



Fate of Organic Micropollutants during Hydrothermal Carbonization

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The hydrothermal carbonization (HTC) is an exothermic process, in which biomass in an aqueous suspension is transformed into a bituminous coal-like material (hydrochar) at temperatures between 180-250°C and under moderate pressure. With these process conditions, little gas is generated (1-5%), and a fraction of the organic carbon is dissolved in the aqueous phase (10-30%) but the largest part is obtained as solid char. The respective yields and the molecular composition depend on the choice of educts and the process conditions, such as temperature, pH-value, and reaction time. Various biomass-educts have recently been studied, such as waste materials from agriculture, brewer's spent grains, sewage sludge, as well as wood and paper materials. Besides their use for energy generation, the hydrochars have also been investigated as soil amendments. Prior to addition of the chars to soil, these should be free of toxic components that could be released into the environment as harmful organic pollutants.

Herein, the potential for the degradation of trace organic pollutants, such as pesticides and pharmaceuticals, under typical HTC conditions will be presented. The degradation of selected organic pollutants with different polarity and hydrophobicity was investigated. Scope and limitations of the degradation potential of the HTC are discussed on examples of micro pollutants such as hormones, residues of pharmaceuticals and personal care products including their metabolites, and pesticides. We will show that the target analytes are partially and in some cases completely degraded. The degree of degradation depends on the HTC process conditions such as reaction temperature and time, the solution pH value, the presence of catalysts or additional reagents.

The biotic and abiotic degradation of chlorinated organic compounds, in particular chlorinated aromatics, has been a well-known environmental problem and remains a challenging issue for the development of a HTC process for contaminated biomass. Chlorinated aromatic compounds are not fully degraded during HTC. Therefore, the addition of catalysts and reagents for a possible reduction has been studied. Zero-valent environmentally acceptable metals, such as Fe or Si, are presented as potential additives for the dechlorination of chloronaphthalene as a representative of chloroaromatics.

Furthermore, when using municipal household waste, such as the 'organic' bin, or gardening greens as biomass educts, these materials often contain traces of synthetic plastics, which can lead to problems during waste incineration. Initial studies on the fate of synthetic polymers will also be presented.