PERFORMANCE OF AN AUGER REACTOR FOR BIO-OIL PRODUCTION FROM CONTAMINATED BIOMASS

D.Amato*, P. Giudicianni*, C.M. Grottola*, R. Ragucci*
davide.amato@stems.cnr.it
**Institute of Sciences and Technologies for Sustainable Energy and Mobility (STEMS), National Research Council (CNR), Naples, Italy*

Abstract
CERESiS European project aims to develop, assess and validate integrated biofuel production pathways linking land decontamination to appropriate bioenergy crops and environmentally and economically efficient advanced biofuel production. The thermochemical process considered for the production of biofuels and key biofuel precursors from contaminated biomasses is Fast/Intermediate Pyrolysis (FP/IP).
The optimal ranges of operating conditions were properly tuned to take into account the presence of Potentially Toxic Elements (PTE) in the feedstock. Solid residence time and carrier gas flow rate have been selected as key influential parameters since, they greatly affect not only the liquid yield and quality but also the distribution of PTE, especially Heavy Metals (HM) in the three pyrolysis products (char, bio-oil and gas). The process conditions were optimized with the aim of reducing as much as possible the translocation of HM in the liquid product in such a way as to facilitate the subsequent purification process. With this in mind, a screw reactor was preferred to other pyrolysis technologies operating under fast pyrolysis conditions. This choice shifted the pyrolysis conditions from fast to intermediate (100-500 °C/min), thus penalizing the liquid yield. Nevertheless, in the presence of heavy metals, a compromise had to be pursued between maximizing liquid yield and minimizing solids elutriation phenomena.
The reactor configuration was changed several times during the project to achieve the desired pyrolysis temperature; the final configuration was then used to test the effect of the other operational parameters (solid residence time and nitrogen flow rate) and identify the optimal operating conditions.
The optimized system was then employed to test several contaminated biomasses. The system was able to convert all the considered biomasses, both woody and herbaceous, obtaining moderate variability in pyrolysis products yields and bio-oil composition. This confirms that the designed system, based on an auger reactor, is a robust pyrolysis system; the quality of the produced bio-oil could be further improved by optimizing also the condensation section of the pyrolysis system.