

Thermal upgrading of sustainable woody material: experimental and numerical torrefaction assessment

Edgar A. Silveira ^{a*}, Sandra Luz ^b, Mauricio Simões Santanna ^a, Rosineide M. Leão ^b, Patrick Rousset^c, Armando Caldeira-Pires ^a

a. Mechanical Engineering Department, University of Brasília, Brasília, DF 70910-900, Brazil

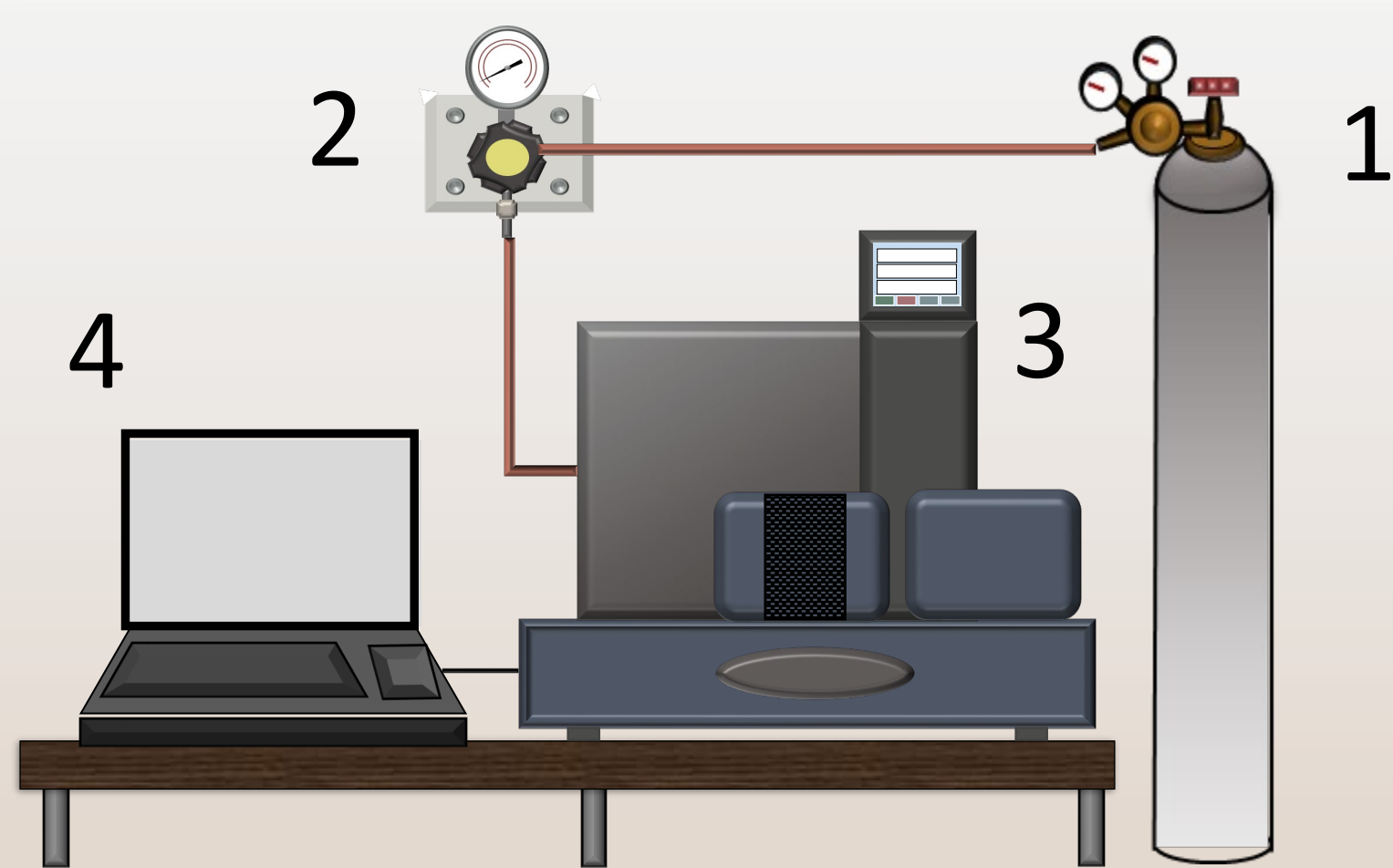
b. Engineering Materials Integrity Program, University of Brasília (UnB), Brasília, Brazil

c. French Agriculture Research Centre for International Development (CIRAD), 73 rue J. F. Breton, 34398 Montpellier, Cedex 5, France

INTRODUCTION

- Torrefaction is a **wood thermal modification** process carried out in inert atmosphere under relatively low temperatures (200°C-300°C) enhancing wood properties as moisture content, grindability and material homogeneity
- A hardwood (*Eucalyptus grandis*) was investigated by using thermogravimetric analysis (TGA), as well as elemental analysis
- Numerical models, are applied to predict processes parameters giving treatment time estimation, solid and volatile yields, and calorific values of the solid fuels

MATERIAL AND METHODS

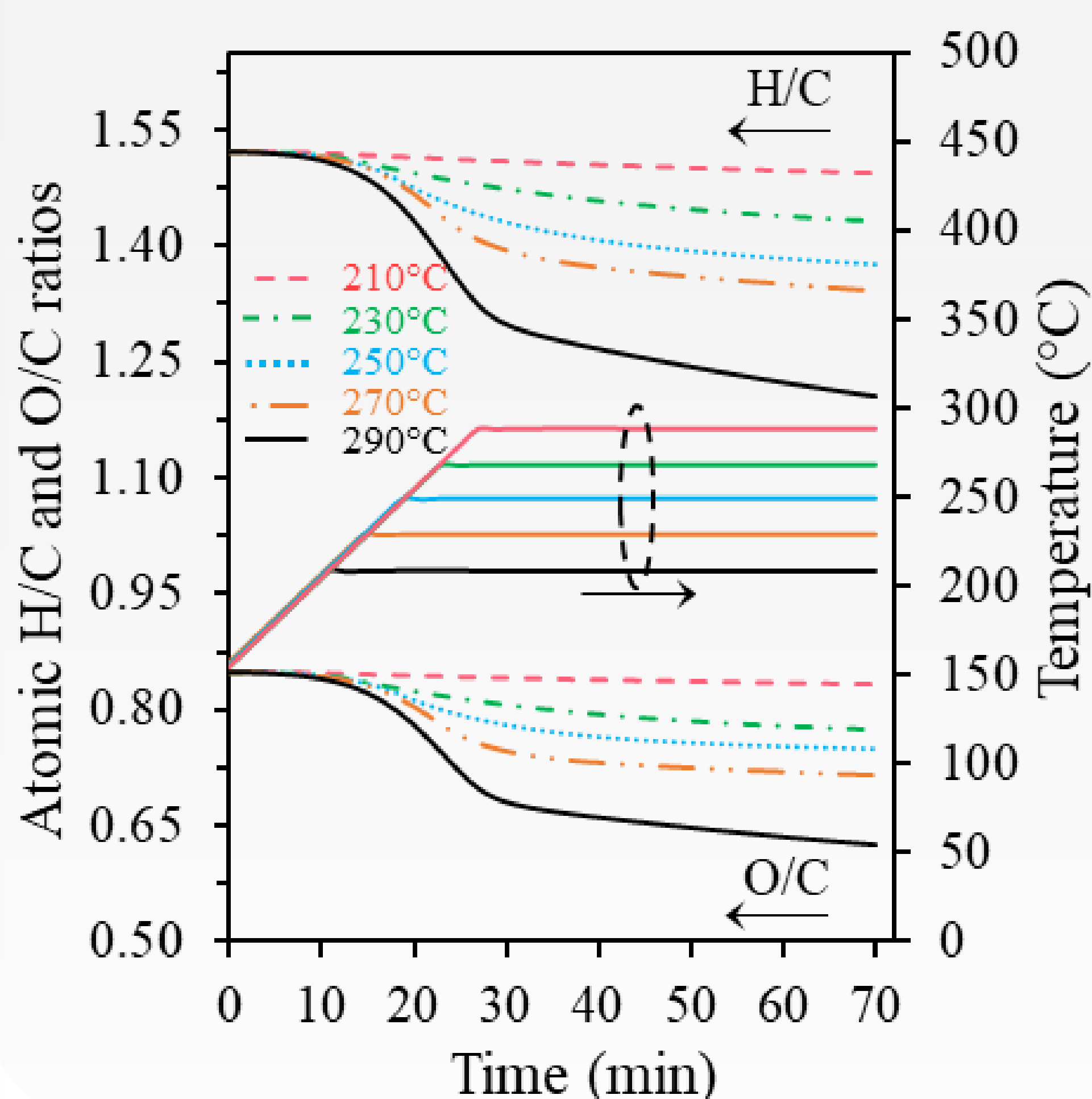


	Duration	Heating rate	Final temperature
Drying	30 min	20 °C.min ⁻¹	104 °C
Torrefaction	60 min	5 °C.min ⁻¹	210 °C
			230 °C
			250 °C
			270 °C
			290 °C

Torrefaction system 1) N₂ cylinder, 2) Gas control rotameter, 3) SDT Q600 TA, 4) Computer

RESULTS

Predicted profiles of H/C and O/C ratios



- Torrefaction severity strongly affected wood thermodegradation
- Predicted kinetics and properties are in good agreement with the experimental results
- Higher carbon, lower hydrogen, and lower oxygen contents were obtained for higher temperature treatments, as expected
- The HHV were 18.18 (210°C), 18.66 (230 °C), 18.82 (250°C), 19.11 (270 °C) 19.91 (290 °C) MJ.kg⁻¹

CONCLUSIONS AND PERSPECTIVES

- Eucalyptus hardwood torrefaction between 210–290 °C has been successfully evaluated by prediction profiles and 3D surfaces
- The atomic H/C and O/C ratios were decreasing throughout torrefaction treatment
- The enhancement factors of HHVs were in a range of 1.006 and 1.102 for treatments between 210 and 290 °C
- Essential information for a torrefaction can be predicted, and process optimization can be carried out with some additional information.

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