

**15-Crown-5, an “impossible” compound derived from partially  
biodegraded lignin by *E. Coli* BL21(Lacc) and detected by GC-MS**

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## Abstract

**Background:** Due to its recalcitrance and complex molecular structure, the valorization of lignin still represents a challenge. Nowadays, millions of tons of lignin are burned to use its heat for electricity production and to improve the thermal efficiency in paper pulping and lignocellulosic ethanol industries. At the same time the molecular constitution of lignin opens many possibilities in its use as food flavorings, substrates for the synthesis of plastics, biofuels and others. Some analytical methods, as is the case of the gas chromatography-mass spectrometry (GC-MS) have shown important percentages of the final compounds that can be considered as “intermediates”.

**Results:** In this study we proposed an alternative, and simple, methodology for lignin partial biodegradation for 48 hours by using different concentrations of water and black liquor under different treatments, including the use of *E. Coli* BL21(Lacc) as ligninolytic bacterial strain, 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) as mediator and hydrogen peroxide as co-substrate, which have led to the identification of 15-crown-5, with a maximum probability of 64%, and a maximum abundance of 25.35% under different reaction conditions. The detection of 15-crown-5 is alternated with ethanol, 2-[2-(ethenyloxy)ethoxy] with similar percentages of abundance and probabilities of occurrence, which have a molecular structure that suggests that this compound could be a precursor of the first one under polymerization reactions.

**Conclusions:** GC-MS analysis method has some advantages for the identification of compounds in lignin under a probabilistic basis, suggesting the presence of 15-crown-5, which in the context of lignin valorization could be considered as an “impossible compound”. The presence of reactive functional groups in lignin opens the possibility to explore novel strategies for lignin treatment and valorization under the biorefinery approach.

**Keywords:** 15-Crown-5, lignin valorization, *E.coli* BL21(Lacc), polymerization, isomerization.