A NOVEL SOLUTION FOR UTILIZING LIQUID FRACTIONS FROM SLOW PYROLYSIS AND HYDROTHERMAL CARBONIZATION – ACIDIFICATION OF ANIMAL SLURRY

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Pyrolysis and hydrothermal carbonization (HTC) have recently gained much interest in the field of biomass processing. This is due to the process flexibility with respect to raw materials and the range of potential applications proposed for the end products. In addition to the main product, biochar, the processes yield a liquid fraction that has turned out to be challenging to productize. Considering the feasibility of the thermochemical conversion technologies, it is crucial that all the produced fractions can be utilized reasonably and no waste fractions expensive to dispose remain. In spite of active research and development work, unambiguous uses for the liquid fractions have not been recognized yet.

The liquid fractions derived at low pyrolysis temperature regime (< 280 ºC) contain weak organic acids while liquids derived at higher temperatures contain more tar compounds. We investigated whether the acidic liquid fraction derived from slow pyrolysis and HTC processes could replace the strong synthetic acids in animal slurry acidification (Keskinen et al. 2017). Slurry acidification is a growing agriculture-related technology aiming to reduce adverse environmental and health effects arising from gaseous emissions of ammonia (NH_3). By reducing the slurry pH to 6.0-5.5, these emissions can be minimized. Presently, strong sulfuric acid is used for the purpose but risks of safety are involved in its use.

We compared the slurry acidification potential of liquids obtained from pyrolysis of Scots pine bark, Scots pine forest residue, wheat straw and willow (*Salix*) at temperature below 280 ºC, and the liquid from HTC of willow. The total acidity of pyrolysis liquids varied between 850 and 2560 meq l^{-1} depending on the biomass. The acidity of the HTC liquid (220 meq l^{-1}) was markedly lower than the corresponding value even in the weakest of the pyrolysis liquids. Greatest potential for practical use was found in the liquid derived from pyrolysis of willow. Its required application rate for decreasing the pH of pig and cattle slurries from >7.5 to 6.0 was 20–50 l t^{-1}, which is about 20-fold compared to the application rate of sulfuric acid. In conclusion, the acidic liquid fraction from pyrolysis processes shows promise in use for slurry acidification. However, its feasibility and economic performance in different practical environments still needs to be studied in more detail.

References:
Keskinen, R., Hyväluoma, J., Wikberg, H., Källi, A., Salo, T. & Rasa, K. 2017. Possibilities of Using Liquids from Slow Pyrolysis and Hydrothermal Carbonization in Acidification of Animal Slurry. Waste and Biomass Valorization. In press. DOI 10.1007/s12649-017-9910-4