

Project Scissors

1. Public Summary

Society is increasingly aware of the scarcity of natural resources, as well as the effects of climate change. This has strengthened the quest for processes that enable the reuse of materials and reduce GHG emissions.

Wet residual streams remain difficult and/or energy intensive to process or even impossible to process. Incineration or simply landfill is the present solution available but requires a lot of extra energy and subsequent produces large additional emissions, due to the wet nature of these streams. Many wet residual waste streams can be identified with a great diversity of origin ranging from agricultural waste, domestic sewage to industrial flush waste streams. Valuable components and materials are lost or can only be converted into electricity of which storage is very difficult or costly.

SCW Systems has developed a technology using Super Critical Water gasification (SCWG) treatment that offers the opportunity to address the mentioned issues in a more efficient and circular way, in a CO₂ - neutral way and retaining their building blocks including the water. In the SCW technology, water is an essential part of the reaction mixture, hence wet waste streams are advantaged. Dow Benelux has identified the SCW technology to have the potential to treat some industrial waste streams in an advanced and environmentally friendly way. The SPT group of Twente University is a group specialized in process technology and has experience to perform Live Cycle Analysis (LCA). In this project, these 3 partners had the objective to investigate the potential to treat several industrial waste streams from Dow Benelux in Super Critical Water Gasification (SCWG) and convert it into valuable products in an environmentally advanced and sustainable process.

Within this project, six types of industrial streams from Dow Terneuzen were selected to perform supercritical gasification tests. Each of the selected streams were evaluated by the New Stream Evaluation protocol of SCW Systems. This protocol evaluates the possibility to treat waste streams in the SCWG technology. The evaluation showed that four of those streams pass this test and were gasified under supercritical water conditions without special pretreatment. Two streams that contain a certain solid fraction need a pre-treatment step before they meet the requirements for SCWG.

As part of this project, a new SCW gasification bench scale plant and a new pretreatment unit were assembled and tested. About 120 SCW gasification experiments studying different gasification conditions (Temperature, Residence Time, Concentration, Blend concentrations) were performed. The outcome of the mentioned experiments is that the SCW gasification technology is validated and demonstrated on an IO level for all analyzed streams.

Based on the results of the analyzed streams, an interactive LCA data analysis was executed. Results gave insight into the differences on the impact for the environment, with focus on the CO₂ footprint. The LCA proves that the technology is able to process those specific wet streams in a sustainable technology with reduced CO₂ footprint compared to conventional waste handling techniques (incineration).

From these results, it is concluded that the project reached the objective to process the evaluated streams and convert them into valuable products that can be re-used. This data will be used to make the decision on the full-scale commercial processing of the evaluated waste streams.

The project is intended to act as the precursor for a more elaborate program towards a much wider application field in areas of other defined wet waste streams. This is in full alignment with the objective of TKI-E&I through CO₂ reduction, electrification, and circular economy.

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