

# NOVEL FORMULATION OF BIO-ADHESIVE USING NATURAL RUBBER LATEX AND STARCH FOR WOOD COMPOSITE INDUSTRY



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## INTRODUCTION

Adhesives play a very crucial role in determining the end product quality in wood composite industry. Strong adhesive joints resemble greater mechanical properties of the wood panels, and therefore, selection of adhesives in the manufacturing of particleboard, MDF and plywood really accounts for the rise or fall of the industry. Conventionally, formaldehyde based resins are widely used as adhesives in the manufacturing of wood panel, by which urea formaldehyde (UF), tops the preference among the wood composite manufacturers. UF based adhesive applications on the wood composites tend to endanger human lives through subsequent formaldehyde emission into the air. Due to that limitation, bio-adhesive which is renewable, cheaper, possess greater mechanical properties in terms of stronger adhesion properties as well as with zero formaldehyde emission is vital to be discovered in the upcoming years so that consumers' health will not be sacrificed at any extent. Hence, this project portrays the potential of bio-adhesive development from natural Rubber latex and rice starch. By the application of new adhesive, the mechanical properties were comparable to the market standard. It will also not emit any toxic emissions, thus no health problems.

## PROBLEM STATEMENT

The application of conventional urea formaldehyde resins as adhesives in wood composite industry creates hazardous effect to human health. Since 2004, formaldehyde has been declared as human carcinogen by the International Agency Research on Cancer (IARC). Therefore, the acceptable levels of formaldehyde emission from wood products are getting stringent and stricter regulations on the formaldehyde usage and exposure limits by legal bodies in most of the countries. Most of the developed countries banned the import of wood based products with this formaldehyde based resins, which obviously threaten the economic prosperity of wood composite industry. Thus, the synthesis and development of bio-adhesive from NRL and starch can definitely eradicate this problem.

## COMMERCIAL POTENTIAL

- Adhesive in wood composite industry, furniture making.
- Food packaging and paper application industry
- Construction and personal care items manufacturing industry

## CONCLUSION

- The strength properties of the boards treated with bio-adhesives are comparable to standard boards.
- Bio-based adhesives from NRL & Starch is a breakthrough in this sector.
- The agreement is signed with large wood composite manufacturers for technology commercialization.
- The Project received Special Medal and Gold Medal in CITREX 2018

## INDUSTRIAL COLLABORATION

- MIECO Chipboard Sdn Bhd, Malaysia
- Robin Resources Sdn Bhd, Malaysia
- Dynea Malaysia, Seremban, Malaysia
- Segamat Panel Board, Segamat, Malaysia



## NOVELTY

- A new formulation of adhesive for wood composite industry based on natural substances such as Natural Rubber Latex and starch.
- Bio-adhesive synthesized is of zero formaldehyde emission and eco-friendly.
- The prepared composite is of comparable strength and is cheaper in price as compared to industrial adhesive.
- Formulated bio-adhesive will be commercialized to wood composite industry.

## PATENT

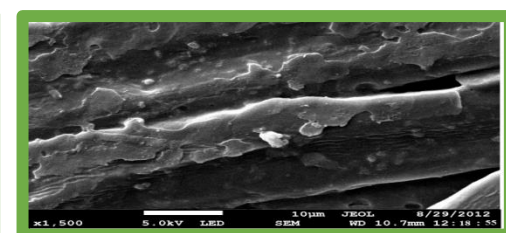
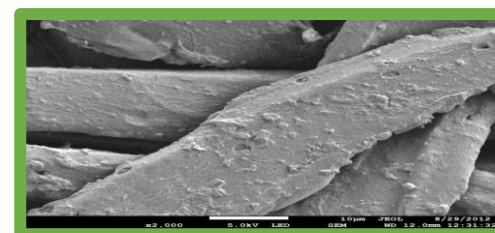
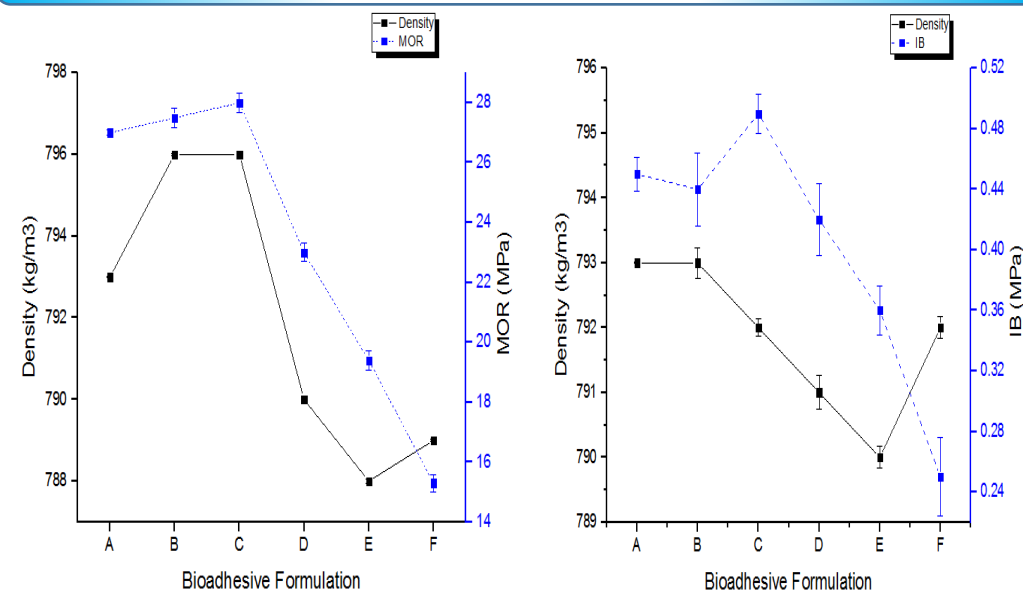
PI2014000332 (Malaysian Patent Applied in 2014)

## METHODOLOGY

Weight of MDF (g)	Adhesive Composition (from total weight of fiber)	pH	Solid content (%)	Moisture content (%)
200.0	5g NRL + 15g RS + 2% CL	11.4	55.38	14.90
200.0	10g NRL + 10g RS + 2% CL	11.2	57.10	13.33
200.0	15g NRL + 5g RS + 2% CL	12.3	59.72	11.64



## RESULTS



SEM images of fibers bonding on NRL and RS based adhesive with 2% cross-linker