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# Mechanical property enhanced ultra-high molecular weight polypropylene by compounding modified cellulose

**Ju-Hong Lee, Jae-Ryong Lee, Won-Bin Lim, Jin-Gyu Min, Ha-Song Bong, Min-Ju Kim, Sang-Wook Byun, Seoung-Ho Kim, PilHo Huh* and Ji-Hong Bae***

*Department of Polymer Science and Engineering, Pusan National University, Busan 46241, Korea*

**** pilho.huh@pusan.ac.kr***

## ABSTRACT

**For the mechanical strength and low specific gravity of ultra-high molecular weight polypropylene (UHMWPP), UHMWPP was combined with modified cellulose using octadecyl isocyanate (ODI)/vinyl ester (VE). It is difficult to combine polymer resins with hydrophobicity on the surface with cellulose, which generally has hydrophilic groups. The NCO group of ODI combines with the OH group of cellulose to form a urethane bond, VE was substituted with a hydroxyl group through esterification to make the surface hydrophobic. This process was confirmed through Fourier transform infrared spectroscopy. The modified cellulose could ensure a particle size in units of several micrometers through spray drying, and it could be confirmed that cellulose was hydrophobized through contact angle and solvent dispersion. the distribution of cellulose on the surface of the complex was confirmed through scanning electron microscope analysis. Solvent-dispersed cellulose was reprocessed into powder with a uniform micrometer particle size through spray drying. UHMWPP and modified cellulose were physically compounded using a twin-screw extruder, the tensile strength was measured using the universal testing machine. As a result, it was found that the mechanical properties of the composite were improved when the modified cellulose was applied.**

## EXPERIMENTAL

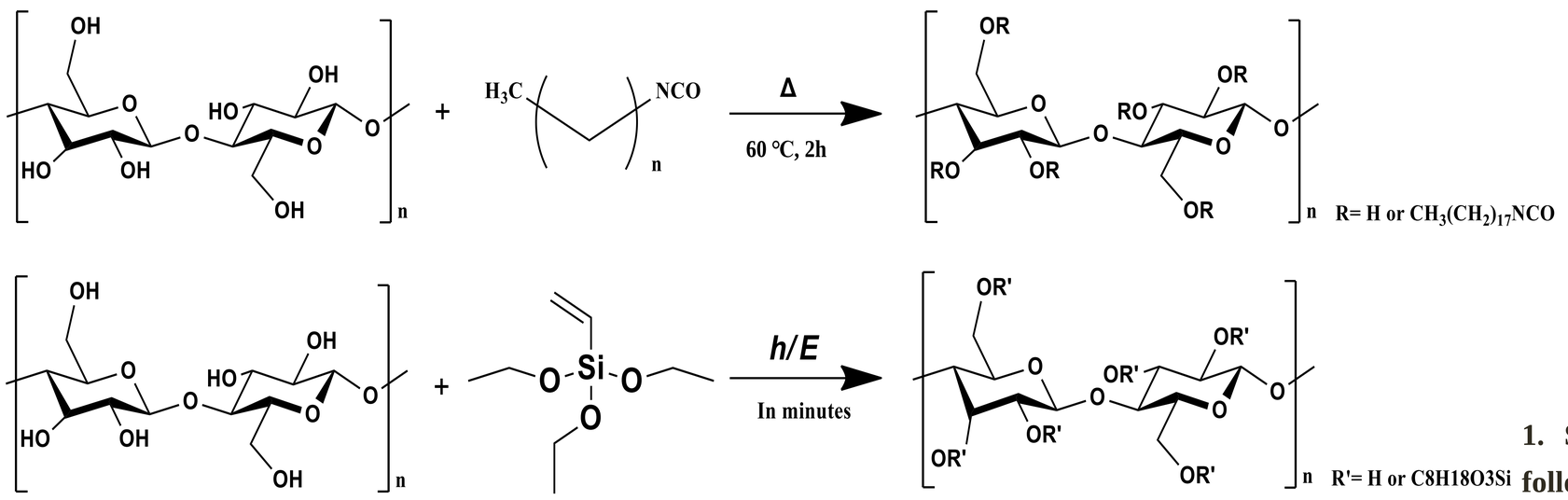



**Figure 1. (a) Urethane bonding of ODI with CNF and (b) esterification and hydrolysis reaction of vinyl silane in DMSO**

**Step 1** Fabrication of surface-modified nanocellulose

**Step 2** Compounding with UHMWPP using twin screw extruder

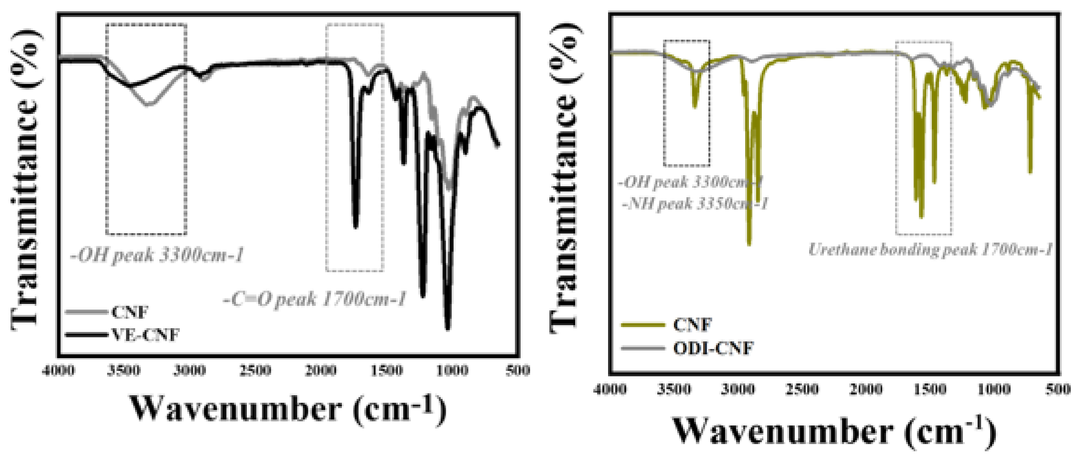
**Step 3** Manufacture of dog bone specimens through the press and evaluation of physical properties

**1. Surface modification of nanocellulose using modifiers followed by complexation with UHMWPP**

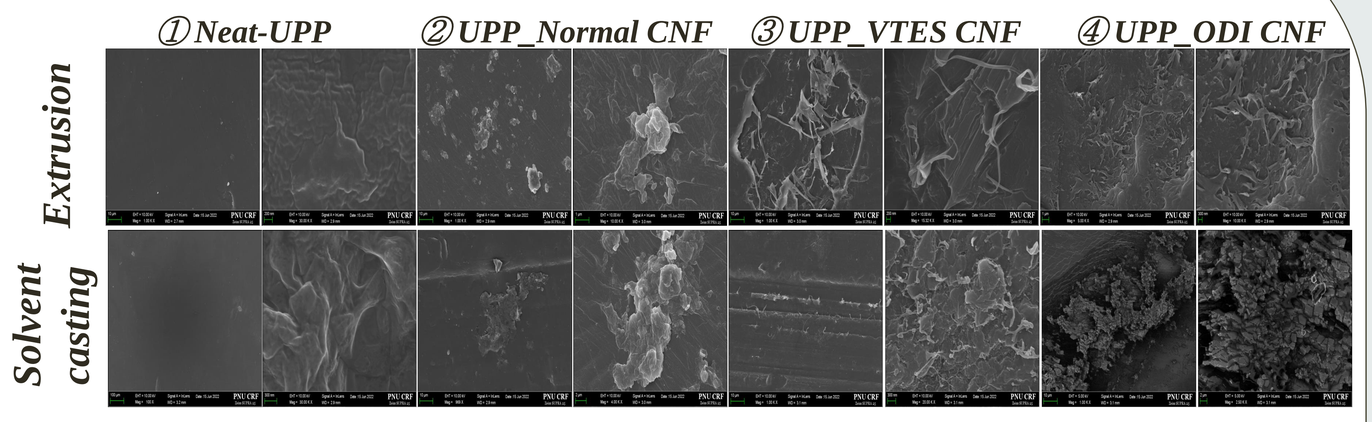
**2. Comparison of mechanical properties and spectroscopic properties of UHMWPP containing modified nanocellulose**

## RESULTS

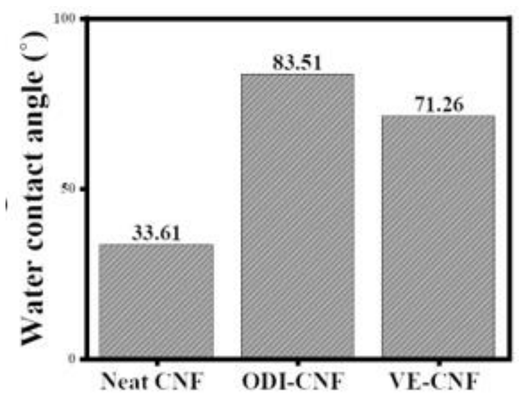
### FT-IR



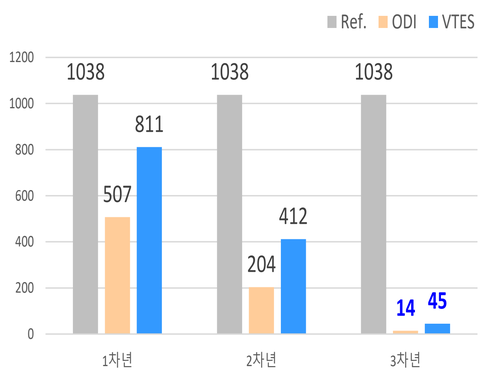

### SEM



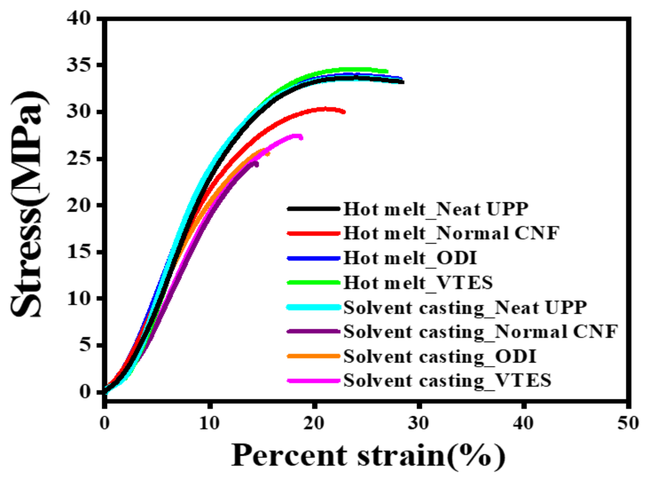

### Water CA




### OH value




### UTM




### Images

-. Water contact angle: modification → 34° → 80° ~ 84°

-. According to the optimization of the synthesis ratio, the OH value decreased.

-. Successfully synthesized through spectroscopic and mechanical properties analysis.

-. The prepared composite was homogeneously mixed at 1% content to improve mechanical properties compared to pure UHMWPP

## ACKNOWLEDGEMENT

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