PART I: BOTANY
Sansevieria trifasciata Potential to Reduce Noise Viewed from the Anatomy Structure

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Abstract
Sansevieria trifasciata has been known to have great potential in absorbing pollutants. Apparently this plant also has the ability to reduce noise. The purpose of this research is to know the absorption coefficient (α) of S. trifasciata leaves and to see anatomic structures. Plants have unique properties because the surfaces of the leaves are covered with fine hairs and the presence of a stoma. The presence of a stoma is quite identical with the state of the surface of the porous panels used to absorb sound. Based on the respondent’s perception of the existence of plants indoors S. trifasciata showed that most respondents stated the noise level remains the same between the existing Sansevieria plants indoors or not. Meanwhile, based on the results of measurements of the noise level were 7 dB differences in the absence of this plant and after when this plant placed in that area. Absorption coefficients of S. trifasciata leaves were 0.37 in the reference frequency of 500 Hz. To support this assessment study has been done by looking at the anatomical structures and networks existing stomata on leaves to further ensure S. trifasciata owned structure leaves Sansevieria to see similarities with the siding panels to reduce noise.

Keywords: absorption coefficients, noise pollution, Sansevieria trifasciata

Introduction
Plants are known to have great potential in absorbing pollutants. Kusumaningrum [1] research proved that plants are able to absorb pollutants. Meanwhile, the plant is also known to improve the microclimate in the room, such as the research that has been done. Those plants are also known to have the potential to reduce the noise. Researches on the use of plants in reducing noise conducted outdoors have conducted. Research on the reduction of noise in the room was made by Costa & James [2].

Why do plants have the potential of noise reduction? Fahn [3] states that the plant has unique properties because the surface of the leaf is covered with fine hairs and the presence of a stoma, although the density of the stoma is very different characteristics of each plant The presence of a stoma is quite identical with the state of the surface of the porous panels used to absorb sound. Because of the stoma on the leaf surface is very smooth/small then as the theory of sound absorption, leaves surface can absorb in high frequency sound. High-frequency sound is a sound that has no great movement, like the sounds that appear in the room. While sound in low frequency has a large wavelength [4], which is not captured by the stoma afford very fine / small. It is also proved by Costa & James [2] on the measurement of absorption coefficient several types of leaves.

This research used Sansevieria trifasciata. The plant was chosen because the plant does not require difficult care and have good resistance. In addition, research is also carried out to further prove of 2 previous studies on “Perceptions and Facts to Use Plants to Reduce Noise on Shaped Open Plan Office Space”. This research will be studied more deeply about S. trifasciata leaf anatomical structure, especially of the stomata and network sclerenchyma owned this plant to further prove its potential to absorb noise.

Research Methods
This research conducted at Environmental Biotechnology and Industrial Biotechnology Laboratory, Atma Jaya Yogyakarta University. The material used in this study is Sansevieria trifasciata leaves are still fresh to behold anatomic structures. The sections of leaf were observed covering the epidermis, cuticula, stomata and sclerenchyma.
Result

Sansevieria trifasciata Potensial to noise absorbing

The trees and shrubs have been used extensively to reduce the noise from the traffic on the highway. New research shows that plants can also help to reduce the noise level in the room, which is dominated by reflective surfaces. If in the room consisted of marble or tiled floors, plaster walls, or large glass windows or doors, will be seen to see the benefits of significant noise reduction by following one crop can be for every 100 square feet.

Acoustic benefits of interior plants Investigation performed at the South Bank University in London. To measure the effect of acoustics, sound absorption coefficient of a number of plant species was measured and compared with other building materials. The results showed that the plants are generally more efficient at absorbing high-frequency noise than low frequency. Examples of plants that can absorb the noise as above is Spathiphyllum, Philodendron, Ficus benjamina and Dracaena marginata.

Based on previous research [5,6], by placing plants Sansevieria in the room with noise measurements for three days and three days no Sansevieria. Length measurements were performed for 6 hours from 8:00 to 14:00 pm. Measurements were performed using omni microphones (capture sound from all directions) connected to the laptop, using software DSSF3 Noise Measurement. Based on the results of this study indicate that the noise level is equivalent to an average of 3 days during the study was the difference between the 0.51 dB to 3.97 dB between before and after the plant is placed. The difference in noise levels that are too small less than 7 dB cannot be perceived by human senses [7]. The difference can only be felt in the difference up or down by 7 dB and a significant perceived rise or fall by 10 dB [7].

Meanwhile, the results of absorption coefficient leaves carried on Research and Development of Settlements, Ministry of Public Works, Dublin using the impedance tube, it is known that the absorption coefficient at S. trifasciata leaves are at frequencies between 250 Hz and 500 Hz. Absorption coefficient at a frequency of 500 Hz at S. trifasciata leaf is 0.37. Absorption coefficient is considered perfect if the result is close to 1.

Anatomy Structure of Sansevieria trifasciata Leaf

Sansevieria trifasciata is an herb with horizontal rhizomes, height of about 0.4 to 1.8 meters; 2-6 leaves per plant form a line, narrowed towards the base with a pointed end. The position of leaf is dorsiventral. The color of leaf is green stripes in the middle and yellow at the edges. Sansevieria trifasciata leaves have isobilateral position, meaning that both sides usually grow vertically, the upper and lower leaf surfaces uniformly. This can be seen in the anatomical structure of the leaves Sansevieria like Figure 1 below. The leaves are composed of the upper and lower epidermis, with epidermal derivatives such as stomata at the top and bottom. The epidermis is covered by a fairly thick cuticle. Parenchyma/mesophyll modified into the sponge tissue and found the palisade parenchyma. Chlorophyll is spread evenly on the parenchymal tissue. Among the parenchymal found sclerenchyma that form fibers. Parenchyma also contains water. Furthermore, it appears the carrier file. In longitudinal section Sansevieria trifasciata leaves on the upper surface, it appears the stomata are scattered among the epidermis. The guard cells of stomata are kidney-shaped, with the type of stomata anomocytic. In this type of stomatal guard cells surrounded by a number of neighboring cells whose shape and size similar to the surrounding epidermal cells.
Noise Absorption Potential and Anatomic Structural of Sansevieria trifasciata Leaf

Refraction is the phenomenon of acoustic sound waves change direction when these sound waves propagate through the two layers of material of different density. This phenomenon is similar to the refraction of light as it passes two different material densities. Thus, the phenomenon of refractions can be defined sound.

On reflection wave, which arrived at the medium will be reflected in the direction of the original. In refraction, a wave on the boundary between two media some will be reflected and part will be transmitted or refracted. The refracted wave will undergo deflection from the original direction depending on the medium. In the second medium, wave propagation speed changes and these changes were dependent on the medium. In other words, wave refraction is the bending direction of the wave trajectory after passing the boundary between two different media.

Sound absorbent material is generally divided into three types, namely a porous material, the panel absorber, and the resonator cavity. The grouping is based on the change in sound energy striking the surface of the material to heat energy. Characteristics of a sound absorbent material are expressed by the value of sound absorption coefficient for each excitation frequency. In general, the sound absorbent material has a high absorption at a particular frequency range.

In anatomical observations S. trifasciata leaves the stomata are evident enough in the upper and lower epidermis of the leaves. The stomata pores are capable of absorbing sound. In addition, with the presence of air cavities in the leaf mesophyll, it is able to supply space for the refraction of sound. According Iffandani [8], plants with high fiber content such as water hyacinth was suitable for use as a raw material mixture of cement board, fiber board and other industrial materials.

The absorption of sound in absorbent material absorption coefficient is expressed by ($\alpha$). Absorption coefficient ($\alpha$) is expressed in a number between 0 and 1. Absorption coefficient of 0 indicates no sound energy is absorbed and the absorption coefficient of 1 indicates perfect absorption. Reactions absorption caused by vibration in the material contributed to the sound waves that reach the surface of the material. Sound vibrations to the surface of the particles and the co thrilling air pores in the
material. Some of the vibrations are reflected back into the room, partly transformed into heat and partly forwarded to other fields of materials. 

The results of this study indicate that there is potential that *Sanseviera* plants to absorb the noise, but the noise level of the measurement reduction is still very low. Please note the arrangement of plants, density and height of these plants in the room so that the absorption increases. Possible addition of this plant is used as a raw material in the manufacture of wall panels.

**Conclusion**

Based on these results it can be concluded that *S. trifasciata* has the potential in noise absorption. The absorption coefficient at a 500 Hz frequency of *S. trifasciata* leaf is 0.37. However, reduction of noise in the room is only small noise absorption capability is only about 0.51 dB to 3.97 dB. Some of the things that allow this plant as a noise absorber are the stomatal pore many as noise absorption, refraction sclerenchym and mesophyll as sound.

**References**


