MWP – Young Researcher Abstract 2025

Project title: Ozonolysis of lignin nanoparticles	
Author: Alexandros Efraim Alexakis	
Affiliation: Stockholm University	**E-mail:** alexandros.alexakis@su.se
Abstract (approx. 200 words)**:** Lignin is increasingly in the spotlight as a renewable resource for high-value materials that enhance forest resource utilization and sustainability. Among its promising applications, lignin nanoparticles (LNPs) have gained significant interest in packaging, coatings, and composites. However, while their functional properties and chemical robustness, especially when crosslinked, make them ideal for demanding environments, their end-of-life has been largely overlooked. This raises environmental concerns, particularly the risk of persistent nano- or microplastics. My research addresses this critical gap by investigating the oxidative degradation of both regular and crosslinked LNPs via ozonolysis. I demonstrate that these particles undergo similar degradation pathways, breaking down aromatic structures into smaller, more manageable molecules such as muconic acid derivatives. These findings lay the groundwork for the rational design of LNPs that balance durability with controlled degradability. Looking ahead, my vision is to explore mild ozonolysis as a sustainable modification strategy, enabling recyclable lignin-based nanomaterials that align with circular economy principles and advance the forest industry's contribution to a greener, more resource-efficient future.	
Key words: Lignin, nanoparticles, ozone, oxidation, degradation	