LAB-SCALE PYROLYSIS AND HYDROTHERMAL CARBONIZATION OF BIOMASS DIGESTATE: CHARACTERIZATION OF SOLID PRODUCTS

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The aim of the present study is to investigate the production of biochar from anaerobic digestion (AD) digestate. Re-Cord selected digestate from real and representative (regarding the scale and the process technology) anaerobic digestion plant.
The digestate derived from agro-industrial residues and herbaceous biomass, was characterized by proximate and ultimate analysis, determining macroscopic parameters such as moisture content, ash, volatile substances and higher and lower heating value and elemental composition, including ICP analysis.
The sample of digestate was processed by two different thermochemical conversion routes: slow pyrolysis (SP) and hydrothermal carbonization (HTC).
Prior to thermochemical conversion, the sample was dried in an oven at 75°C for 48 hours. Before processing the digestate in the SP reactor in batch mode at 500°C, preliminary batch thermogravimetric analyses (TGA) were carried out, setting the same pilot plant process conditions, in order to investigate the expected solid yield. Char obtained by these experiments was analyzed in terms of elemental composition, specific area and pores diameter (BET analysis) in order to identify the best process condition to be used in the pyrolysis reactor.
Digestate was also tested in a stainless steel micro-HTC reactor in batch mode. HTC, indeed, represents an innovative technology, capable of directly exploiting the digestate high water content. Several experiments were carried out by varying reaction temperature (200-250°C) and residence time (0.5-3 h) in order to evaluate the influence of these parameters on the characteristics of the char and on the product yield.
The products obtained from the slow pyrolysis and hydrothermal carbonization of digestate were characterized and compared each other in terms of ultimate, proximate and BET analysis. In addition, other specific analyses were carried out, comparing the obtained char with the current Italian and international product standards in order to assess their potential commercialization and limits.
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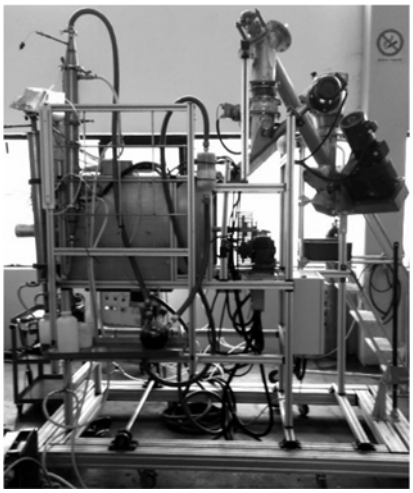

Figure 1 – RE-CORD pyrolysis reactor

Figure 2 – RE-CORD micro-HTC reactor