Valorization of pyrolysis by-products from sugar cane bagasse for the protection of biomaterials

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This research focused on the "Energy valorization of lignocellulosic products and their by-products for the protection of bio-materials", is dedicated to the valorization of the sugar cane bagasse from Réunion Island (Oversea territory, France), a region where the sugar industry plays an important role in the agricultural sector. The objectives of this research were to: (i) characterize the biochar and the bio-oil according to the pyrolysis process parameter and the biomass used, and to (ii) evaluate the potential of said bio-oil as wood preservatives. Pyrolysis of bagasse was conducted using an experimental set up of fixed bed reactor. Various temperatures (T = 400 °C, 500 °C) and holding time th (30 and 60 minutes), and a heating rate of 10 °C/minutes were applied. Pyrolysis products, consisting of biochar and bio-oil, were recovered for further analysis. The biochars were characterized for their proximate and ultimate analysis for energy valorization. For evaluating the antifungal efficacy of the recovered bio-oil, we conducted fungal growth inhibition tests against two types of wood-decaying fungi: *Coriolus versicolor* (white-rot) and *Coniophora puteana* (brown-rot) on Petri dishes, as well as decay tests on treated wood samples.

Engineered Wood Products (EWPs) in mass timber construction and their durability

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With proven improved performance in fire and seismic characteristic, the projected market potential for softwood Engineered Wood Products such as CLT (Cross Laminated Timber) and LVL (Laminated Veneer Lumber) for multi-story buildings are very positive. However, potential prolonged rain leakage or moisture exposure during construction and in-service could pose considerable concern for its durability and reputation. This research was conducted to assess the decay resistance of LVL, OSB (Oriented Strand Board) and CLT produced from radiata pine in an accelerated trial. This testing method is used in establishing the effectiveness of wood products in framing subject to intermittent wetting. The results showed untreated OSB and CLT were very susceptible to decay. In comparison, LVL was less susceptible. Testing conducted on CLT using surface application of boron preservative prevented decay. Further work is needed to understand the full extent of moisture ingress in wooden panels during construction and service of the multi-story buildings and improving the durability of panel products.

Improvement of the dimensional stability and weathering resistency of wood treated with an hydrorepelent product for exterior use

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Wood is a common construction material used in all environments. However its sensibility to abiotic agents, in particular its dimentional inestability limit its durability and decrease its properties. In In this work, the efficiency of a parafine-emulsion-based product as a wood protector was tested for its use on both interiors and exteriors- mainly decks and utility poles. *Eucalyptus grandis* and *Pinus taeda* sapwood were treated with the Bethel method at two retention levels, and later compared with untreated wood. The dimensional stability of the treated samples was studied through determining the swelling percentage and the water repellency level. Test samples were also exposed to accelerated weathering processes of 100 and 300 h, and later analized by FTIR and SEM microscopy. Results showed a significative improvement of the dimensional stability of treated wood when compared to untreated samples. Despite the weathering process slightly affected the surface of the wood, the product is suitable for exterior use.

Protection of wood from fungi and termite with liquefied wood polyols

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Liquefaction of wood is one of the promising approaches to utilize woody waste wherein wood meal is converted into chemically active liquid with the help of a liquefying agent like polyhydric alcohols, phenol, cresol, etc. The potential of liquefied wood as a wood preservative has not been studied. In this study, wood meal was liquefied in phenol, glycerol and polyethylene glycol as the liquefying media and the efficacy of liquefied wood was tested as a wood preservative against termite and fungi.Wood samples were impregnated with liquefied wood diluted with methanol and were subjected to accelerated termite graveyard test and fungal resistance test. The level of impregnation of liquefied wood in wood was estimated by determining the weight percent gain. In the graveyard test, samples were periodically observed for 18 months. Samples treated with phenol-assisted liquefied wood exhibited promising results both in visual observation and percentage weight loss as compare to initial condition and untreated control samples. The percentage weight loss of phenolated wood treated wood sample was ranging from only 5 - 20% of its initial weight; whereas treatment with glycerol and PEG based liquefied wood did not exhibit any improved resistance against termite as compared to the untreated samples. The treated samples were also exposed to fungus for 16 weeks. The fungicidal traits of phenolated wood showed higher antifungal efficacy against both white rot and brown rot of wood whereas liquefied wood in glycerol and polyethylene glycol shows insignificant effects on growth of fungus and was similar to control samples.

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The contributions of rate and duration of stem radial increment to annual increments of *Picea meyeri* in a sub-alpine habitat, North-Central China

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Stem radial increment rate and duration are the most important parameters in determining the width of annual tree rings. To identify the contributions of rate and duration to annual radial increments and their relationships with environmental factors, we analyzed intra-annual stem increments of five *Picea meyeri* trees