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Lemnaceae Plants Superheated Steam Torrefaction Process and Its Conditions Effect on Phytotoxicity

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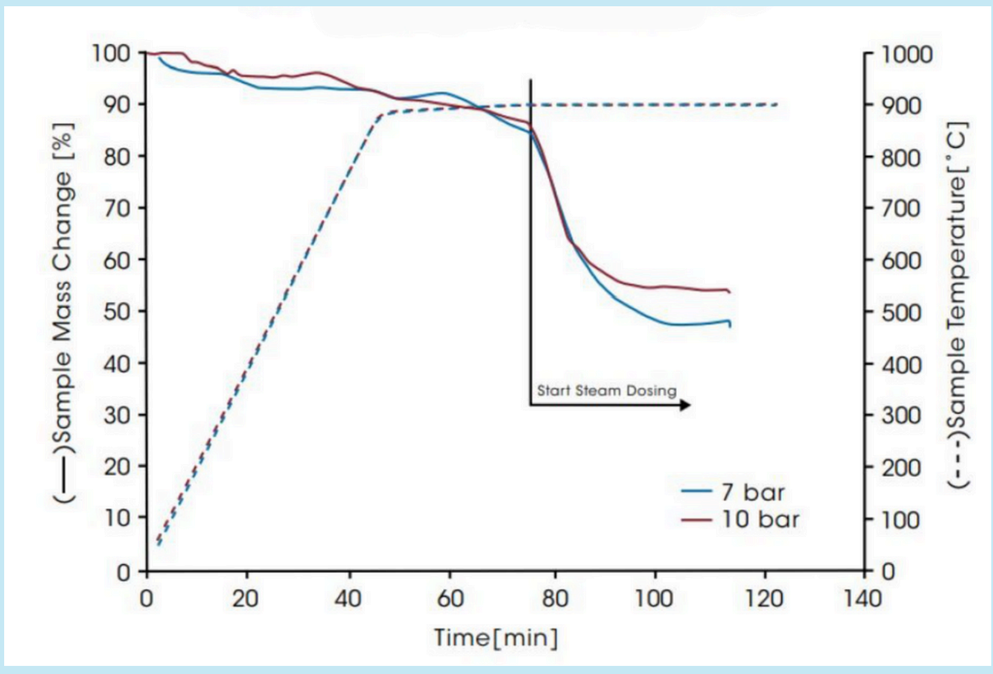
Introduction

Phytotoxicity denotes the detrimental effects or harms inflicted upon plants by diverse chemical substances, environmental factors, physical agents, and notably fertilizers. Fertilizers characterized by excessive nutrient content, salinity issues, impurities or contaminants, and irregular pH levels can induce phytotoxicity in plants.

Objectives

To valorize Lemnaceae plants through superheated steam torrefaction, exploring various conditions to assess their efficacy in mitigating the phytotoxicity of the substrate.



Methods

- Utilization of DynTHERM TG Rubotherm high-temperature and high-pressure Thermogravimetric Analysis apparatus.
- Superheated steam flow conditions.
- Residence times: 20, 30, and 40 minutes.
- Torrefaction temperatures: 240°C, 250°C, 260°C, 270°C, 280°C, and 290°C.
- Toxicity assessment using OECD tests and Phytotoxkit methodology on Lemna minor L. and Spirodela oligorrhiza.

Results

- Optimal conditions identified: 260°C with a residence time of 30 minutes.
- Further temperature increase to 300°C did not reduce phytotoxicity.
- SHS torrefaction reduces phytotoxicity by modifying chemical composition, notably reducing organic acids and amino acids.

Conclusion

Superheated steam (SHS) torrefaction is effective in significantly diminishing the phytotoxicity of Lemnaceae plants, presenting new avenues for sustainable incorporation in growing media.

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