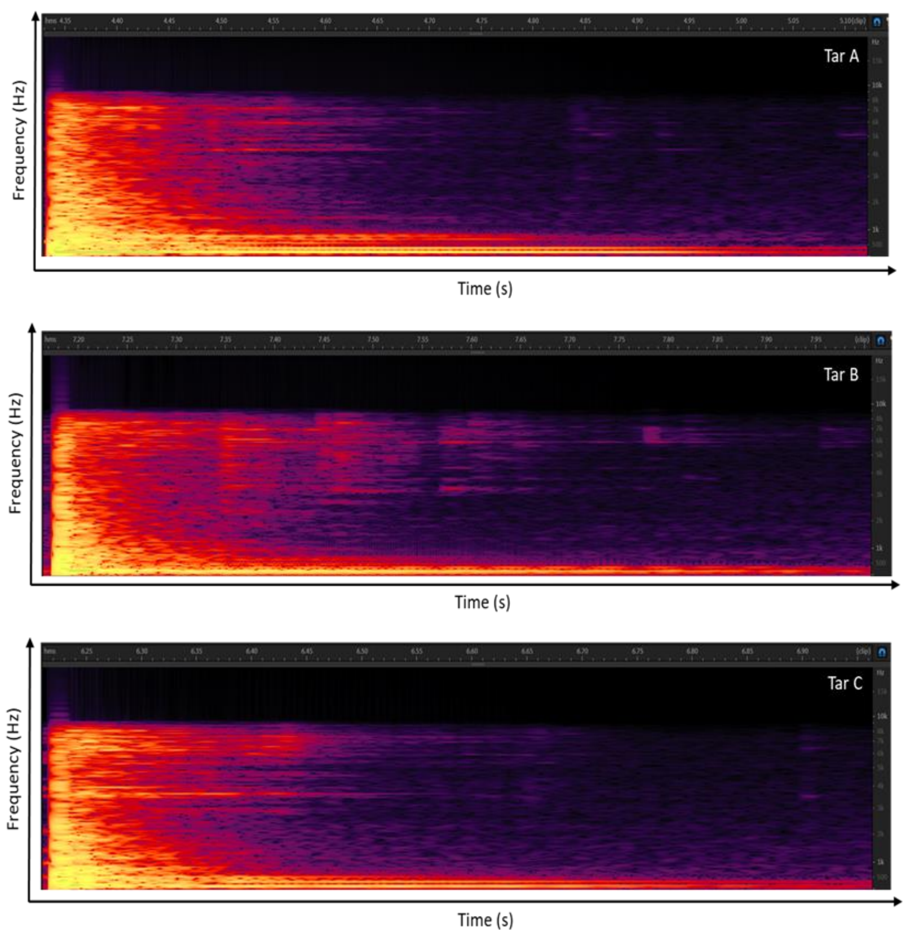
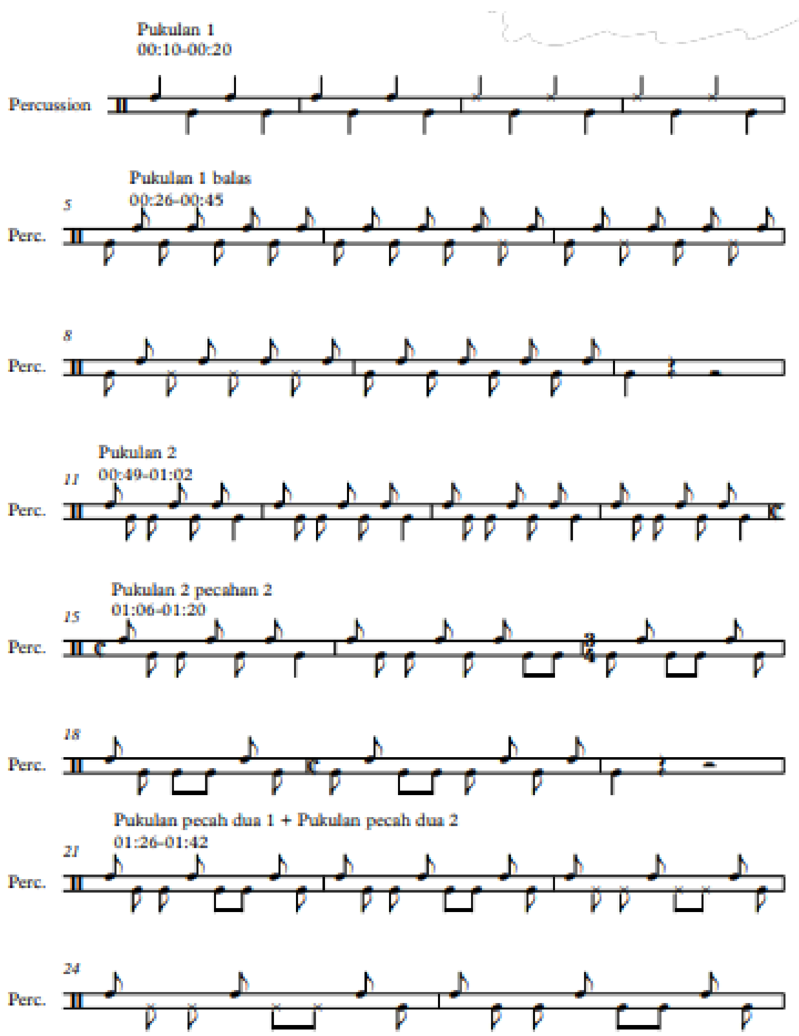


Fig. 7. The TFA for 'tar' A, 'tar' B, and 'tar' C obtained from Adobe Audition

The pitch depends on the tautness and thickness of the batter head skin. Although the luthier had tuned the 'tar' to the acceptable sound and is not tuned to any standard pitch (where each instrument is slightly different in pitch and timbres), this study showed that the 'tar' from belian wood, had the highest pitch *i.e.*, at 180 Hz. From Table 1 it is clearly shown that the 3 'tar' vary in the pitch, *i.e.*, F3#, D3#, and A2. The overtones are not integer multiples of the fundamental frequency except for second and third overtones from 'tar' C (F2/F0 = 3 and F3/F0 = 4). Figure 7 shows the time frequency analysis (TFA) for 'tar' A, 'tar' B, and 'tar' C obtained from Adobe Audition. The spectrogram in 'tar' A is the brightest compared to 'tar' B and 'tar' C. The brightness of 'tar' A displayed the strong fundamental compared with 'tar' b and 'tar' C.

The Repertoire

The rhythm pattern of the hadrah ensemble is composed of three or more different parts. Traditionally, the complete set of the interlocking rhythmic patterns in all types of hadrah ensemble found in Sarawak, Malaysia is called the pukulan (the beat). The rhythms are shown in Fig. 8.



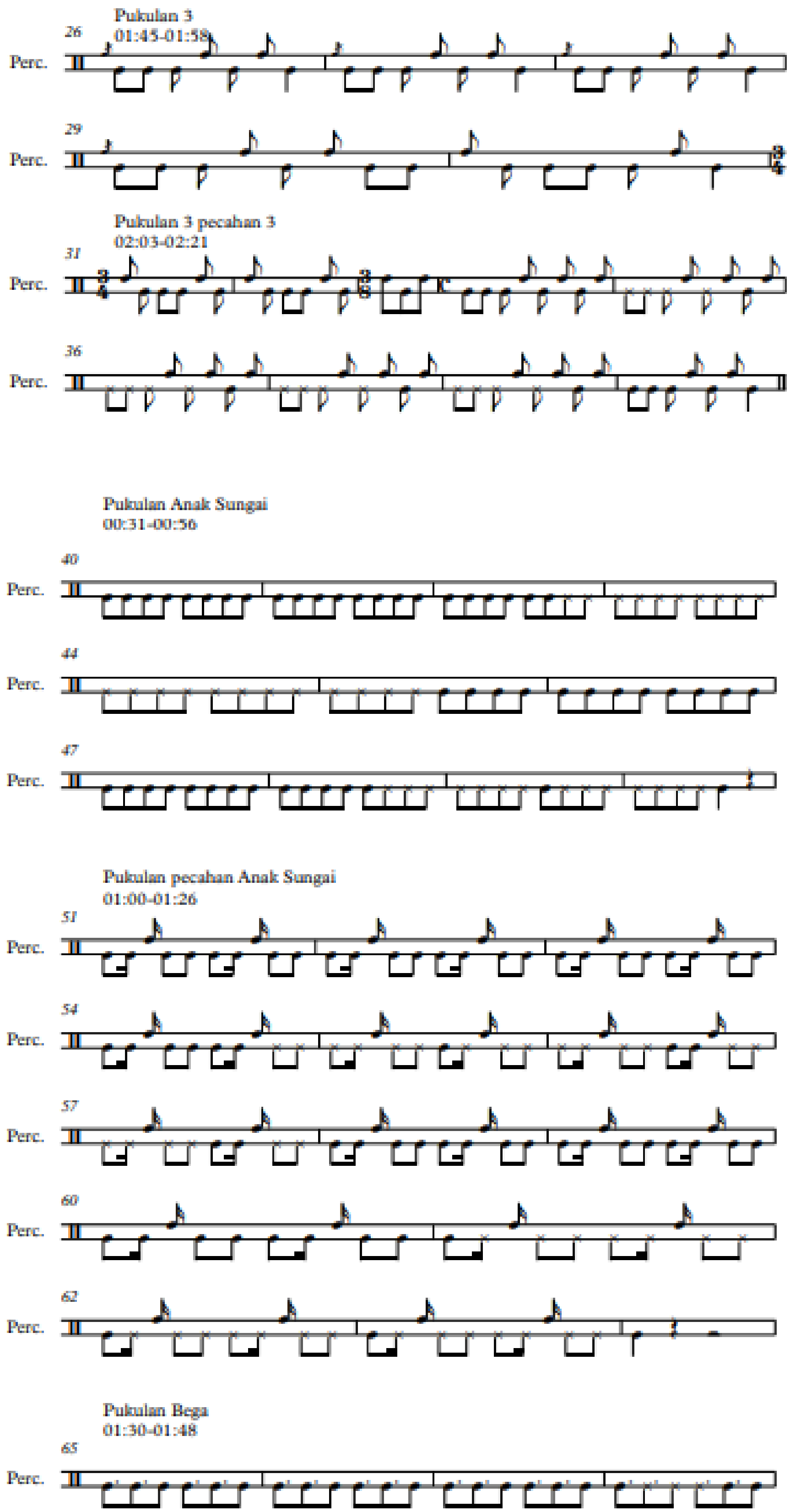

Pukulan 3
01:45-01:58
26
Perc.
29
Perc.
Pukulan 3 pecahan 3
02:03-02:21
31
Perc.
36
Perc.
Pukulan Anak Sungai
00:31-00:56
40
Perc.
44
Perc.
47
Perc.
Pukulan pecahan Anak Sungai
01:00-01:26
51
Perc.
54
Perc.
57
Perc.
60
Perc.
62
Perc.
Pukulan Bega
01:30-01:48
65
Perc.

Fig. 8. The percussion score for Pukulan 1, Pukulan 1 balas, Pukulan 2, Pukulan 2 pecahan 2, Pukulan pecah dua 1, Pukulan pecah dua 2, Pukulan 3, Pukulan 3 pecah 3, Pukulan anak sungai, Pukulan pecahan anak sungai, Pukulan bega, and Pukulan bega 2. Upper note is 'pung' sound, the lower note is the 'pak' sound. X means the rhythm is the same as the previous bar.

Some of the beats used in one ensemble of hadrah are as follows:

1. Pukulan 1,
2. Pukulan 1 balas,
3. Pukulan 2,
4. Pukulan 2 pecahan 2,
5. Pukulan pecah dua 1,
6. Pukulan pecah dua 2,
7. Pukulan 3,
8. Pukulan 3 pecah 3,
9. Pukulan anak sungai,
10. Pukulan pecahan anak sungai,
11. Pukulan bega,
12. Pukulan bega 2,

In summary, a close relationship between pitch distributions and the intersecting rhythm of three different patterns is revealed by investigating sound and cultural preservation in the context of hadrah. Using Adobe Audition for TFA and PicoScope for oscilloscope recordings for a 'tar', the data collection method provided insightful information. The subtle pitch fluctuations of 'tar' A, 'tar' B, and 'tar' C are shown by the FFT signals in Fig. 5, which also highlights their importance in the Western scale. The frequencies 'tar' A, 'tar' B, and 'tar' C translate into Western scale tones as F3#, D3#, and A2, respectively. 'Tar' A is 180 Hz, 'tar' B is 150 Hz, and 'tar' C is 110 Hz. This unique tuning helps hadrah singers stress particular lines through the interaction of steady and syncopated rhythms, in addition to serving as a foundation for recognizing pitch changes. The communal efforts of practitioners, who are frequently grouped together, perpetuate the cultural heritage of hadrah. These instructors, who teach the basic rhythmic patterns known as pukulan 1, 2, and 3, are essential in passing on information to the next generation. In addition, practitioners and students alike find great joy and enrichment in the results of the study on pitch distributions, especially those obtained from the resonant belian wood. Essentially, by offering a thorough grasp of the intricate melodic details woven in hadrah's cultural fabric, this research adds to the genre's continuing heritage.

CONCLUSIONS

1. The investigation utilizing the PicoScope signal extraction process yielded valuable information concerning the belian wood and its use in 'tar' production. This discovery supports the manufacturer's assertion about the long-lasting nature of belian wood and showcases its capacity to maintain excellent sound quality across all frequencies.
2. The manufacturer's selection of chosen materials was not exclusively influenced by structural factors, but also by their deep awareness of wood's acoustic qualities, which they analyzed solely by auditory sense.
3. The PicoScope research confirms the acoustic accuracy of their selection. In addition, the maker's careful and precise methods used in 'tar' manufacturing play a remarkable role in preserving Sarawak's intangible legacy. This guarantees that the expertise and tradition may be successfully transmitted to future generations.
4. The relevance of belian wood in the 'tar' making process is rooted in the combination of workmanship, acoustic knowledge, and sustainability principles. Moreover, while contemplating the large-scale manufacturing of this 'tar', it is crucial to examine not only the wood's level of hardness but also issues, like cost, availability, and durability. Belian's high level of hardness, although beneficial for specific uses, might lead to higher manufacturing expenses due to the need for specialized tools and expertise, thereby reducing its cost-effectiveness.
5. Furthermore, the accessibility of belian wood may be restricted, which could affect its suitability for extensive manufacturing. In contrast, the robustness of belian wood can enhance the resistance to wear and decay, hence increasing the longevity of products. When deciding between belian and menggeris wood for wood production in Malaysia, it is important to examine a harmonious combination of acoustic properties, cost-efficiency, accessibility, and longevity. The comprehensive methodology is essential for determining the appropriate wood species for different uses in Malaysia's wood sector.

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