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Summary of the Project (540 words)

The global community is searching for more sustainable processes, and this perspective tends to be more evident in a post-pandemic world, mainly focused on the reduction of carbon emissions by the industries. Industrial lines adopting biorefinery concepts are well accepted since they highlight the strategies related to a bioeconomy. Usually, they propose the use of renewable materials as an energy source and the obtainment of chemicals from biomasses, promoting less management of fossil sources.

Following the global tendency of the market, the forestry sector has been researched for better ways to manage its residues, transforming them into byproducts and increasing the sustainability. One of the most efficient ways to improve the uses of biomass is by applying a fast-pyrolysis conversion, and generating a liquid fraction commonly known as bio-oil. This bio-oil concentrates a complex composition of chemicals produced during the wood thermal degradation.

Among the methods applied to improve the bio-oil routes based on a biorefinery platform, the separation of chemicals by physicomechanical fractionation has been presented as an advantageous alternative. This method is a simple way to separate the fractions according to their polarity, generating two chemically distinct

phases. It consists in adding slowly the bio-oil to cold water under vigorous agitation. The non-polar fraction generated in this process concentrates the chemicals from the thermal degradation of lignin, while the polar fraction presents the chemicals mainly originated from carbohydrates. The non-polar fraction – also called pyrolytic lignin – has well-known applications, such as the production of resins and binders. On the contrary, the water-soluble fraction generated during the pyrolytic lignin extraction still is a byproduct without well-defined high added value applications compared to the one.

This proposal aims to adopt the concepts of biorefinery for the separation and purification of high added value chemical compounds presented in the polar fraction of bio-oil generated during the pyrolytic lignin extraction. One of the focuses of this project is the separation and purification of levoglucosan, but we also will be interested to recover phenolic compounds.

Firstly, the method of physical fractionation under vigorous agitation adopted here followed by sequential protocols using adsorbent resins have proportionated the separation of chemicals, such as levoglucosan and phenolics like catechol and vanillin.

The protocol developed here considers the chemical affinity between the chemicals and adsorbents, which result in interesting routes to obtain polar fractions rich in high added-value chemicals. In addition to the demands of the company that financially supports this research – Suzano S.A. - this bio-oil may be used to improve the value of the productive chain since it contains other interesting chemicals like

ketones and aldehydes used in the food industry, for instance, representing flexibility regarding the markets.

This Ph.D. project is under development and aims to use a more sustainable process with less amount of carbon emission in the environment. This will result in better efficiency of the forestry sector due to the full use of the wood biomass, and the availability of renewable products with great interest in global chain. Thus, among the indirect and direct possibilities, we highlight the relation of the scope of this project with the following UN SDFs:

Goal 7: Affordable and clean energy.

Goal 9: Industry, Innovation, and infrastructure.

Goal 12: Responsible consumption and production.

Goal 13: Climate action.