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Recovering shrub biowaste involved in wildland fires in the South of Europe through torrefaction mobile units

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Abstract

In the last decades, longer and drier seasons, as well as human activity, increased the incidence of forest fires in the South of Europe. This phenomenon was enhanced by the accumulation of vegetal mass in forest and mountains, favoured by the decrease of agricultural and farming activities. However, it is precisely the valorisation of this abundant and cheap shrub biowaste at local scale which may provide rural areas of valuable resources, contribute to prevent fire and restore modernized rural activities. The European project MOBILE FLIP developed and demonstrated mobile conversion processes suitable with underexploited agro- and forest-based resources to produce energy carriers, chemicals and materials. Torrefaction is a mild thermochemical treatment (200 to 300 °C, default-oxygen atmosphere) producing a torrefied solid, whose properties are close to those of coal. During torrefaction, gaseous species are released, among which volatile species that may be source of green chemicals (Chen W.-H., 2015). The objective of this study is to assess the suitability of valorising through torrefaction 6 underexploited Spanish biowaste and wood samples (two brooms, fern, gorse, heather and oak), which are typically involved in fires in the region of study (Chandrexa de Queixa, Spain). Selected species were harvested and deeply characterized at lab-scale. Solid kinetics and volatile species release were studied in a thermobalance coupled to a GC/MS through a heated storage loop system (TGA-GC/MS). All species presented a high calorific value, as well as similar properties and kinetic behaviour, close to deciduous wood, except fern, close to agricultural biomass (González Martínez et al., 2018). This last material usually grows separately, in wet areas, and its fire risk is considered as low. Consequently, the direct in-situ valorisation of these biomass species seems promising and suitable without separation. The production profiles in torrefaction were studied for 23 chemical compounds released. A direct valorisation of the gaseous mixture is possible, by enhancing the production of the component of interest (such as acetic acid) through the suitable operating conditions, thanks to the obtained lab-scale results in chemical regime. A torrefaction model able to predict solid kinetics in function of the operating conditions was proposed for several biomass families (González Martínez et al., 2020). This model was also validated for predicting solid yield of shrub biowaste and oak in

torrefaction, with an acceptable error margin. The use of this model would facilitate torrefaction mobile unit handling for in-situ valorisation.

Keywords: Torrefaction, Solid mass loss, Shrubs, Oak, Fire risk, Volatile species

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