

## **Microwave-Assisted Chemical Pre-Treatment of Waste Sorghum Leaves: Process Optimization and Development of an Intelligent Model for Determination of Volatile Compound Fractions**

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**Abstract :** The shift towards renewable energy sources for biofuel production has received increasing attention. However, the use and pre-treatment of lignocellulosic material are inundated with the generation of fermentation inhibitors which severely impact the feasibility of bioprocesses. This study reports the profiling of all volatile compounds generated during microwave assisted chemical pre-treatment of sorghum leaves. Furthermore, the optimization of reducing sugar (RS) from microwave assisted acid pre-treatment of sorghum leaves was assessed and gave a coefficient of determination ( $R^2$ ) of 0.76, producing an optimal RS yield of 2.74 g FS/g substrate. The development of an intelligent model to predict volatile compound fractions gave  $R^2$  values of up to 0.93 for 21 volatile compounds. Sensitivity analysis revealed that furfural and phenol exhibited high sensitivity to acid concentration, alkali concentration and S:L ratio, while phenol showed high sensitivity to microwave duration and intensity as well. These findings illustrate the potential of using an intelligent model to predict the volatile compound fraction profile of compounds generated during pre-treatment of sorghum leaves in order to establish a more robust and efficient pre-treatment regime for biofuel production.

**Keywords :** artificial neural networks, fermentation inhibitors, lignocellulosic pre-treatment, sorghum leaves

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