Hydrothermal oxidation as a promising technology for the removal of sewage sludge

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Abstract

Over the last few years, there has been a significant increase in the interest on environmental issues and on proper sustainable development and circular economy. Along these lines, the sludge management from urban or industrial wastewater treatment plants is one of the most complex challenges associated with wastewater management. The need to develop economically viable technologies to tackle this problem is essential. The European Union is promoting the elimination, stabilisation or reuse of these sludges. Hydrothermal oxidation emerges as a promising technology, not only in the technical aspect, but also as an economically feasible option. It is therefore ready to be implemented on an industrial scale for the treatment of these types of waste. Urban sludge contains everything from microorganisms and pathogens to toxic compounds and emerging pollutants.

The technology proposes to maintain the liquid phase of the sludge and to use pure oxygen at high pressure and temperature (pressure and temperatures above 200 bar and 300ºC, respectively), so that the C-C bonds of these molecules are destroyed [1], obtaining easily biodegradable low molecular weight molecules, such as short chain fatty acids (mainly acetic acid), CO_2 and H_2O, as it is shown in Figure 1.

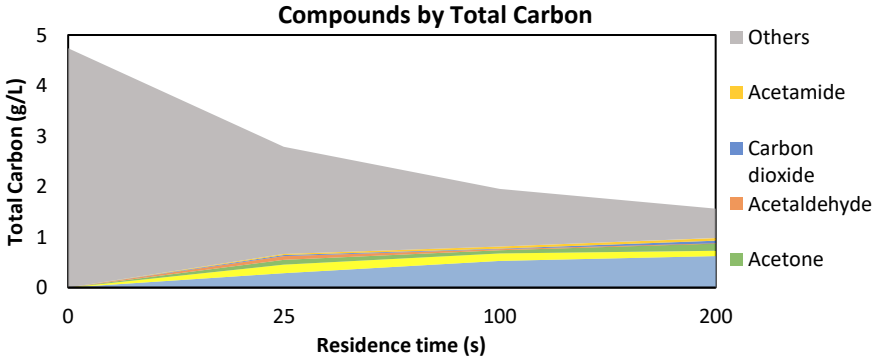

Figure 1. Compounds evolution based on total carbon.

Figure 2. Initial sludge vs treated sludge

However, this process requires in-depth research due to the high costs involved in scaling up and implementing a novel technology. The various effects of mass transfer, oxygen solubility, temperature, pressure, oxygen flow, residence time, as well as empirical kinetics have been analysed in the present study. In Figure 2, the difference between the original sludge (left) and the treated sludge (right) is shown as an example, in just a few minutes of reaction.

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