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Hydrothermal liquefaction of kitchen waste and digested sludge

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Hydrothermal liquefaction (HTL) is the thermochemical process which accept moisture in the substrate up to 99%. As a substrate we choose kitchen waste (KW) and digested sludge (DS) from the wastewater treatment plant. The aim of this study was to determine the yield and properties of products from HTL of KW and DS. The process was carried out in a pressure reactor (4563M, Parr) and control unit (4842, Parr). The temperature of the reactor during HTL was equal to 285°C, with a residence time of 3.5 hours. The working volume of the reactor was equal to 0.4 dm³. Dry matter content of the KW and DS was 10.0% and 3.1%, respectively. After the process, the reactor was rapidly cooled down and the gas fraction was analysed. The solid fraction was separated from the liquid fraction by filtration. The quantity and composition of the solid and liquid fractions were also analysed.

Based on the results, we observed that the yield production of hydrochar from KW and DS was equal to 34.8 and 46.2%, respectively. The higher yield production of hydrochar from DS was due to the fact that DS contained 36.8% d.b. (dry basis) ash. In comparison, KW contains only 4.25% d.b. ash. The higher heating value (HHV) of KW was equal to 28.9 MJ/kg d.b., and was three times higher than that of DS. Yield production of the liquid fraction was 58.9 and 51.1% for KW and DS, respectively. The pH value after HTL was equal to 4.82 for KW and 8.34 for DS. The low pH was caused by the high content of acetic acid (4.55 g/L) in the liquid phase after HTL of KW. Total organic carbon (TOC) in the liquid fraction after HTL of KW and DS was 10.6 and 4.16 g/L, respectively. Analysis of volatile organic compounds (VOCs) in the liquid fraction using a GC/MS system detected 65 and 52 compounds after HTL of KW and DS, respectively. The gas production yield during HTL of KW and DS was 6.29 and 2.72%, respectively.

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