IN-SITU SYNTHESIS OF ZnO, SiO_2, AND TiO_2 NANOPARTICLES TO IMPROVE THE WOOD WITH SUPERHYDROPHOBICITY, UV RESISTANCE, AND ANTIFUNGAL PROPERTIES

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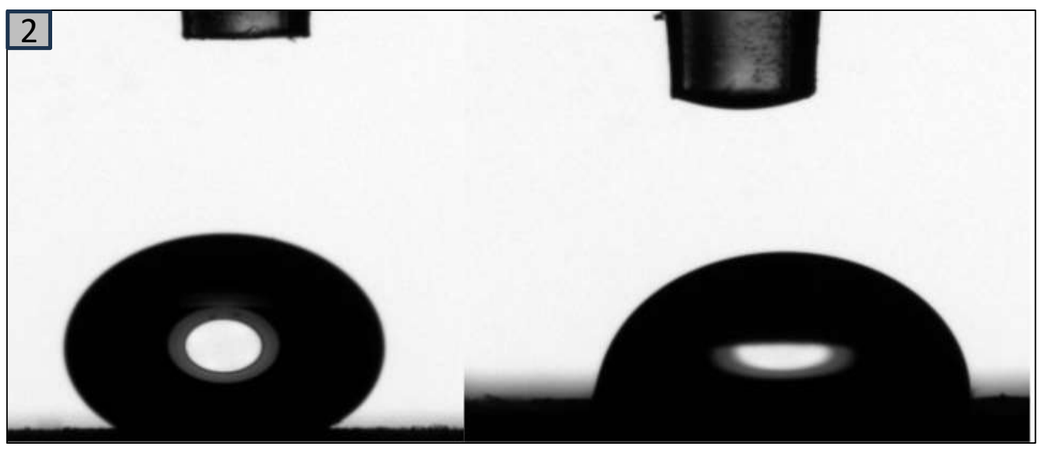
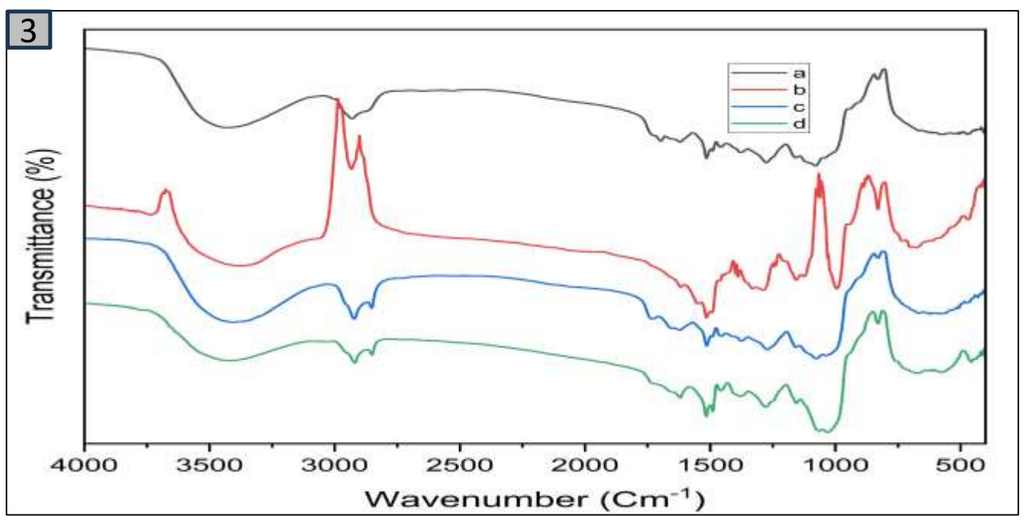
Background: Wood shows inherent challenges, including susceptibility to decay, moisture absorption, and dimensional instability. Various wood modification techniques have been envisioned to address these concerns, aiming to reinforce wood product durability and advance environmentally conscious resource utilization. Our research accomplishments involve the integration of in-situ nanoparticles into wood structures, to augment hydrophobic properties, UV resistance, and antifungal characteristics for enhanced performance.

Hypothesis: Nanoparticle impregnation will increase wood's superhydrophobicity, UV resistance and antibacterial properties.

Material and Methods: Pine and spruce were taken for the experiment and ZnO, SiO_2, and TiO_2. were synthesised with different chemicals and the nanoparticles were impregnated by the vacuum impregnation method.

Results: Noticeable changes are observed in all tests when comparing untreated and treated samples. Treated samples demonstrate notably higher hydrophobicity, surpassing 150˚C, with this enhanced property remaining consistent following UV exposure. In contrast, untreated samples exhibit a substantial decrease in hydrophobicity after UV exposure. The Fourier-transform infrared (FTIR) and SEM analyses emphasised the conspicuous presence of nanoparticles.





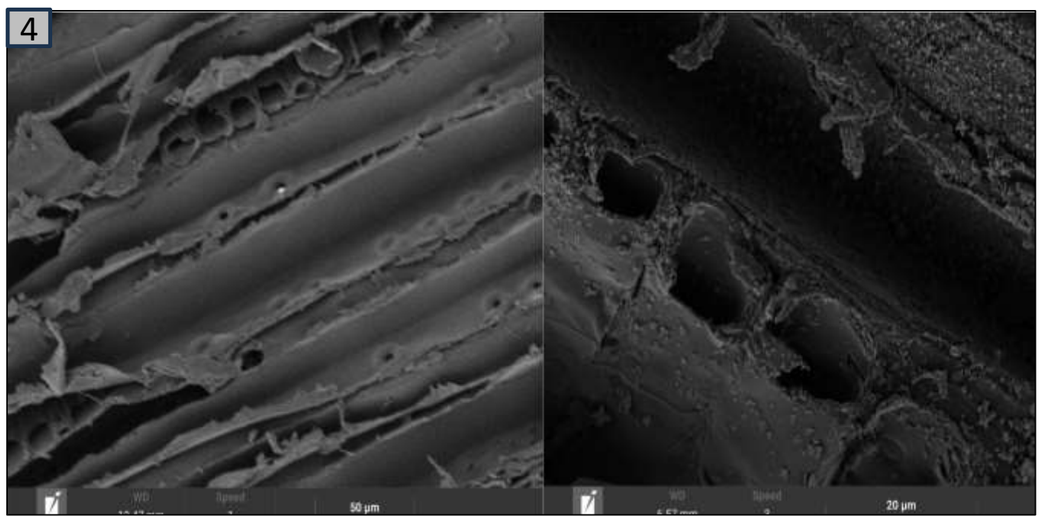


Figure 1. Illustrates a pronounced distinction between untreated and treated wood (pine) characteristics for antifungal tests.
Figure 2. Demonstrated the contact angle of treated and untreated wood(pine).
Figure 3. Shows the FTIR peaks of untreated wood(Pine) and treated wood (a) control, (b) ZnO, (c) TiO_2, (d) $SiO_{2.}$
Figure 4. Demonstrated the SEM image and morphology of untreated and treated wood.

Conclusion: To summarize, the promising potential of using ultrasonic waves in revolutionizing wood modification depicts exciting opportunities for advancing wood modification techniques and their wide-ranging applications. In addition, the compelling prospects of binding ultrasonic waves to transform wood modification offer a treasure of exciting possibilities for advancing the field of wood modification techniques and broadening their applications.

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