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Comparison analysis of sound of through notation 'A' produced by Angklung Instruments which are made from different species of bamboo

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ABSTRACT

Angklung is a traditional musical instrument that originated in Indonesia and later been established in Malaysia since the 1930s. The tube is the most important part of the angklung. Almost 100% of the material used in making/producing the angklung instrument is from bamboo. There are 3 types of bamboo species commonly used in producing the angklung. Mostly use is the *Gigantochloa atroviolaceae widjaja* species of bamboo and two option is *Gigantochloa scortechinii* and *Bambusa vulgaris*. In this study, the results of the note 'a' sound recordings from all three species were performed by 'kerulung' technique and the comparison between the three species was carried out through frequency sound analysis using: audio waze, spectrogram and fast Fourier transform (FFT) using adobe audition software. The results showed a character difference through the timber element of the species of bamboo material to the sound analysis.

Keywords: Angklung, Bamboo, Sound Analysis, Adobe Audition.

INTRODUCTION

The fast-growing and easy-to-use bamboo properties are always the choice of raw materials in sustainable construction materials (Daud, Nor, Yusof, Al Bakhri, & Shaarri, 2018). It has the potential to help replace wood, wood biomass, but also reduces production costs, lose weight, recycle and even help in the manufacturing, design and construction use sectors (Siti Suhaily, Abdul Khalil, Wan Nadirah & Jawaid, 2013; Hanafi, 2017; Bhat, Mustafa, Mohmod, & Abdul Khalil, 2011). In this regard, bamboo has also been widely used in the production of traditional musical instruments from ancient times (Hamid, 2014). Similarly, the traditional musical instrument originated in Indonesia, but was established in Malaysia around 1930 (Mohd Bakri, 2021).

Gigantochloa atroviolaceae widjaja species of bamboo is a major choice in the making of angklung but is relatively small in Malaysia, still, there is a choice of other materials, namely *Gigantochloa scortechinii* and *Bambusa vulgaris* species, and it is suitable due to its hard and usable material properties. Studies have identified these 3 species of bamboo only on *G. Atroviolaceae widjaja*, *G. Scortechinii* and *B. Vulgaris*. *B. Vulgaris* species, found in tropical and subtropical regions, and wetland (Drumond, Wiedman, 2017; Yakubu, & Bukoye, 2009). The common use of *B. Vulgaris* species of bamboo is in the joint production system in electricity production and in the pulp and paper

manufacturing industry (Guarnetti, 2013). *G. Atroviolaceae widjaja* or known as Black Bamboo, is a very interesting ornamental bamboo from Java and Sumatra. The bamboo species of *G. Atroviolaceae widjaja* is used for the construction of buildings and furniture, musical instruments, crafts and decorative purposes (Bisht, Pant, & Kant, 2010). *G. Scortechinii* is the most abundant bamboo found in Peninsular Malaysia and globally (Anokye, Bakar, Abare, Kalong, & Muhammad, 2014; Khairuddin Kamaruddin, 2009; Mohamed, & Appanah, 2000). *G. Scortechinii* species used to replace conventional materials such as wood, brick, concrete and steel (Daud, Nor, Yusof, Al Bakhri, & Shaarri, 2018; Kamaruddin, 2009).

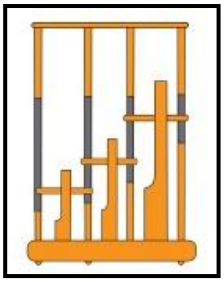

Figure 1. Instrument music Angklung

There are two types of angklung: the melody angklung and the accompaniment angklung (Siswanto, Tam, & Kasron, 2012). In Malaysia, the angklung consists of 3 types: choir, solo and mini set. Several parts of the angklung, such as the frames, base tube, and the handle while the large tube, the small tube is the most important part of the angklung instrument (Masiswo, Guring, & Vivin, 2015; Arifin, & Pribadi, 2019). Most of the tubes in Malaysia consist of two tubes and three tubes (Siswanto, Tam, & Kasron, 2012; Mohd Bakri, 2021). The angklung performances require a group of people to perform, just like a choir (Julia, Iswara, & Supriyadi, 2019). Each person plays and holds one or more notes and emit vibrations that produced the song's rhythmic sound (Amatyakul, 2019). There are various techniques in playing angklung, such as 'kurulung' (shaking), 'centok' (snapping) and 'tengkep' (Budi, Suhada, Dipojono, Handojo, & Sarwono, 2013; Usman, Nasaruddin, & Sayidiman, 2019).

Researchers use a complete angklung and are made from several different species of bamboo for experimentation. Mature bamboo, which is between 3 to 4 years old, is used to make the angklung. The bamboo is taken and dried for 6 months, then soaked in soda for a week. After that, it is processed to produce angklung with the some note base A for each different bamboo species, which will make it easier for researchers to identify differences. The sound produced by the angklung will be recorded and to be analyzed.

Problem Statement

In Malaysia, Ibrahim (2010) angklung makers only use *G. Atroviolaceae widjaja* and *G. Scortechinii* species of bamboo due to its suitability as a material to make angklung. However, it is hard to find it in Malaysia. They could only get the bamboo supply from Batu Pahat or grow it on their own. Due to the limitations and dependence only on certain bamboo species in the making of angklung, the study was conducted to find an alternative bamboo species suitable for angklung making.

G. Scortechinii and *B. Vulgaris* are popular bamboo in Malaysia (Anokye, Bakar, Abare, Kalong, & Muhammad, 2014). *B. Vulgaris* has been used in the making angklung, but still less compared to *G. Atroviolaceae widjaja* (Widjaja, 1980). The data obtained, *B. Vulgaris* species of bamboo is used in the making of angklung in Indonesia while *G. Scortechinii* species of bamboo *B. Vulgaris* are also used in the making of angklung in Malaysia. However, *G. Atroviolaceae widjaja* and species of bamboo is the main choice of angklung makers in both countries. To overcome the limited dependence of bamboo species *G. Atroviolaceae widjaja*, studies need to be done on bamboo found in Malaysia. Sound analysis should be done on all three angklung materials to find the factor *G.*

Atroviolaceae widjaja as the main choice as well as know the capabilities of *G. Scortechinii* and *B. Vulgaris*.

RESEARCH OBJECTIVES

a) To identify the species of bamboo commonly used in the making of angklung in Malaysia.

b) To analyze the sound produced by each of the angklung instruments made from different species of bamboo.

METHODOLOGY

This study produced a sound level analysis test produced by angklung with three different bamboo materials, namely *Gigantochloa atroviolaceae widjaja*, *Gigantochloa scortechinii* and *Bambusa vulgaris* through the same 'a' note. The sound recording produced is played using the same technique which is the 'kerulung' technique with 4 attempts and the same length of 31cm from the Zoom H1n Digital Handy Recorder in the recording studio. As a result of the recording, only 0.00.119 seconds was taken to analyze using Adobe Audition software. Three methods available in Adobe Audition software namely; waze audio, frequency (spectrogram) and FFT frequency analysis.

DATA ANALYSIS

Figure 2-4 shows the value of sound samples recorded by Audio Waze on all three bamboo species using the 'kerulung' technique to identify the differences in angklung sound made from various species of bamboo. Figure 3 shows a loud sound and greater pattern than other diagrams because the *G. Scortechinii* bamboo species sound greater and rough, just like the nature of bamboo itself. The angklung made from different bamboo materials produced different sounds, although it is being recorded with the same distance and strength.

Figure 5-7 shows a display through the frequency analysis method (spectrogram) used in the adobe audition software on all three bamboo species using the 'kerulung' technique when played. The average shows the octave value of the note 'a' on all three bamboo species in the 6-7 octave range in the range of 1760,000 Hz to 3520,000 Hz. The three note positions are approximately the same. This shows that the accuracy of the note used is the same despite the different species. In addition, we can see the element of timber which is a species of bamboo in which the red colour is more abundant in the bamboo species *G. Scortechinii* than the bamboo species *B. Vulgaris* and *G. Atroviolaceae widjaja*. Bamboo species *G. Atroviolaceae widjaja* has a better note than other bamboo species because the colour redness is clear except for octaves 6 to 7.

Frequency of analysis is used to analyse the noise between different species of bamboo material. This is because, the frequency spectrum can recognize the overall tone of the music note and know the overall frequency through bar graphs and logarithmic scales. In addition, the waveform sound format is taken from one moment to another and is converted into a frequency spectrum. FFT functions as a segment that produces a series of frequency spectra for each sound signal in seconds: 1 second to another or in other words is (short-time Fourier transform). The selected size FFT is 1024. Furthermore, this method can also find out the highest graph value in terms of Hz sound level, overall frequency, know average value and overall musical note tone. Figure 8-10 shows the sound analysis, among several species of bamboo species played by coil techniques. Display through FFT spectrum analysis frequency method analysed in adobe audition software.

Figure 8 shows the overall tone note is the A # 6-28 cents left and right A # 6-23 cents. While the overall frequency for bamboo species *G. Atroviolaceae widjaja* is left 1834.50 Hz and right 1839. 06 Hz. The highest value was 1969 Hz, the left was -45.56 dB and the right -47.92 dB and the average was -46.66 dB. The lowest value was 47906 Hz with the left -89.84 dB and the right -94.32 dB with an average value of -91.79 dB.

Figure 9 has shown the whole tone note at the top left and right 6-2 cents 6-15 cents. The overall frequency of the bamboo species *G. Scortechinii* was left 1757.41 Hz and right 1744.37 Hz. Next, the highest value of the graph is 31688 Hz; the left side is -101.97 dB and the right side is -101.43 dB and the average is -101.69 dB. The lowest value in the graph is 1969 Hz, which is the left -20.37 dB and the right is -19.96 dB and the average value is -20.16 dB.

Figure 10 has shown the whole note at the left side A # 6 -7 cents and right A # 6 -5 cents. The entire frequency range was for bamboo species *B. Vulgaris* on the left 1856.18 Hz and on the right 1858.41 Hz. Highest values on the 1969 Hz graph; left -22.73 dB and right -22.45 dB and average is -22.59 dB. The lowest value on the graph is 47906 Hz which is left - 99.95 dB and right -99.65 dB and the average value is -99.80 dB.

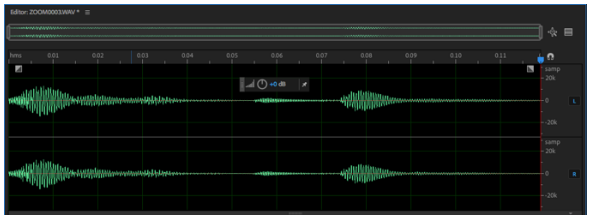

Figure 2. Display effect of audio waze, using 'kerulung' technique and was analysed in software adobe audition from G. Atroviolaceae widjaja bamboo species.

Figure 3. Display effect of audio waze, using 'kerulung' technique and was analysed in software adobe audition from G. Scortechinii bamboo species.

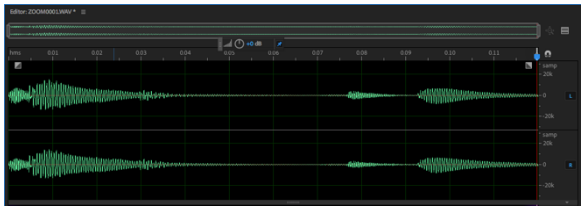

Figure 4. Display effect of audio waze, using 'kerulung' technique and was analysed in software adobe audition from *B. Vulgaris* bamboo species.

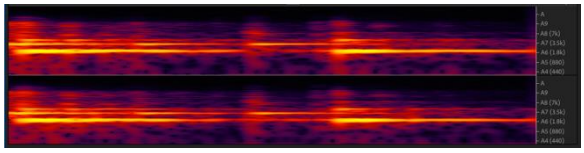

Figure 5. Display by frequency analysis method, note spectrogram performed, using the 'kerulung' technique in the adobe audition software from *G. Atroviolaceae widjaja* species.

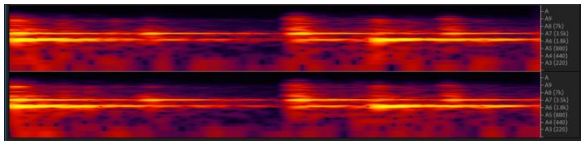

Figure 6. Display by frequency analysis method, note spectrogram performed, using the 'kerulung' technique in the adobe audition software from G. Scortechinii species.

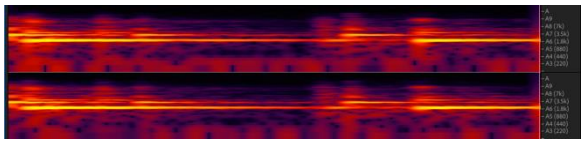

Figure 7. Display by frequency analysis method, note spectrogram performed, using the 'kerulung' technique in the adobe audition software from *B. Vulgaris* species.

Figure 8. Display by frequency method of FFT spectrum analysis, performed using 'kerulung' technique and analysed in adobe audition software using *G. Atroviolaceae widjaja* bamboo species.

Figure 9. Display by frequency method of FFT spectrum analysis, performed using 'kerulung' technique and analysed in adobe audition software using G. Scortechinii bamboo species.

Figure 10. Display by frequency method of FFT spectrum analysis, performed using 'kerulung' technique and analysed in adobe audition software using *B. Vulgaris* bamboo species.

RESULTS AND DISCUSSION

The results of audio waze testings, found there is a difference in sound pattern for each species of bamboo. In terms of frequency and spectrogram method, we can see the differences of timber element for each bamboo colour position next Fast Fourier Transform (FFT) and there is a graphical difference through the sound spectrum. Audio waze: Bamboo species *G. Scortechinii* has shown the volume and pattern of larger and more powerful sound generated from different bamboo species. In addition, the sound patterns between the species are different, although the recorded distance and strength are the same. Frequency spectrogram: The position of the three notes/tones are approximately the same. It shows precision tuned of tones at the same note. In addition, we can see the timber (is it the correct terms to be used) element from the bamboo species in red colour which more abundant from the *G. Scortechinii* bamboo species rather than the bamboo species *B. Vulgaris* and *G. Atroviolaceae widjaja*. *G. Atroviolaceae widjaja* bamboo species has better notes rather than others bamboo species since the red colour are clearer except for octaves 6 to 7. Fast Fourier Transform (FFT): The overall frequency of bamboo species *G. Atroviolaceae widjaja* and *B. Vulgaris* is nearly Hz left and right, while *G. Scortechinii* species bamboo is slightly different due to the note tone from bamboo species *G. Scortechinii* is the note A for the entire music notes and frequency. It is contrast to the note A# for the bamboo species *G. Atroviolaceae widjaja* and *B. Vulgaris*. Based on the analysis of sound, produced by the 'kerulung' technique when played. It has shown bamboo species *B. Vulgaris* and *G. Atroviolaceae widjaja* are almost Hz and note notes.

CONCLUSION AND RECOMENDATIONS

From the researchers point of view, the discussed bamboo types can produce the angklung instrument. However, there are some different of sounds produced by *G. Atroviolaceae widjaja* that still can be used as fibre material. The sounds produced by the bamboo species *B. Vulgaris* are delicate, while the bamboo sounds from the bamboo species *G. Scortechinii* are thick and the sound from bamboo species *G. Atroviolaceae widjaja* is the simplest from these three species. As a conclusion, the nature of the bamboo criteria plays an important roles in the making of angklung musical instruments (category music Idiophone). Hopefully for future scholarly research, there will be a study discussing on how to improvise the angklung making using different bamboo types. Therefore, future research study are required for the students.

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