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Investigation composition and materials of the termite nest in the forest Muaralabuh, West Sumatra, Indonesia

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Abstract

Abstract-Termites are insects that live in colonies or groups. In order to maintain the viability of the cooperation is the solution in their individual capacity. Seen at the time to build a house, to accommodate materials from the existing selection on the environment so that the combination of this material can create a building with its own composition that can accommodate termites. Retrieved termite in tropical forests, Muaralabuh City, province of West Sumatra, Indonesia. The uniqueness of this area is still a natural forest that has endemic plants and germplasm resources. This research is to present the natural conditions that existed at the termites to adapt later evolved to maintain the existence of the adaptive behavior. Termite nest samples tested with XRF, XRD, and granulometry analysis that can be known materials and property surrounding the house of termites. These results indicate the dominance of ferrous metal mineral elements which are naturally selected by termites itself as one of the constituent material of his house. Nests made more solid from ambient conditions to be able to accommodate the weather conditions in the tropical rain forest. Another benefit is to determine the natural resources contained in the area. Nests made more solid from ambient conditions to be able to accommodate the weather conditions in the tropical rain forest.

Keywords

Termite, Nest, Materials, Composition, Ferrous

1. Introduction

Termites are a colony that have characteristics in the manufacture of nests. Termite makes its nest in the form of alleys inside wood or alleys in the soil, but in certain types of nesting termites, the honey-shaped nests with vast and extensive nest construction. The termite nest is made of clay, sand, humus and termite saliva (serves as a glue), resulting in a hard building. Inside the termite nest, built spaces with depths can reach hundreds of meters from the ground [1]. Termites nest with hard and sturdy structures built by worker caste termites. In nest it is suspected of having protein, mushroom, and vitamin content derived from the termite saliva of the worker [2]. Termite is a one group of insects that could potentially be used as a bioindicator to assess the condition of ecosystems. Termites also showed high sensitivity to environmental conditions, both biotic or abiotic that exposed them, as well as on ecosystem processes [7]. Termites have the ability to burrow to the subsoil and contribute to the development of soil profiles through bioturbation and the consequence, termite nest structures have long

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been used as geochemical and mineralogical sample media for the discovery of ore deposits buried beneath the weathered cover and shallow sediments [8].

Muaralabuh forest located in West Sumatera Province is one of the forests that store many metal materials. The most stored metal materials are iron. The ecosystem condition that many stored iron content makes it possible that in making nests, soil termites will use the iron contained in the surrounding ecosystem. Seeing the possibility of termites using metal materials in the surrounding ecosystem needs to be done determination of composition and material in termite nest in Muaralabuh forest, West Sumatra Province.

This research purposes to:

1. Knowing the composition and material in termite nest in the Muaralabuh forest of West Sumatra Province
2. Knowing the relationship between material-material content in termites nest ecosystem with the composition and material in termites nest.

Benefits of this research that termite nest can be used as an indicator in determining the material content that exists around the termites ecosystem.

2. Method

This research was conducted from February to April 2018. The sampling of land termite nest was conducted by exploring the Muaralabuh forest of West Sumatera Province, and also the soil samples that were around the termite nest. Analysis of the composition and material content of the termite nest was performed by Fourier Transform InfraRed (FTIR) analysis to determine the type of material in termite and soil nest, X-Ray Powder Diffraction (XRD) analysis to determine the material structure of termite nest, and Granulometric analysis to find out particle size.

3. Results and Discussion

Analysis of Fourier Transform InfraRed (FTIR)

Based on analysis of Fourier Transform InfraRed (FTIR) the results are:

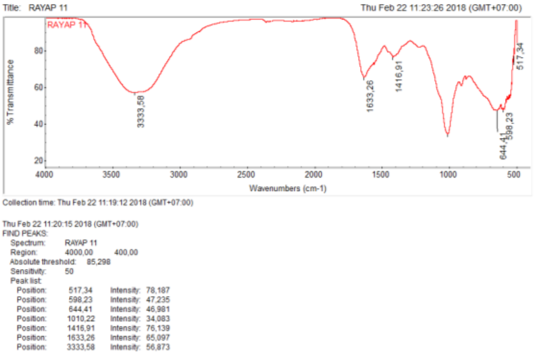

Figure. 1 Shows a functional groups on termite nest material

Based to Fig. 1, several absorption bands from the preparation of termite nest material were found, including absorption bands at the 1633,26 cm-1 wave numbers indicating the buckling vibrations of the carbonyl group (C=O). In the wave number 3333,58 cm-1 is the vibration of the carboxylic acid (O-H) functional group with the wave uptake, In the wave numbers 517,34 cm-1, 1598,23 cm-1, and 644,41 cm-1 are group vibrations the function of thebonding type C-H Bending, 1010.22 cm-1 is a functional group vibration with a type of C-O bond which gives rise to a sharp and strong absorption. 1416,91 cm-1.

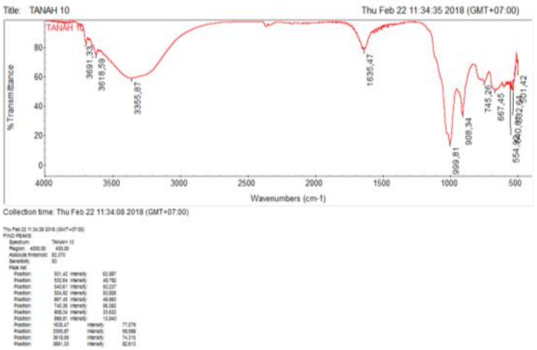

Fig. 2 Shows a functional group on the surrounding soil material

Based to Fig. 2, several absorption bands from the preparation of termite nest material, including absorbing bands at 3691,33 cm-1 and 3618,59 cm-1, are vibrations of the Alcoholor Phenol (O-H) functional groups, waves 3355 cm-1, carboxylic acid (O-H) functional groups, and wave numbers 999,81 cm-1, 908.34-1, 745,26 cm-1, 667, 45 cm-1, 554,92 cm -1,540,51 cm-1, 532,63 cm-1, 501,42 cm-1 is vibration of functional group of Alkena / Aromatic (C-H Bending).

Analisis of X-Ray Fluorescence (XRF)

Based on analysis of X-Ray Fluoresence (XRF), the result is found in samples of nest termite found in Fe (14,658%), Al (16,844%), Si (36,339%), Ca (18,673%) and other elements. While in the soil samples obtained element Fe (23,372%), Al (7,499%), Si (17,292%), Ca (31,331%) and other elements. To know the absorption of energy in each element is done by spectrometry analysis. The result of spectrometric analysis can be seen in Fig. 3 and Fig. 4.

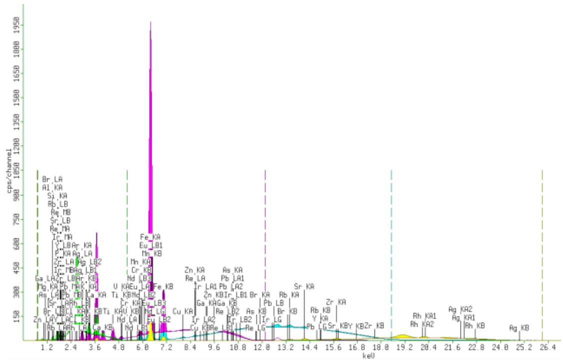

Fig. 3 Graph of spectrometry on soil termite nest sample

Based on Fig. 3 graph of spectrometry on soil termite nest sample found that Fe element has 6.3 keV energy from the KA wave, Al element has 1.5 keV energy from the KA wave, Si has 1.8 keV energy from the KA wave and Ca has 3.6 keV energy from the KB.

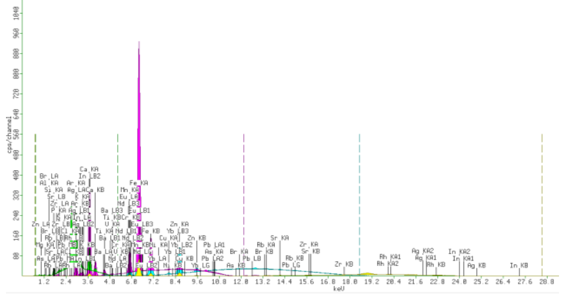

Fig. 4 Graph of spectrometry on soil samples

Based on Fig. 4 graph of spectrometric on soil samples is known that Fe element has 6.6 keV energy from the KA wave, Al element has 1.5 keV energy from the KA wave, Si has 1.8 keV energy from the KA wave and Ca has 3.6 keV energy from the KA wave.

Analisis of X-Ray Powder Diffraction (XRD)

Based on analysis of X-Ray Powder Diffraction (XRD) the results are:

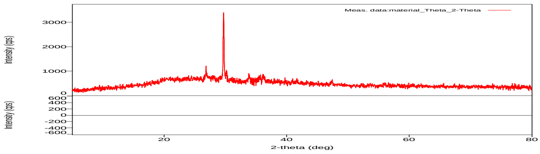

Fig. 5 Graphical analysis of XRD in termite nest samples

Minerals found with the dominant composition of ferrosilite (FeO_3Si), which can be seen in Fig. 5 are seen from the intensity (cps) and 2-thete (deg) shown with the strain value of 6.1% and the crystal size13.34 Amstrong. XRD provides diffraction data and quantization of diffraction intensity at the corners of a material. Data obtained from XRD are diffraction X-ray diffraction and angle 2θ. Each pattern that appears on the XRD pattern represents a crystal field that has a specific orientation [3]. XRD characterization aims to determine the crystal system. The X-ray diffraction method can explain the lattice parameters, the type of structure, the different atomic arrangements of the crystal, the imperfection of the crystal, the orientation, the grains and the size of the grain [4].

Analisis of Granulometri

Based on Analisis of Granulometri the results are:

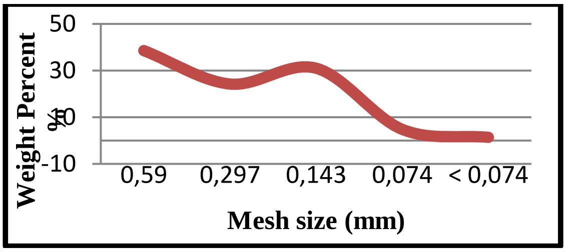

Fig. 6 Frequency of soil nest sample samples from comparison of weight percent% with mesh size (mm)

Fig. 6 shows the frequency of the number of samples performed by sieving where the most dominant grain size is located at the size of 0.59 mm or is in the mesh 30 (U.S Mesh).

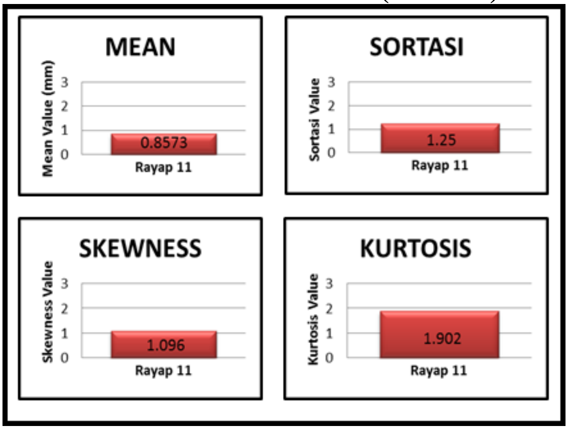

Fig. 7 Grain size distribution of particles.

Based on Fig. 7, Mean data on granular particles that have been done large grain size separation process and conducted analysis, in the determination of the average known result is 0.8573 mm. Based on the size scale of the classification is included into coarse sand [5]. Sort the standard deviation value of the grain size distribution (the value distribution around the mean). This parameter indicates the level of uniformity of the item. From the sortation calculation is 1.25 which is included into the Poorly Sort [6]. Skewness denotes the degree of unsymmetry of a curve. If Skewness is positivethen the corresponding sediments have more coarse grains than fine grains and vice versa if they are negative, then the sediment has a higher number of grains than the number of coarse grains. The resulting data is 1.096124 which is included into the classification of very fine skewness because of its positive value [6]. Kurtosis may show an intermediate rate of mid-range sorting against the edges of a curve showing either the stability or distribution plane by considering the ratio of the normal distribution. From the analysis the resulting value is 1.90231 included into the classification of very leptokurtic [6].

4. CONCLUSION

Based on research that has been done to get the conclusion that is:

1. The type of material in termite nest contains the carbonyl group (C=O), the functional group of the carboxylic acid (O-H), the functional group C-H Bending, the C-O functional group and soil sample there is the functional group Alcohol /Phenol (O-H), function of carboxylic acid (O-H), and Alkene/Aromatic function group (C-H Bending).

2. There are elements of Al, Ca, Si, and Fe in termite and soil nests with each of the amounts of Fe found in termite and soil nests not much different, indicating a between the elements of soil and soil termite nest in the surrounding environment.

Acknowledgment

Use the singular heading even if you have many acknowledgments. Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page, not here.

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