

Sawdust Saccharification and Phenolic Compound Quantification in Three Different Commercial South African Trees.

ON Nduli, TM Ndlovu and JPH van Wyk

Department of Pharmacology and Therapeutics, School of Medicine, Sefako Makgatho Health Sciences University (SMU), South Africa

Abstract:

The pharmaceutical industry's dependence on fossil-derived raw materials necessitates the exploration of sustainable and biologically relevant alternatives. Biomass waste, including sawdust, serves as a renewable feedstock for the advancement of environmentally friendly pharmaceuticals and an abundant source of bioactive compounds with therapeutic significance. Phenolic compounds are widely recognized for their antioxidant and anti-inflammatory properties. This study investigates the valorization of sawdust from three commercial South African trees—Poplar (*Populus*), Pine (*Pinus*), and Bluegum (*Eucalyptus globulus*)—for the dual production of fermentable sugars and extraction of phenolic compounds. Sawdust samples were subjected to hot water reflux extraction for 2, 4, and 6 hours. Total phenolic content was quantified using the Folin—Ciocalteu assay, while cellulase-mediated saccharification using *Aspergillus niger* was assessed using the dinitrosalicylic acid (DNS) assay. After 6 hours of extraction, poplar sawdust had the most phenolic content. Heat pretreatment enhanced enzymatic saccharification, with pine sawdust yielding the highest glucose concentration. The presence of phenolic compounds and fermentable sugars across all biomass samples highlights their potential as sources of anti-inflammatory agents and supports their application in sustainable pharmaceutical production.

Methods:

Sawdust samples obtained from three commercial south African tree species- poplar (*Populus*), pine (*Pinus*), and blue gum (*Eucalyptus globulus*)- were subjected to hot water reflux extraction to simultaneously isolate phenolic compounds and prepare the

biomass for saccharification. Approximately 100 mg of each sawdust sample was refluxed in 50 mL of boiling distilled water for 2, 4, and 6 hours in triplicate. After cooling, the mixtures were filtered using Whatman no.1 filter paper to separate the liquid extracts (filtrates) from the solid residues. The filtrates were analyzed for total phenolic content using the Folin-Ciocalteu assay, where absorbance was measured spectrophotometrically at 750 nm wavelength using catechin as the calibration standard. The solid residues were subjected to enzymatic saccharification using *Aspergillus niger* cellulase. The amount of reducing sugars released was quantified using the dinitrosalicylic acid (DNS) assay, with absorbance measured at 520nm against a glucose standard curve.

Results:

Phenolic compounds were successfully extracted from all three sawdust types, with yields increasing as the reflux time increased. After 6 hours of extraction, poplar sawdust exhibited the highest phenolic content, followed by blue gum and pine. Enzymatic saccharification results showed that heat pretreatment enhanced glucose release in most cases. Pine sawdust produced the highest concentration of fermentable sugars after saccharification, followed by poplar, while blue gum yielded the lowest sugar concentration overall. For blue gum and pine, sugar production increased progressively with longer reflux pretreatment times. In contrast, poplar showed improved saccharification after 2 hours of treatment, with no significant increase at longer durations.

Conclusion:

The study demonstrates that sawdust from commercial South African trees can be effectively valorized through a dual-process approach involving phenolic compound extraction and enzymatic saccharification. The presence of bioactive compounds such as phenolics, particularly in poplar, highlights the potential for developing antioxidant and anti-inflammatory agents, while the production of fermentable sugars, especially in pine, supports the use of sawdust as a renewable feedstock for biopharmaceutical and biotechnological applications. Overall, these findings highlight the potential of biomass

waste as a sustainable alternative to fossil-derived raw materials in pharmaceutical development.