

## MWP – Young Researcher Abstract 2025

<b>Project title:</b> Towards the development of multifunctional and structurally-colored materials based on cellulose derivatives	
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<b>Abstract</b> (approx. 200 words): Dyed textiles and plastics fill our world with bright colors but the hazardous chemicals that give these objects striking hues are pollutive and responsible for 20% of industrial wastewater. Moreover, absorption-based colorants do not add functionality beyond color. My work counteracts multiple environmental challenges associated with industrial dyes by developing sustainable cellulosic platforms to replace colorants and monitor ambient conditions. Natural organisms create iridescent, adaptive appearances via structural color, a phenomenon where periodic nano-features interact with light to reflect bright hues. Cellulose ethers self-assemble into structurally-colored phases, so I focus on harnessing these bio-based and non-toxic constituents for multifunctional, colorful, and dye-free materials. I characterize how processing kinetics influence the color of solid films and fibers, unraveling fundamental scientific knowledge necessary to realize scalable manufacturing. By adjusting the composition of the cellulosic composites, I unlock dynamic optical properties unlike those of petroleum-derived dyed materials. Additionally, I incorporate electrically-conductive and photoactive components to create colorimetric sensors responsive to different chemical or light conditions, like those in contaminated wastewater. I connect these optical properties back to the underlying structures to facilitate rational design of structurally-colored and responsive cellulose-based materials.	
<b>Key words:</b> Cellulose, structural color, colorimetric	