

## **Effect of TEMPO-oxidization and rapid cooling on thermo-structural properties of nanocellulose**

### **ABSTRACT**

Recently, surface functionality and thermal property of the green nanomaterials have received wide attention in numerous applications. In this study, microcrystalline cellulose (MCC) was used to prepare the nanocrystalline celluloses (NCCs) using acid hydrolysis method. The NCCs was treated with TEMPO [(2,2,6,6-tetramethylpiperidin-1-yl)oxy radical]-oxidation to prepare TEMPO-oxidized NCCs. Cellulose nanofibrils (CNFs) also prepared from MCC using TEMPO-oxidation. The effects of rapid cooling and chemical treatments on the thermo-structural property studies of the prepared nanocelluloses were investigated through FTIR, thermogravimetric analysis-derivative thermogravimetric (TGA-DTG), and XRD. A posteriori knowledge of the FTIR and TGA-DTG analysis revealed that the rapid cooling treatment enhanced the hydrogen bond energy and thermal stability of the TEMPO-oxidized NCC compared to other nanocelluloses. XRD analysis exhibits the effect of rapid cooling on pseudo 2I helical conformation. This was the first investigation performed on the effect of rapid cooling on structural properties of the nanocellulose.

**Keyword:** Nanocellulose; TEMPO-oxidation; Rapid cooling; Thermal stability; Hydrogen bond energy; TGA-DTG