

## Understanding the Production and Stability of Aldehydes through the Catalytic Oxidation of Native Lignin to Phenolic Monomers

Maria Martinez\*

Department of Chemistry, Stockholm University, Stockholm, Sweden

\*Corresponding author: Maria Martinez, Department of Chemistry, Stockholm University, Stockholm, Sweden; E-mail: Martinez23@yahoo.com

**Received:** November 24, 2022, Manuscript No. TSOC-22-81054; **Editor assigned:** November 28, 2022, PreQC No. TSOC-22-81054 (PQ); **Reviewed:** December 12, 2022, QC No. TSOC-22-81054; **Revised:** February 24, 2023, Manuscript No. TSOC-22-81054 (R); **Published:** March 03, 2023, DOI: 10.37532/0974-7516.2023.17(1).004

### Abstract

Although the catalytic oxidation of lignin to produce phenolic monomers with aldehydes as the primary products is highly appealing, the yield of desired monomers is still only moderate. The purpose of this research is to examine the reaction mechanism for lignin to aldehyde conversion and aldehyde stabilization in alkaline media. Studies on the stability of pure aldehydes have shown that condensation and over oxidation to carboxylic acids are the main causes of low yield. Real lignin was depolymerized utilizing a chemical protection approach and the theoretical maximum monomer production was attained in 30 minutes at 160°C using aniline as the capping agent.

**Keywords:** *Organozides; Photoredox catalysis; Lithium alkylamides; Dehydrogenative; Tetrasubstituted alkenes*

### Description

The most prevalent renewable resource in nature is lignin, which is made up of aromatic units (p coumaryl alcohol (H), coniferyl alcohol (G) and sinapyl alcohol (S)). Lignin is a viable candidate raw material for aromatic compounds due to its chemical makeup. However, lignin depolymerization is incredibly difficult due to the three dimensional structure and great stability of lignin linkages (such as -O-4, -, and -1). In reality, the pulp and paper sector burns almost 98% of lignin, which is a significant waste. Given that lignin makes about 10%-35% of the weight and up to 40% of the energy in biomass, producing industrial chemicals from it will significantly improve the process profitability. Pyrolysis acid or alkali hydrolysis reduction or oxidations have all been devised to valorize this complicated polymer to yield value added phenolic compounds. Lignin oxidation has a number of significant advantages from the perspective of process economics, including the need for moderate temperatures and pressures and the production of important platform chemicals with extra functional groups.

For the oxidative depolymerization of lignin into phenols like vanillin and syringaldehyde, it is extremely promising. These phenolic compounds can be utilized as intermediates to synthesis other fine chemicals of industrial value and are widely used in the fragrance, cosmetic, food, and pharmaceutical industries. The maximum yields of oxidative products from lignin have been reported to be around 10%-15%, whereas the average yields of compounds containing vanillin are in the range of 3 wt%-5 wt%. The difficulty of depolymerization and the volatility of the target phenolic monomers can be blamed for the low product yield. On the one hand, selective depolymerization is quite difficult since natural lignin has strong interunit C-C linkages. The productions of phenolic compounds as well as the cleavage of C-C or C-O lignin links are made easier by an appropriate catalyst. It has been extensively researched to depolymerize lignin with oxygen utilizing homogeneous metal ions and heterogeneous metal oxides as catalysts. However, due to several, yet poorly understood secondary reaction processes, highly functionalized monomers are unstable under oxidative circumstances. This is yet another significant factor in the low yield of monomer derived products. Therefore, it is important to assess how the primary products behave in oxidative environments. Finding a workable solution to stabilize and improve the yield of desired products should be substantially aided by a thorough understanding of the factors that cause the instability of the target goods. To learn more about the production process and stability of aldehydes when natural corn Stover lignin is oxidized over a copper catalyst Density Functional Theory (DFT) simulations and intermediate

**Citation:** Martinez M. Understanding the Production and Stability of Aldehydes through the Catalytic Oxidation of Native Lignin to Phenolic Monomers. *Org Chem Ind J.* 2023;17(1):004.

© 2023 Trade Science Inc.

experiments were used to study the production pathway of aldehydes. To comprehend the mechanisms that cause the primary products to degrade, the stability of aldehydes was examined. In an effort to increase the yield of valuable products, a novel stabilizing technique was lastly suggested and applied to the oxidative conversion of genuine lignin. According to our findings, which focused on the synthesis and stabilization of aldehydes, the monomer products produced by the oxidation of native lignin are the outcome of a delicate balance between depolymerization and over oxidation (and/or condensation).

We suggest that the lignin O-4 linkage proceeds through hydroxyl oxidation and then quickly breaks down the retro aldol C-C to generate aldehydes. Pure aldehyde reactions demonstrated that condensation and over oxidation to carboxylic acids are the main causes of low yield. Most crucially, the oxidative depolymerization of actual lignin was successfully accomplished using the chemical protection approach, raising the monomer yield to nearly the theoretical maximum yield.