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Application of Gaba-Gaba Egg Rack Bio-Composite as Material Wall Meeting Room Acoustics

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A B S T R A C T

Bio composite materials are a combination of two or more natural polymer materials or biofiber (natural fibers) which can be degraded as reinforcement and polymer or matrix. Natural fibers generally have the ability to absorb sound well and have basic properties as composite reinforcements. If a wave hits a material, the wave can be straightened, reflected and absorbed. The ability of composite structures to absorb sound can be used to reduce noise levels. This research models a combination of egg rack waste mixed with sago leaf stem (gaba-gaba) waste as a bio-composite material for room acoustic panels. This research uses a material modeling engineering method which is a pure experiment, with the stages of making test samples based on fixed variables and measurable variables and then testing to obtain the material absorption coefficient, then the test results are based on the specified variables, then applying the material to the meeting room. After that tested the acoustic level of the room, especially the meeting room.

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INTRODUCTION

Technological developments in the field of bio-composite materials are very rapid, Good its implementation on Structure building, furniture, nor panel acoustic room, material composite Which used as function acoustic mature This Which various material are produced including; *Polyethylene Terephthalate* (PET), namely; fabric, gypsum, egg foam, *polyester*, *rockwool*, and *soft board*, this type is material made from *fiberglass.* The importance of using materials the acoustics in the room aim to provide hearing comfort space users, because noise pollution can disrupt concentration somebody which possible cause stress. Material acoustic Also works as barrier noise which originate from one room which has an effect on other spaces. Bio composite materials are synthetic and fiberglass, price market very expensive And Also material composite with made from the very influence human health. (Münzel *et al*., 2014).

Bio composite materials are a combination of two or more materials natural polymer or biofiber (natural fiber) that can be degraded as reinforcement and polymer or matrix. Natural fibers in general have the ability to absorb sound quite well in addition to having properties as a material basic reinforcement in composites. If a wave hits a material then wave the can straightened out, reflected and absorption. Ability structure composite for absorb sound the can used for reduce noise levels. (Elvaswer, 2011). Use of composite materials Natural materials are an alternative interior material soundproofing in the room. Characteristics of low-density composite boards can function effectively at low frequencies, while the board with high density high effective at high frequencies. (Karlinasari et al., 2012), board density 0.5 g/cm3 effective for absorbing sound at frequencies >1000Hz, while the board with density 0.8 g/cm effective for reduce noise on frequency <250Hz. (Chou et al., 2014). Study panel wall acoustic use material composites with natural base ingredients are very good as sound absorbers, for example; Jile fiber composite has better acoustic properties frequency 1000-4000Hz, fiber palm oil frequency 125 – 4000 Hz, sugarcane bagasse and bamboo composites have characteristic acoustics at frequencies 0 – 6000 Hz.

On research This, researcher utilize waste rack egg in combine with waste stalk leaf sago (all of a sudden) as material bio composite for walls and or panel space acoustics. Egg tray (egg tray), which is a paper-based egg tray, used as a shelf Eggs have now become waste because they are generally used at the moment keep egg, after that used egg rack no Again used until become waste, these egg racks are easy to find in inorganic waste places. waste/garbage egg (egg tray). has in apply as panel acoustic room class in elementary schools, it can reduce noise up to 10 - 59 Db against activity traffic in road main. (Muhammad et al., 2018).

Gaba-gaba (sago/sago leaf stalk) comes from the sago/sago palm plant which is known as *Metroxylon sago Rottb,* palm leaf stalks (gaba-gaba) previously used traditionally on building walls, rafters, floors and Building ceilings, along with developments over time, now have no walls Again in use as material main building, so that all of a sudden become logging waste. The characteristics of the gaba-gaba material are that it has a hard skin and

filling/meat which soft, light and stand to weather Which extreme. Wall gaba-gaba not yet in exercise get mark absorption Lowest 0.83 db - 0.98 db. (Kongle, 2009). Gaba-gaba composites have excellent absorption rate properties water very small mechanical properties pretty good, (Samad et al., 2017). Judging from the characteristics of the egg rack material made from paper and gaba-gaba, so this research uses these two materials combined and made as material composite acoustic on room building, and applied it.

THEORETICAL REVIEW

In the scope of architecture, studying acoustics is related to how produce comfort sound on A room. Planning acoustic room aim for optimization acoustic so that can avoid decline quality, noise (noise) And disabled acoustic in room Which can cause sound disturbance that reaches the human ear (Asmoro, 2007). Physics theory building explain, that that sound resurrected in in something room will transmitted, reflected, and absorbed by every surface Which There is in it in various ways depending on shape, size, and construction from that space (Kutruf H., 1979; Sum, 1979).

Optimization acoustic on room can utilized materials acoustic which nature absorb, reflect and diffusion sound. Acoustic materials and construction absorption voice Which usually used as controller in room noisy can classified become material porous, panel absorbent, cavity resonator, room absorbent, And absorption by air (Doelle, 1985). Solution architectural which offered for disabled acoustic for example noise with utilize material acoustic (material insulation/absorbent voice). Material porous like carpet, curtains, foam, glass wool, rockwool, rack egg, fiber coconut and material soft other absorb energy voice through energy swipe Which happen between component speed of sound waves with the surface of the material (Marasabessy, 2016) Material experience Which only made rubbish, now start developed for panel acoustic, for example sludge, fiber coconut, midrib banana, wood, stem corn and etc. Application remainder results agriculture (rubbish) stem corn Which tested with method bio composite can works as strengthening resin epoxy for material isolation thermal and acoustic (Binici et al., 2016). Particle stalk flower sun which tied together by chitosan, based bio composite capable absorption voice with involve pores or group dead end and a number of scale porosity in material (Mati-Baouche et al., 2016). Results study composite BP.

(Banana Stem Fiber) with epoxy can absorb sound up to 30% ie with fraction volume fiber 30% capable absorb sound with Good For low frequency (f = 400 Hz) and medium frequency (1000 Hz) (Khotimah et al., 2014). Based on study Which on room semi- free echo, utilization rack Eggs can reduce sound up to 31.94 dB with reduced power levels sound (Lw) of 67.93% (Fachrul et al., 2011). Other research shows that research on the absorption of sound waves by glass tube sound absorbers (thickness 3mm) rack egg (egg tray) own mark coefficient absorption sound highest that is 0.9287 or can reduce sound until 72% (Syech et al., 2015). Application rack egg direct on wall room class school base capable reduce level noise until 15 dB (Muhammad et al., 2018). Temporary research on gaba gaba material from Kongle's research (2009) shows that this material is capable of absorbing sound with a sound absorption

coefficient value range Lowest 0.83 And highest 0.98. Material gaba gaba can absorb sound with panel shaped hexagonal, so that economical for applied as an acoustic material and can also strengthen the material structure (Samad *et al*., 2017).

From previous research, the hypothesis of this research is formed is the combination of egg rack waste material and gaba gaba to produce Acoustic material that has a better level of sound absorption than other materials other. Development of Kongle's research (2009), so the difference with Previous research combined two waste materials, namely gaba gaba and egg racks can be reused as wall material acoustic. The research method adopts previous research, namely the bio method composite with modification of fiber particles (through *pre-treatment)* as a method new. This method is a special treatment to determine how much big mark coefficient absorb sound with material composite.

METHODOLOGY

The research methodology uses a pure experimental research design (*true experimental research*), is something method study Which test hypothesis connection because consequence with control in a way strict to variables which is not in desire its influence (Wagiran, 2014).

The research stages are divided into three, starting with preparation and sampling material standard and tool production. Stages next as in explain on the research plan map can explained as following:

1. This stage is carried out by searching the literature and related theories with characteristics acoustic room and principles base planning acoustic room, material acoustics, and characteristics local materials.
2. The next stage is identifying equipment and collecting materials local as well as preparation for making test materials.
3. Stages of making test materials based on characteristics with 3 categories sample different ones
4. Stages of testing the sound absorption efficiency of the material according to the sample made.
5. Production/printing material as well as Implementation On room with material Which has acoustic characteristics in accordance with space function.
6. The final stage in this research is carrying out acoustic testing on room which has been in apply research results material.

Figure 1. Research Plan Map

RESULTS AND DISCUSSION

Making sample test material acoustic made from combination rack egg and gaba-gaba composite, made based on 3 sample characters by doing variables on composition as well as treatment on sample test Which vary that is:

1. Test samples with composite composition *categories,* that is rack egg as bone filler pegikat particle all of a sudden. Making sample test as many as 2 pieces with different variables, namely

No.	Variable (X)	Definition Operational	Measurable (Y)	Scale
1.	Composite Composition, Egg Rack and Gaba Particles Gaba	*composite composition,* sample is merge 3 ingredients into one unity Which solid.	1. Size/dimensions material study	30 x 30 Cm
			2. Composite thickness particle	6 Cm
			3. Comparison particle with adhesive	1: 2.5 Kg
			4. Composite pressure	100 - 200 kg/cm2
			5. Long Hold Press	20 - 60 minute
			6. Particle density composite	0.4-0.9
			7. rate water	5-14 %
			8. Development thick	5 – 15 %

2. Sample Making Process Test

The process of making test samples in stages, namely; the gaba-gaba raw material is removed skin Which hard Then in scar as well as in dry in a way experience, process manufacturing can in serve on picture as follows:

Figure 2. Process Taking and preparation of materials Test

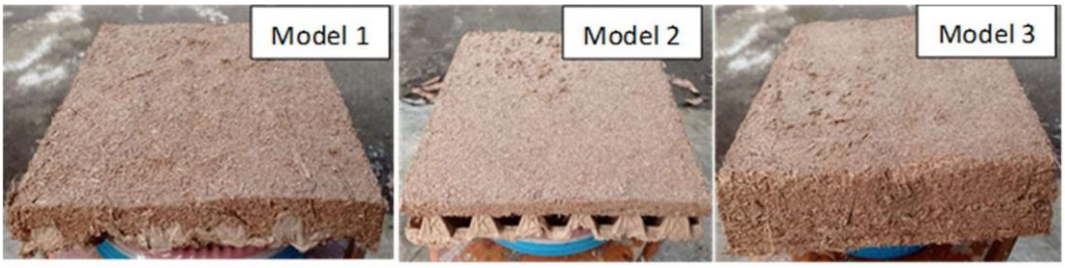
Picture 2 above showing process collection and taking material research standards.

Figure 3. Process Mixing Test Materials

Figure 3 above shows the dosing and mixing process making research test samples

Figure 4. Process Making Test Materials

Figure 4 above shows the process of printing the egg rack composite test material and gaba-gaba as a room acoustic panel.



Picture 5. Test Sample Modeling

Making test sample made 3 (three) modeling, that is:

1. Model 1 test sample with code AKA01 made 2 sample characters with the modeling is a combination of fiber particles made of gaba-

gaba material Which solid on One surface rack egg, And in give treatment Which vary that is; thick sample 4 Cm X 30 cm x 30 cm combination 1 layer, given a pressure of 100 kg/cm^2, and the 2nd character code is AKA02 thickness 4 cm x 30 cm x 30 cm given pressure 200 kg/cm^2

2. Sample test model 2 with code AKB01 made 2-character sample the modelling is composite all of a sudden as coating on surface rack egg, with treatment making it vary that is; thick sample 1.5 cm x 30 cm x 30 cm, combination of 1 surface layer, is given pressure 200 kg/cm^2, and character to 2 code AKB02 thickness 1.5 cm x 30 cm x 30 cm pressure is applied 250 kg/cm^2
3. Model 3 test sample with code AKC01 made 2 sample characters with The modeling is a combination of fiber particles made of gaba-gaba solid material on 2 (two) surfaces of the egg rack, and provided treatment Which vary that is; thick sample 5 Cm X 30 cm x 30 cm combination of 2 layers, given a pressure of 100 kg/cm^2, and the 2nd character code AKC02 thickness 4 cm x 30 cm x 30 cm is given pressure 200 kg/cm^2

CONCLUSIONS AND RECOMMENDATIONS

Ability structure composite for absorb sound then it can be used to reduce noise levels. Through modeling combine egg rack waste mixed with sago leaf stalk waste (gaba-gaba) as bio-composite material for panels room acoustics. Through the stages of making test samples, testing, and application in the meeting room.

FURTHER STUDY

Suggestions for further research Conduct a more detailed acoustic analysis related to the use of Gaba-Gaba Egg Rack Bio-Composite as a wall material. Focus on various acoustic parameters such as sound absorption, sound reflection and sound dispersion.

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