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### **Abstract**

Green roofs are a key measure used to alleviate the urban heat island effect and reduce stagnant water from urban runoff. However, the expensive substrate material and high construction cost restrict the large-scale application of green roofs. Wheat straw (WS) contains abundant nutrients needed for plant growth; however, burning this straw waste causes severe environmental pollution. In this study, six pretreatment methods, including mixed, soaked, hydrothermal, ultrasonic, microwave, and steam explosion, and three liquid media, including deionized water, acetic acid, and wood vinegar, were used to treat WS to improve its properties and decrease its environmental pollution effects. The results showed that, compared to other treatments, physical methods (microwave, ultrasonic) used in conjunction with wood vinegar could effectively break down the particle structure of WS and increase porosity. Most of the crystallinities were reduced by 1.45–6.66% compared to WS when using these methods, and the absolute values of the surface zeta potential were reduced by 4.224.67 mV. Additionally, the contents of macromolecular lignocellulose, which is difficult to decompose, were reduced by 3.6613.75%. Compared with the use of deionized water or acetic acid, wood vinegar reduced the compressive force of the WS substrates and the energy consumption of compression. Hydrophilic groups such as hydroxyl were introduced into the WS to increase the water absorption rate. Overall, the microwave-assisted wood vinegar pretreatment was an effective method for improving the WS properties for use as a potential alternative substrate material in green roof construction.



## Pretreatments of wheat straw for possibility use in maintenance-free compressed green roof substrates

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