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13^É JOURNÉES SCIENTIFIQUES GDR SCIENCE DU BOIS

Renewable Energy Evaluation of Recycled Wood Through Thermochemical Conversion Pathway and Artificial Intelligence Optimization

Physicochemical, Thermodegradation, and Flammability Behaviours

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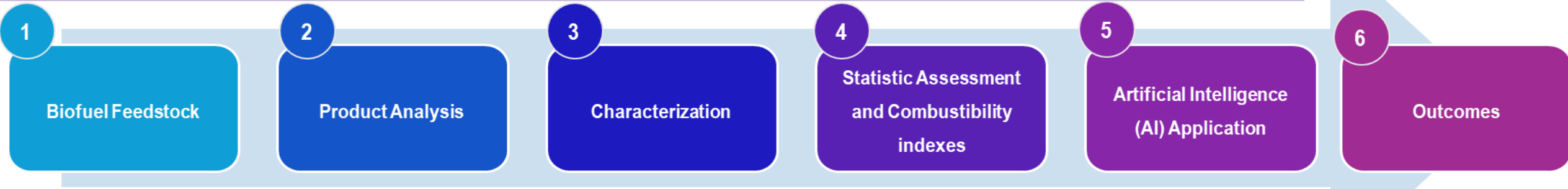
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Waste-to-Energy Wood Valorization in Circular Economy Concept

Novelty / Idea: Transforming Wood Waste into Renewable energy



Wood Waste-Engineered Timber Products

- Sample selection



Samples

- Hardwood (HW) – Beech
- Softwood (SW) – Fir
- Woods blend (WB) – Beech/Fir
- Sample preparation (grinding, sieving, storing)

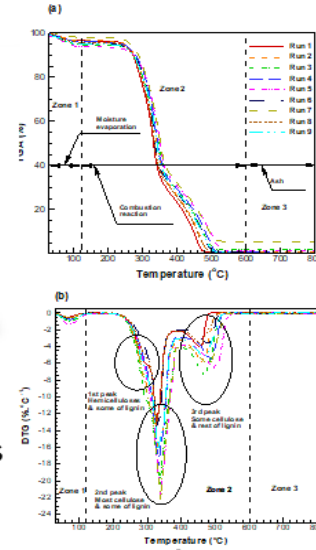
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Combustion Behaviour Analysis

TGA method

- TGA curvatures
- DTG curvature
- Variables
- Sample feedstock (HW, SW, WB)
- Heating rates
- Particle size

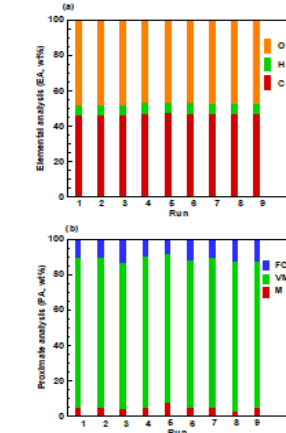


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Evaluations

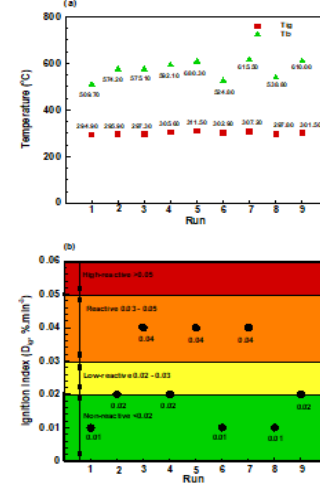
- Physicochemical analysis
- Proximate analysis
 - Elemental analysis
 - Calorific value (HHV)
 - Bioexergy value (SCB)

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Statistic and Indexes

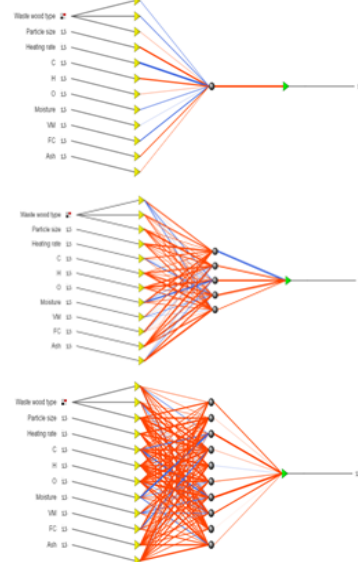
- Taguchi orthogonal array
- S/N ratio
- ANOVA ($\alpha \leq 0.05$)
- Ignition index (Dig)
- Reactivity index (Rfuel)
- Comprehensive combustion characteristic index (Sn)



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AI model training

- Artificial neural network (ANN) model
- Activation function
- Hidden layer configurations
- Neuron architectures
- Two outputs: HHV and SCB of wood waste prediction



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Outcomes of the study:

1. Wood waste (timber) utilization
2. Combustion behavior and characterization
3. Data analysis: statistic assessment
4. Combustibility index evaluation
5. Prediction model by AI application