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## On the use of unconventional methods for the catalytic oxidative cleavage of lignin by dioxygen

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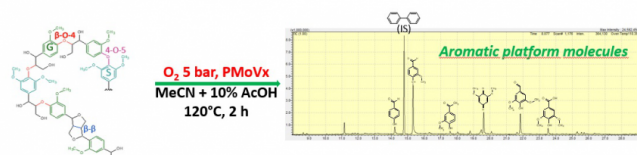
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### PURPOSE OF THE ABSTRACT

Nowadays, the production of aromatic compounds depends on oil, a fossil fuel whose resources are depleting. Among biomass, lignin is the only polymer with an aromatic backbone. That is the reason why, there has been growing interest in the utilization of this bio-resource as a sustainable and renewable feedstock for aromatic compounds [1, 2]. The aim of this work is to develop a catalytic oxidative cleavage of lignin by dioxygen using unconventional methods such as ball-milling and ultrasonic cavitation. The considered catalysts are vanadium-substituted Keggin phosphomolybdic acids with tunable vanadium contents [3]. Usually, these materials are prepared through the hydrothermal attack of MoO<sub>3</sub> and V<sub>2</sub>O<sub>5</sub> oxides [4]. Here, this step was preceded by the synthesis of a mixed oxide by a ball-milling procedure [5]. After characterization by XRD, <sup>31</sup>P NMR and XRF, they were assessed for the C-C cleavage of two lignin models, 2-phenoxy-acetophenone (K1HH) and 2-phenoxy-1-phenylethanol (A1HH) in acetonitrile acidified by acetic acid (10 vol.%) under atmospheric O<sub>2</sub> (82°C, 24 h). The main products, benzaldehyde, benzoic acid and phenol were quantified by HPLC. Vanadium has a positive influence on lignin model conversion and C-C cleavage. The catalysts synthesized through ball milling proved to be more active for C-C cleavage in K1HH. A1HH model, which has a structure closer to lignin than K1HH, was found to be more resistant to oxidation than the ketone model, and side products, such as the acetic ester of A1HH, were formed. Consequently, the cleavage of A1HH under more severe conditions (O<sub>2</sub> 5 bar, 120°C) was assayed affording improved conversions while keeping a rather good carbon balance. This has inspired the operative conditions of preliminary tests carried out on an Organosolv wheat straw lignin. We are working presently on the use of sonochemical intensification in order to boost the reactivity of A1HH and then lignin towards oxidation under O<sub>2</sub>.

## FIGURES



**FIGURE 1**

Figure 1

Platform molecules from lignin oxidation with dioxygen

**FIGURE 2**

## KEYWORDS

Biomass | Dioxygen | Ball-milling | Catalysis

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