

**CHARACTERISTIC MECHANIC OF POLYESTER  
COMPOSITE PARTICLE BOARD WITH FILLER  
PARTICLE OF ARECA NUT FIBRE**

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## Areca Nut Fiber

Areca nut fiber is one of the alternative material in the manufacture of natural fiber composites utilization is still scientifically developed, and there are no fiber composite material using areca

Areca fiber development as a composite material is very understandable considering the terms of the availability of the raw material of natural fiber Indonesia which has abundant raw materials

Reasons for use of areca fibers:

- Easily obtained
- Cheap
- Can reduce environmental pollution (biodegradability) so that the composite is capable of addressing environmental problems
- No harm to health

## Chemical Content of Areca Nut Fiber

Composition	Content (%)
Cellulose	70,2
Ash	6,02
Water	10,92

## Particle Board

Particle board is a sheet material containing ligno-cellulose such as pieces, flakes, strands held together with an organic binder and use to provide heat treatment, pressure, moisture content, catalyst and so on.

Factors Affecting to the Quality of Particle Board:

- Wood density
- Wood extractive substances
- Wood type
- Mixture of timber species
- Particle size

# THEORY

## Standard of Particle Board

Physical-Mechanical Properties	Units	FAO	JIS 5908-2003 3	SNI
Density	g/cm <sup>3</sup>	0,4-0,8	0,5-0,9	0,5-0,9
Water Content	g/cm <sup>3</sup>	Maks 12	5-13	Maks 14
Thickness Development	%	5-15	Maks 12	Maks 12
Water Absorption	%	20-75	td	td
Modulus of Rupture	Kg/cm <sup>2</sup>	100-500	82-184	Min 18
Modulus of Elasticity	Kg/cm <sup>2</sup>	10000-50000	20400-36000	Min 15000
Internal Bond	Kg/cm <sup>2</sup>	2-12	1,5-3,1	Min 1,5
Strong Hold of Screw	Kg	td	31-51	Min 30

td = not qualify

## Usefulness of Particle Board

Based on the use of load-related, particle board can be divided into two:

- Common use of particle board
- Structural particle board (requires power higher).

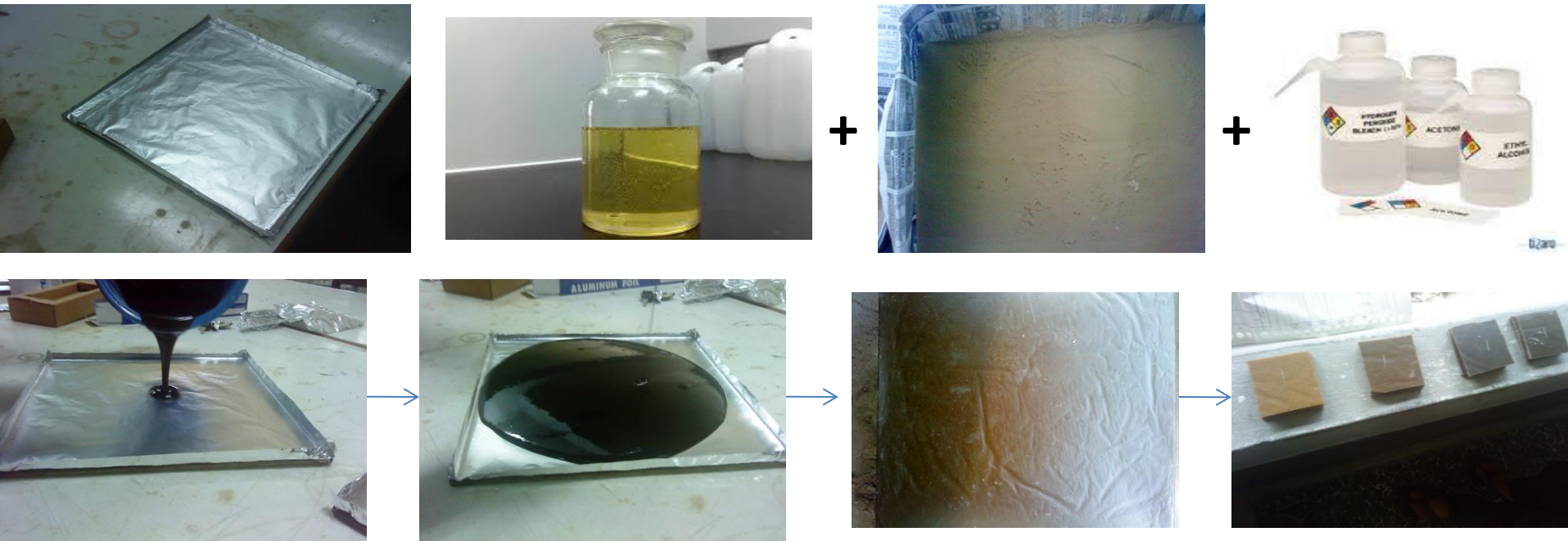
To make furniture tools, wall fastener Common use of particle board is used. To make the composition of the wall, container structural particle board is used.

# RESEARCH METHODOLOGIES

## Preparation of Areca Nut Particle



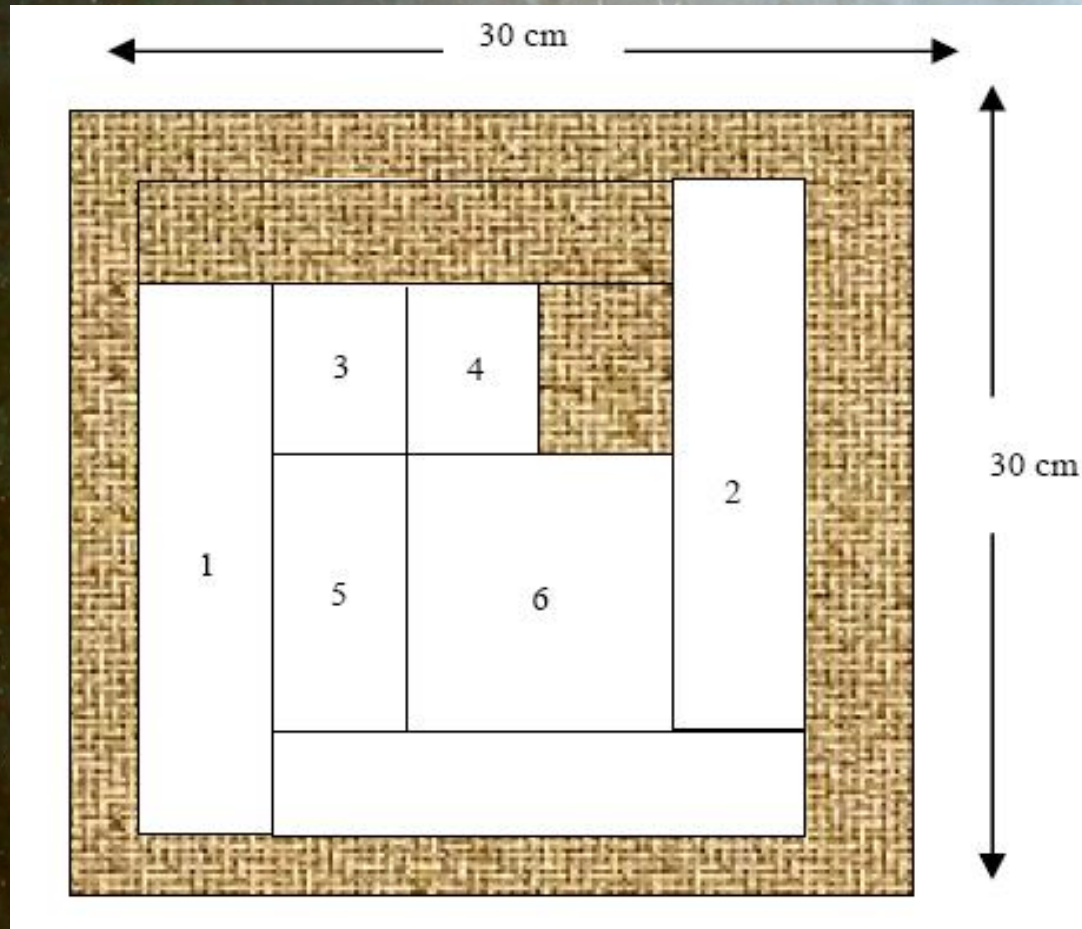
## Making Particle Board



## Testing of Particle Board

Quality parameters of board tested that is covering the mechanical properties of Modulus of Rupture, modulus of elasticity, strong hold of screws and FTIR. The tests conducted to determine whether the resulting product meets the requirements specified for a particular use. The pattern of assorting test as shown below:

# RESEARCH METHODOLOGIES



Keterangan:

1 and 2 = Specimens of Modulus of Rupture (MOR) test

3 and 4 = Specimens of water absorption and thickness development test (5cm

5 = Specimen of Strong hold of Screw test (10 cm x 5 cm)

6 = Specimen of Density and Water Content test (10 cm x 10 cm)

## Testing of Particle Board

### **Modulus of Rupture Test**

*Modulus of Rupture* is ability of board to withstand loads up to the maximum limit, Modulus of Rupture can be calculated:

$$\text{MOR} = 3PL / 2bh^2$$

Dimana :

MOR : Modulus of Rupture (kgf/ cm<sup>2</sup>)

P : Maximum Weight (kgf)

b : Wide of Specimen (cm)

L : apart buttress (cm)

h : thickness of specimen(cm)

## Testing of Particle Board

### **Modulus of Elasticity Test**

Modulus of Elasticity (MOE) is a measure of resistance of the board to maintain the shape of the board related to the stiffness. Modulus of Elasticity can be calculated:

$$\text{MOE} = \frac{L^3 P}{4d^2 b}$$

Where :

MOE: modulus Elastisitas (kgf/ cm<sup>2</sup>)

P : burden weight(kgf)

L : apart buttress (cm)

b : wide of specimen (cm)

d : thick of specimen (cm)

## RESEARCH METHODOLOGIES

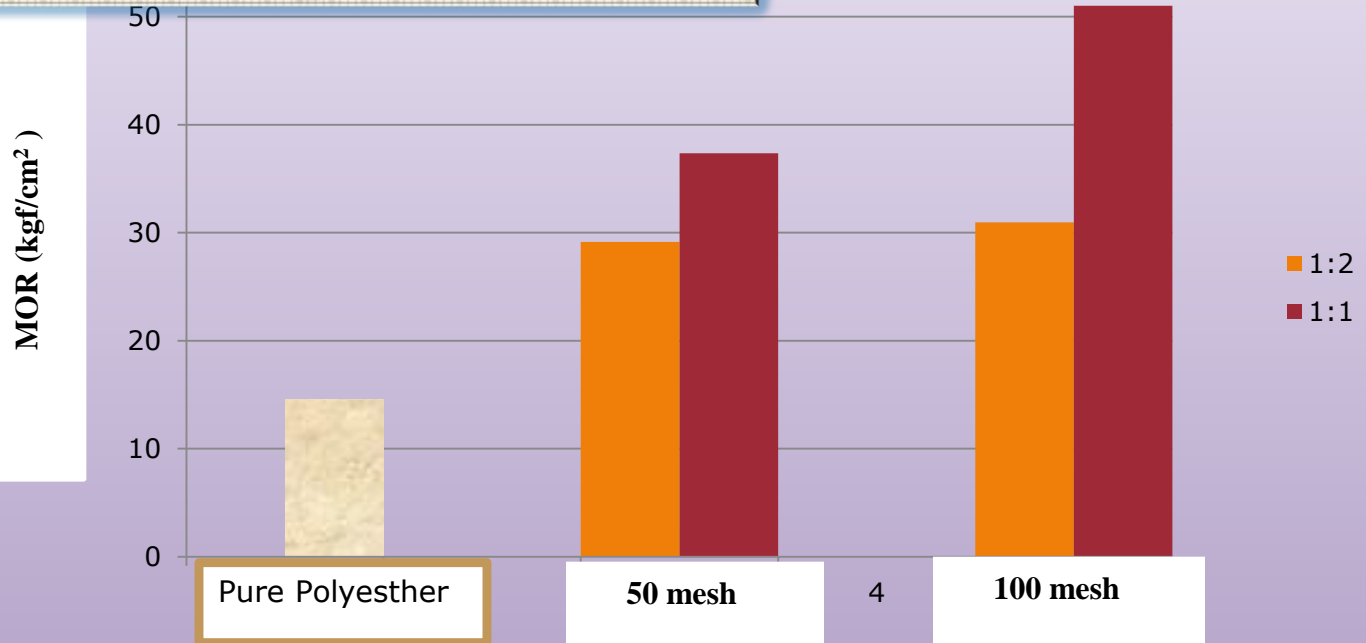
### Testing of Particle Board

#### **Strong Hold of Screw Test**

How to hold the screws robust testing done by screwing a length of 16 mm and a diameter of 3.1 mm. Screw the plug into the 3 mm deep composite board later revoked by UTM. The force required to remove the screws holding the board indicate the power couplers.

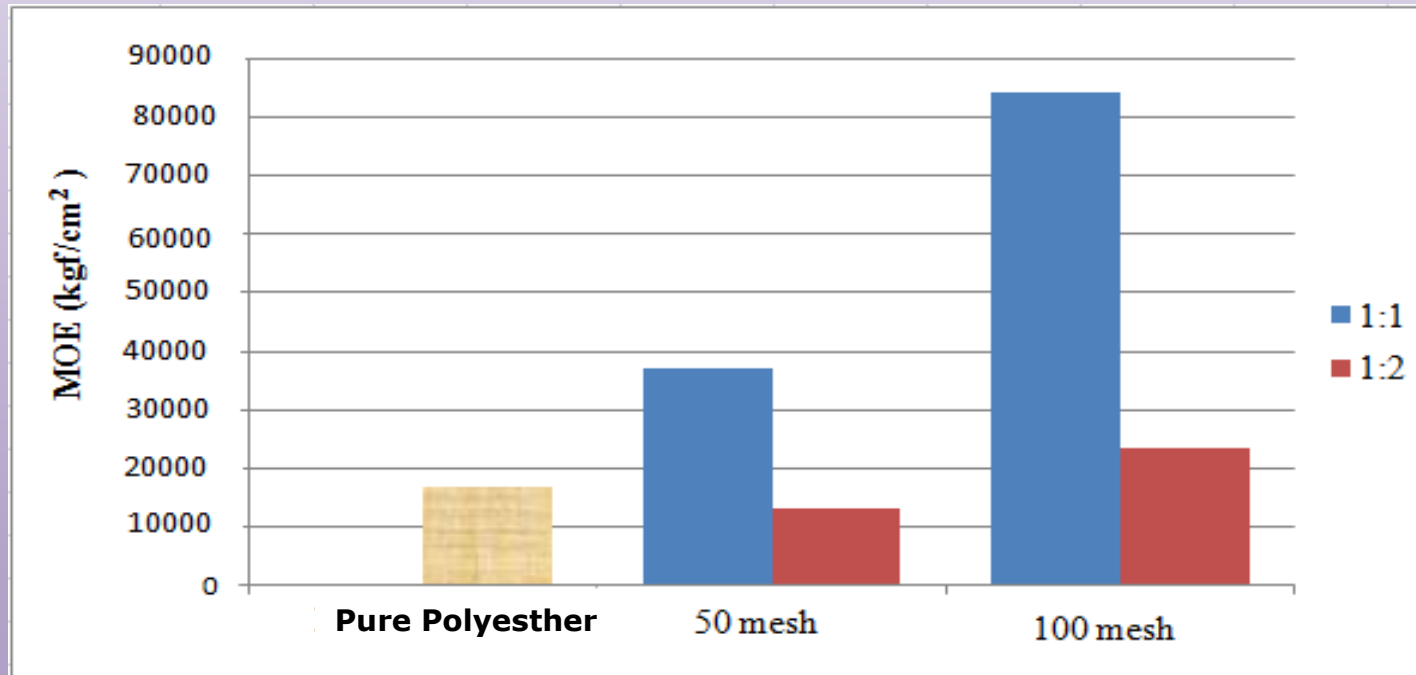
# RESULT

## Modulus of Rupture (MOR)



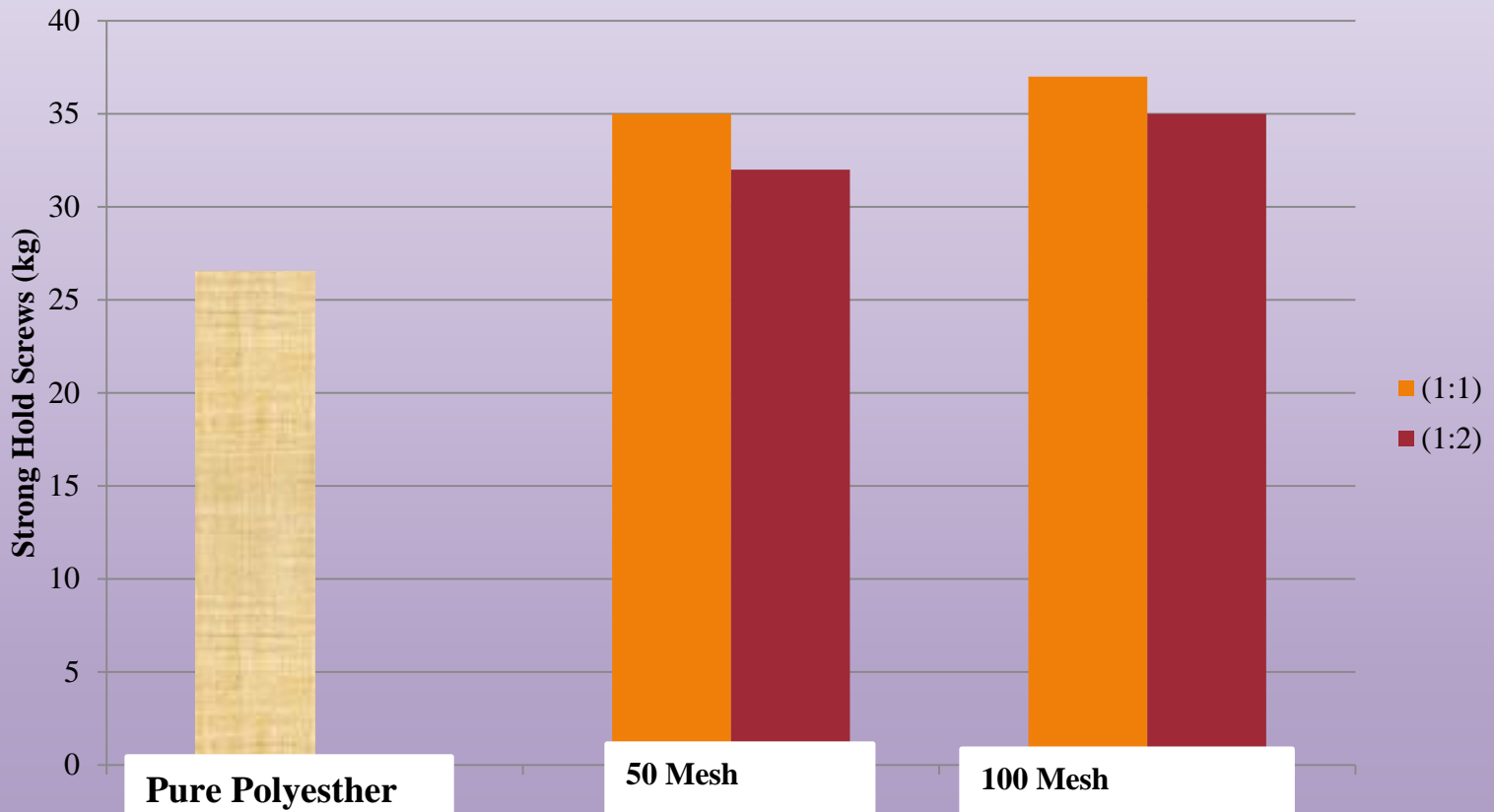
Influence of fiber measure and variation of comparison Polyester with the areca nut fiber to Modulus of Rupture of particle board

# Modulus of Elasticity



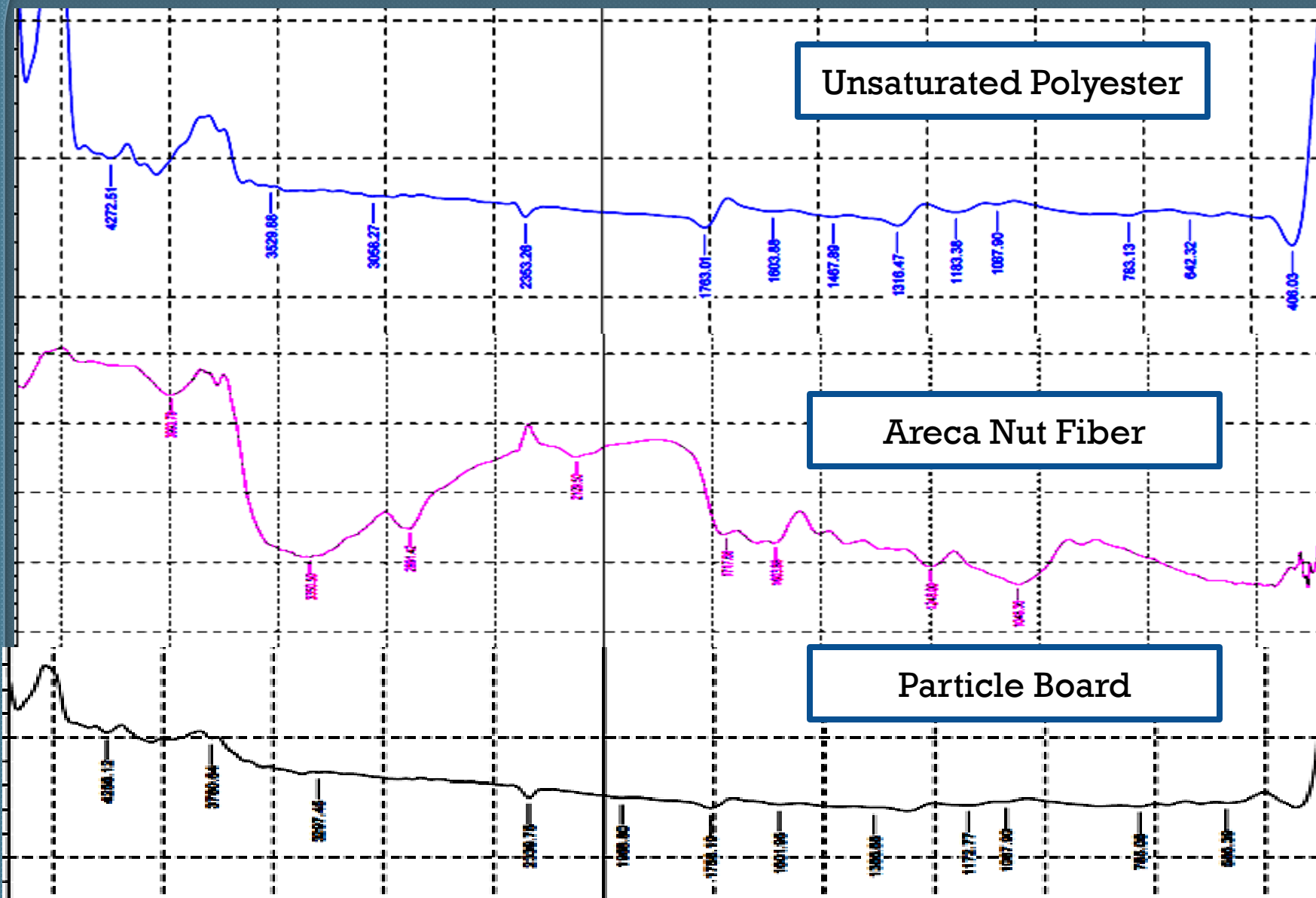
Influence of fiber measure and variation of comparison Polyester with the areca nut fiber to Modulus of Elasticity of particle board

# Strong Hold of Screw



Influence of fiber measure and variation of comparison Polyester with the areca nut fiber to Strong hold of screw of particle board

# FTIR



# FTIR

## Unsaturated Polyester

No.	FREKUENSI VIBRASI ( $\text{cm}^{-1}$ )	IKATAN YG MENYERAP IR
1	3750-3000	REGANG: O-H, N-H
2	3300-3000	REGANG C-H: $\text{C}\equiv\text{C-H}$ , $\text{C}=\text{C-H}$ , $\text{Ar-H}$
3	2400-2100	REGANG : $\text{C}\equiv\text{C}$ , $\text{C}\equiv\text{N}$
4	1900-1650	REGANG : $\text{C}=\text{O}$
5	1675-1500	REGANG: $\text{C}=\text{C}$ , $\text{C}=\text{N}$
6	1200-1000	REGANG: C-O-C
7	1000-650	TEKUK C-H : $\text{C}=\text{C-H}$ , $\text{Ar-H}$

## Areca Nut Fiber

No.	FREKUENSI VIBRASI ( $\text{cm}^{-1}$ )	IKATAN YG MENYERAP IR
1	3750-3000	REGANG: O-H, N-H
2	3300-3000	REGANG C-H: $\text{C}\equiv\text{C-H}$ , $\text{C}=\text{C-H}$ , $\text{Ar-H}$
3	3000-2700	REGANG C-H: $\text{CH}_3$ , $-\text{CH}_2^-$ , $\equiv\text{C-H}$ , $-\text{CHO}$
4	2400-2100	REGANG : $\text{C}\equiv\text{C}$ , $\text{C}\equiv\text{N}$
5	1900-1650	REGANG : $\text{C}=\text{O}$
6	1675-1500	REGANG: $\text{C}=\text{C}$ , $\text{C}=\text{N}$
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## Particle Board

No.	FREKUENSI VIBRASI ( $\text{cm}^{-1}$ )	IKATAN YG MENYERAP IR
1	3750-3000	REGANG: O-H, N-H
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## Conclusion

Composite particle board with a size of 50 mesh fiber and the fiber and polyester ratio of 1:1 and 1: 2 already tested by Modulus Of Rupture, Modulus Of Elasticity and a strong hold of the screw, the data obtained in accordance with the Standar Nasional Indonesia (SNI), except for the Modulus of Elasticity test with specimen 100 mesh ratio of 1 : 2 is not in accordance with SNI

The best result of Modulus of Rupture particle board composite were obtained for the composite particle board with specimen 100 mesh fiber and polyester ratio of 1:1 at 51 kgf/cm<sup>2</sup>

To test the modulus of elasticity of composite particle board obtained the best results for composite particle board with a specimen 50 mesh fiber and polyester ratio of 1:1 at 87840,768 kgf/cm<sup>2</sup>

The best results for test hold of screw composite particle board obtained for composite particle board with a specimen 100 mesh fiber and polyester ratio of 1:1 at 37,06 kg

Areca fiber particles is suitable as polyester filler.

THANK  
YOU