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Bio-oil refineries: Challenges and opportunities

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Biomass derived pyrolysis oils are complex mixtures of hundreds of compounds. These oils typically contain water (19-26 wt.%), GC/MS detectable volatile compounds (30 wt.%), lignin derived oligomers (15-23 wt.%) and water soluble (WS) compounds (28-36 wt.%). The nature of the WS oligomers is still poorly known. In this presentation, we will discuss two strategies to describe the bio-oil composition in terms that can be used for engineering design. The first approach is formalization of the bio-oils' composition in terms of functional groups; the second describes bio-oils' composition in families based on their volatility behavior in thermogravimetric analyses. The chemical composition of the WS fraction is described in detail. Our FT-ICR-MS and UV-Fluorescence studies allowed us to identify the presence of two new fractions: Dehydrated sugars and WS oligomeric phenols. Here we will discuss the advances made by our group on the evaluation of bio-oil new separation schemes and on the development of new products from bio-oil fractions. The combination of these separation schemes with technologies to obtain high value products is foundation for the synthesis of new bio-refinery concepts. We will address several potential bio-refinery concepts, their challenges and opportunities.

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