High Temperature Pyrolysis as a Tool for Energy Recovery: Waste from a Furniture Manufacturing Industry Case Study

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Industrial by-products, which were historically viewed as a burden, can be regarded as a useful resource if treated properly. Our research focalizes on this field by a physical-chemicals characterization of the waste feedstock, high temperature thermal treatment through a proprietary technology developed by a partner start-up company (*Enecolab, Muggia (TS)*) and analysis of the output solids and gases.

The latter is the most interesting product of the pyrolysis process as it can be directly fed to a suitable energy generation system yielding a clean combustion as the main compounds found in the gas phase are hydrogen, methane and carbon monoxide. The solid fraction, which after the treatment often results enriched in carbon, can be employed as an additional energy source *in loco* or supplied to third parties as secondary fuel hence generating an additional revenue while no complex and difficult to process liquid fraction is obtained.

In the case study reported a furniture industry adopted our technology with the aim of reducing its waste disposal cost while generating and energy surplus directly employed in the manufacturing process; a surplus energy per kg of feedstock of about 70% was obtained while halving the mass of the processed waste.

The plant will process 1200 t/yr of waste comprised of dust and off-cuts of lignocellulosic matrix infused with phenolic and melamine resin. The output products were studied first on a lab-scale reactor, where the process was optimized and the main process variables were identified, and consequently on an industrial-scale pilot reactor capable of treating about 20 kg/h of feedstock.

Moreover, since the waste material is derived from biomass the CO_2 produced during combustion of the obtained syngas is carbon-neutral, aiding in reducing the carbon footprint of the facility which relied on the combustion of natural gas in its manufacturing process.

Finally, the research was also focused on the characterization of the char produced by the pyrolysis reaction, assessing if it is suitable for either disposal or as a secondary fuel source, as well as the unwanted by-products, namely particulate matter ad tars, to ensure their efficient removal from the gas stream.

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