WET OXIDATION AS AN ENABELING TECHNOLOGY FOR HYDRTHERMAL LIQUEFACTION

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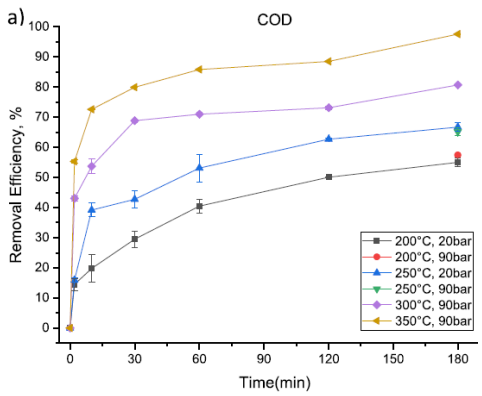

FIGURE 1 – ARIAL 10 PT ITALICS

One of the main bottlenecks of the HTL technology has been the large amounts of process water which are produced during the biocrude production process. As HTL is typically operated at 20 wt% solids loading, there are around 10 m^3 of wastewater produced per ton of biocrude. The process water is high in organic loading (>30 g/L COD) and recalcitrant or inhibitory to many biological processes such as anaerobic digestion or conventional aerobic wastewater treatment. In the current contribution we introduce the possibility of wet oxidation of the HTL process water as a beneficial method to tackle the process water challenge. Wet oxidation is a relatively established technology to oxidize organic compounds in wastewater, often employed when biological processes are not suitable. Air or oxygen is introduced to an aqueous process stream under pressure and heat at conditions similar to the HTL conditions to ixidise all organics to CO_2.

In the current work we have initially tested HTL process waters from the liquefaction of sewage sludge to screen wet oxidation process conditions in batch reactors using bottled oxygen. Subsequently a continuous reactor is employed where compressed air is introduced to the reactor using a compressor. The removal of COD and other investigated parameters are comparable in batch and continuous conditions. We investigated the fate of organics using GC-FID and GC-MS and found that the majority of organic carbon is initially converted to acetic acid and other volatile fatty acids. Only at the most severe conditions is acetic acid converted further to CO_2. The wet oxidation process is exothermic and the data presented herein suggests that more than enough heat is produced in the process to power both the wet-oxidation and the HTL process. These underlying calculations and opportunities for process integration are presented. Essentially the wet-oxidation integration to the HTL process solves the process water challenge, can produce a valuable source of volatile organic acids, provides the heat for both reactions and creates a relatively pure CO_2 stream. All of these opportunities have led to the establishment of a new major Horizon Europe research project which started in January 2023 called CIRCULAIR and will last for the next 4 years. The aim is, in addition of optimizing the integrating HTL and wet-ox, the production of sustainable aviation fuels and also capturing the CO_2 from the HTL and Wet-OX process to produce methanol in a power-2-x concept where the H_2 is provided from electrolysis. The oxygen from electrolysis can then be used to intensify the wet-oxidation process. In the current presentation this new EU project, the concept, objectives and partners will be introduced as well as on-going experimental work on the integration of the HTL and wet-oxidation process.