Geophysical Research Abstracts
Vol. 16, EGU2014-6428, 2014
EGU General Assembly 2014

The potential of the aquatic water fern Azolla within a biobased economy

Klaas G.J. Nierop (1), Anna L. Jongerius (1,2), Peter K. Bijl (3), Pieter C.A. Bruijnincx (2), Robertus J.M. Klein Gebbink (4), Gert-Jan Reichart (1,5)

(1) Organic Geochemistry, Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, The Netherlands, (2) Inorganic Chemistry & Catalysis, Department of Chemistry, Faculty of Science, Utrecht University, Universiteitsweg 99, 3584 CG Utrecht, The Netherlands, (3) LPP Foundation, Laboratory of Palaeobotany and Palynology, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, The Netherlands, (4) Organic Chemistry and Catalysis, Department of Chemistry, Faculty of Science, Utrecht University, Universiteitsweg 99, 3584 CG Utrecht, The Netherlands, (5) Department of Marine Geology and Chemical Oceanography, Royal Netherlands Institute for Sea Research (NIOZ), P.O. Box 59, 1790 AB Den Burg, The Netherlands

Azolla is a free-floating freshwater fern capable of fixing atmospheric carbon dioxide and nitrogen, the latter of which through its symbiosis with the cyanobacteria Anabaena azollae. It is currently ranked among the fastest growing plants on Earth and occurs in both tropical and temperate freshwater ecosystems. Therefore, it is non-directly competitive with food crops. In addition, Azolla does not require inorganic fertilizers, which makes it a potential and unique source of biomass for the sustainable production of fuels and chemicals that are currently derived from fossil (fuel) sources. The biochemical composition of Azolla allows the production of biofuel or biobased chemicals that are of interest to the chemical industry. Of Azolla, two extractable groups of compounds are of particular interest, i.e. the polyphenols (condensed tannins and ester-bound caffeic acid) and the lipids.
The antioxidant property of polyphenols and their application to the treatment of cancer, diabetes and cardiovascular diseases has further contributed to the growth of the polyphenol market. In addition, they can be chemically transformed into aromatic platform and specialty chemicals.
The composition of the lipid fraction of Azolla is characterized by highly specific compounds consisting of C26-C36 carbon chains all bearing a ω20-hydroxy group. Such compounds produce an oil fraction upon hydrous pyrolysis, or, alternatively, are well suited to be converted to e.g. various specialty chemicals that are hardly available from both natural sources. Indeed, upon chemical conversion these lipids may yield components for fuels, plastics, cosmetics, and lubricants. Another group of interesting compounds within the lipid group are the polyunsaturated fatty acids (PUFAs). The demand for PUFAs has witnessed a significant increase over the last three years, particularly due to their benefits as cholesterol lowering agents. Here we will present some of the thermal and chemical conversions of the Azolla-derived biochemicals to show the potential of this crop to produce both commonly used components and promising new ones.