Environmental Engineering and Management Journal

October 2018, Vol. 17, No. 10, 2485-2496 http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu



"Gheorghe Asachi" Technical University of lasi, Romania



## GASIFICATION OF BIOMASS FROM RIVER MAINTENANCE AND CHAR APPLICATION IN BUILDING MATERIALS PRODUCTION

Vittorio Vezzali\*, Fernanda Andreola, Luisa Barbieri, Isabella Lancellotti, Paolo Pozzi, Giulio Allesina, Simone Pedrazzi, Paolo Tartarini

Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Via Vivarelli, 10/1 – 41125 Modena, Italy

## Abstract

This paper exposes the research activities regarding REBAF (Energetic Recover of River Biomasses) project, focused on the maintenance operations self-sustainability of the Secchia river (Italy). Poplar was found as the most abundant and representative wood plant of Secchia riverbanks, with a good behavior during gasification process: from 1 hectare of maintenance every three year, it was possible to produce 23 MWh of electrical power and 31 MWh of thermal power. The biochar obtained was characterized and mixed with local red clay to create both lightweight aggregates (LWAs) for green roofs applications and bricks. Ashes coming from the gasifier cyclone were characterized and used to create bricks. The aims are the saving of raw materials and the obtaining of weight-lightened products with high porosity. Biochar and ashes were found to be suitable for this purpose given their organic carbonaceous nature, according to X-ray diffractometry, Loss on Ignition (LOI) and TG-DTA results. Application on LWAs by substituting 15%wt of the clay with biochar leads to a weight-lightening of the material. To optimize LWAs pH, spent coffee grounds (SCG) were added with proportion of 85% clay-15% biochar/SCG. A greater decrease in weight and pH values in the neutrality range were observed. Adding 20%wt biochar or ashes on bricks led to a significant reduction of materials bulk density (from 2 to 1.5 g/cm<sup>3</sup>) and the achievement of 40-45% porosity. With higher additions (until 40%wt) bulk density gets lower (1.2 g/cm<sup>3</sup>-1.3 g/cm<sup>3</sup>), but the material results weaker with a worst mechanical strength.

Key words: bio-char, biomass, brick, gasification, lightweight-aggregate

Received: March, 2018; Revised final: June, 2018; Accepted: September, 2018; Published in final edited form: October 2018

<sup>\*</sup> Author to whom all correspondence should be addressed: e-mail: vittorio.vezzali@unimore.it; Phone: +39 0592056221; Fax: +390592056243