

Electrochemical Degradation of Lignin at Different
Electrode Materials

D. Schmitt, Dr. C. Regenbrecht, Prof. Dr. S. R.
Waldvogel

University of Mainz
Duesbergweg 10-14, 55128 Mainz, Germany

The biopolymer lignin (see **Figure 1**) occurs as a waste material of the pulping industry, on a megaton scale.^[1] It is also one of the largest natural sources of aromatic compounds.^[2] But due to its complex molecular structure the desired components are difficult to obtain. In the past, different chemical procedures were developed to extract these valuable fine chemicals by degradation.^[3,4]

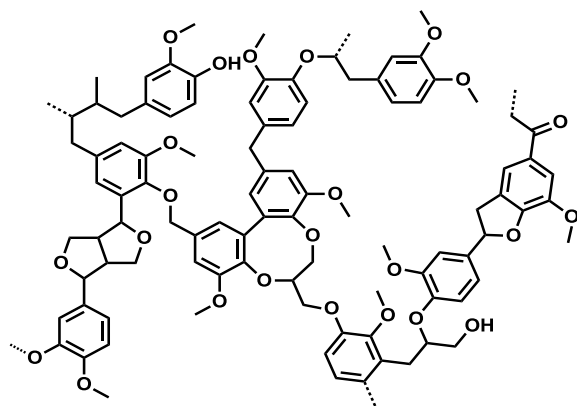


Figure 1: Possible cut-out of the molecular structure of lignin.

The broad variety of by-products based on the non-selectivity of these reactions limits the use of the obtained chemicals as food additives or as precursors for pharmaceutical applications. Electrochemical conversion of lignin offers another promising way to unlock this source. However, high temperatures and strongly basic conditions which were necessary in the past are very disadvantageous from an economical point of view.^[5]

We developed a protocol that allows an electrochemical degradation of lignin under mild conditions with high selectivity to the desired aromatic compounds. In particular the choice of the electrode material has a tremendous effect on yield and selectivity of the process and is the major focus of our study.

In the presentation we will report a strategy to remove the desired but oxidation labile product in time. This allows a repetitive electrolysis protocol.

References:

- [1] R. Ulber, D. Sell, T. Hirth (Eds.) *Renewable raw materials. New feedstocks for the chemical industry*, Wiley-VCH, Weinheim, **2011**.
- [2] J. Zakzeski, P. C. A. Bruijninx, A. L. Jongerius, B. M. Weckhuysen, *Chem. Rev.* **2010**, *110*, 3552–3599.
- [3] K. Lundquist, in *Methods in Lignin Chemistry* (Eds.:S. Y. Lin, C. W. Dence), Springer-Verlag, Berlin Heidelberg, **1992**, p. 291.
- [4] W. Partenheimer, *Adv. Synth. Catal.* **2009**, *351*, 456-466.
- [5] C. Z. Smith, J. H. P. Utley, J. K. Hammond, *J. Appl. Electrochem.* **2011**, *41*, 363-375.