FABRICATION OF NOVEL PARTICLEBOARDS FROM OIL PALM FROND BLENDED WITH EMPTY FRUIT BUNCH AND TREATED WITH PRESERVATIVE AGAINST TERMITE

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DEDICATION

Dedicated especially to my:

Mentors
Family
Friends

Thank you for all of your supports along the way.
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WAHIDA BINTI AMAT FADZIL

Thesis submitted in fulfilment of the requirements for the award of the degree of Master of Engineering

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LIST OF SYMBOLS

\( y \) Predicted response
\( \beta_0 \) Constant coefficient
\( \beta_j, \beta_{ij}, \beta_{ij} \) Regression coefficient
\( X_j, X_i \) Coded independent variables
\( e_i \) Error
\( N \) Number of experiment
\( f \) Number of factor
\( C_0 \) Number of centre points
\( W_{OD} \) Oven dried weight
\( W_w \) Wet weight
\( MC \) Moisture content
\( W_1 \) Oven dried weight
\( W_2 \) Weight of residue, Oven dried weight
\( A \) Linear effect for press temperature
\( B \) Linear effect for press time
\( C \) Linear effect for EFB/OPF ratio
\( AB \) Interaction effect for press temperature and time
\( AC \) Interaction effect for press temperature and EFB/OPF ratio
\( BC \) Interaction effect for press time and EFB/OPF ratio
\( A^2 \) Quadratic effect for press temperature
\( B^2 \) Quadratic effect for press time
\( C^2 \) Quadratic effect for EFB/OPF ratio
\( R_1 \) Modulus of rupture
\( R_2 \) Modulus of elasticity
\( R_3 \) Internal bonding
\( R_4 \) Thickness swelling
\( R_5 \) Water absorption
\( T_1 \) Initial thickness of sample before immersion
\( T_2 \) Final thickness after immersion
$P_m$  Static bending load is
$L$  Specimen’s length
$b$  Specimen’s width
$t$  Specimen’s thickness
$P'$  Maximum rupture load
$R^2$  Coefficient of determination
$R_{adj}^2$  Adjusted coefficient of determination
$R_{pred}^2$  Predicted coefficient of determination
$G$  Weight of the treatment solution absorbed by the block
$C$  Preservative amount in 100 g or 100 ml of the treatment solution
$V$  Volume of the block
$M_1$  Number of termites alive at the beginning of the test
$M_2$  Number of termites alive at the end of the test
$NA$  Not available
$NS$  Not specific
$M-S$  Commercial grade
$M-1$  Commercial grade
$PBU$  Underlayment grade
$W_T$  Total weight
$W_{R\text{(solid)}}$  Solid weight of resin
$W_{H\text{(solid)}}$  Solid weight of hardener
$W_{P\text{(solid)}}$  Solid weight of OPF particles or EFB fibres
$W_R$  Measured weight of resin
$W_H$  Measured weight of hardener
LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>2FI</td>
<td>Two factorial interaction model</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standard Institute</td>
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<tr>
<td>ASTM</td>
<td>American Testing for Testing and Materials</td>
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<tr>
<td>AWPA</td>
<td>American Wood Protection Association</td>
</tr>
<tr>
<td>BJC</td>
<td>Builders’ joinery and carpentry</td>
</tr>
<tr>
<td>CCD</td>
<td>Central composite design</td>
</tr>
<tr>
<td>CPO</td>
<td>Crude palm oil</td>
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<tr>
<td>CV</td>
<td>Coefficient of variation</td>
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<td>DM</td>
<td>Dry matter</td>
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<tr>
<td>EC</td>
<td>Emulsifier concentrate</td>
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<td>EFB</td>
<td>Empty fruit bunch</td>
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<tr>
<td>FFB</td>
<td>Fresh fruit bunch</td>
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<tr>
<td>FRIM</td>
<td>Forest Research Institute Malaysia</td>
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<tr>
<td>GCMS</td>
<td>Gas Spectrometer Mass Spectrometer</td>
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<tr>
<td>HDF</td>
<td>High density fibreboard</td>
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<tr>
<td>IB</td>
<td>Internal bonding</td>
</tr>
<tr>
<td>IC</td>
<td>Isocyanate</td>
</tr>
<tr>
<td>LOF</td>
<td>Lack of fit</td>
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<tr>
<td>MC</td>
<td>Moisture of content</td>
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<td>MDF</td>
<td>Medium density fibreboard</td>
</tr>
<tr>
<td>MF</td>
<td>Melamine formed-formaldehyde</td>
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<tr>
<td>MF</td>
<td>Mesocarp fibres</td>
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<td>MNSB</td>
<td>Malaysian National Biomass Strategy</td>
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<tr>
<td>MOE</td>
<td>Modulus of elasticity</td>
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<td>MOR</td>
<td>Modulus of rupture</td>
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<td>MPOB</td>
<td>Malaysian Palm Oil Berhad</td>
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<td>MTIB</td>
<td>Malaysian Timber Industry Board</td>
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<td>MUF</td>
<td>Melamine urea formaldehyde</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>-------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>NH₄Cl</td>
<td>Ammonium chloride</td>
</tr>
<tr>
<td>OFAT</td>
<td>One Factor at Time</td>
</tr>
<tr>
<td>OPF</td>
<td>Oil palm fronds</td>
</tr>
<tr>
<td>OPT</td>
<td>Oil palm trunks</td>
</tr>
<tr>
<td>OSB</td>
<td>Oriented strand board</td>
</tr>
<tr>
<td>PF</td>
<td>Phenol formaldehyde</td>
</tr>
<tr>
<td>PKO</td>
<td>Palm kernel oil</td>
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<tr>
<td>PKS</td>
<td>Palm kernel shells</td>
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<tr>
<td>PMDI</td>
<td>Polymeric diphenyl methane diisocyanate</td>
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<td>RSM</td>
<td>Response Surface Methodology</td>
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<tr>
<td>TS</td>
<td>Thickness swelling</td>
</tr>
<tr>
<td>UF</td>
<td>Urea formaldehyde</td>
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<tr>
<td>WA</td>
<td>Water absorption capacity</td>
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