

Development of New Competitive and Sustainable Bio-Based Plastics

NewPack
New BioBased-Film for Packaging

Isolation of chitin nanowhiskers

Chitin is the second most abundant semicrystalline polysaccharide on the earth present as a structural component of the exoskeleton of crustacean, e.g. shrimp and crab shells. The crystalline domains of chitin can be extracted by acid hydrolysis under controlled conditions of the chitin. This crystalline chitin is in a form of nanosized whiskers, called chitin nanowhiskers (ChNWs). Due to high mechanical, antimicrobial properties, as well as biodegradability, ChNWs have great potential to be used in reinforcement and functional additive for biopolymers for packaging applications (Zeng et.al, 2011).

The development of chitin nanomaterials in NEWPACK project, within Task 3.1, involved the development of a protocol for ChNWs production, including processing parameters (acid concentration, temperature, time), as well as investigation of the processing scalability.

Production of ChNWs from crustacean shell waste are mainly divided in two steps: 1) chitin extraction from crustacean shell waste by using deproteinization and demineralization steps; 2) chitin to ChNWs isolation by acid hydrolysis following by mechanical dispersion methods. Figure 1 shows the schematic diagram of extraction of chitin nanowhiskers from the shrimp shell.

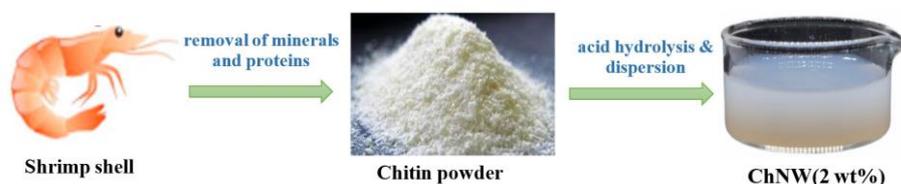


Figure 1: Schematic diagram of isolation of ChNWs from shrimp shell waste

After the isolation process, the produced ChNWs have been characterized by polarized optical microscopy (POM), atomic force microscopy (AFM), X-ray crystallography (XRD) and thermogravimetric analysis, and part of the results are illustrated in **Figure 2**. The POM image shows the birefringence behavior of ChNWs and AFM image shows needle shape, well dispersed ChNWs with size distribution of (279 ± 82) nm in length and (13.8 ± 3.2) nm in width dimension. The XRD result shows, during acid hydrolysis step, the crystallinity increased from 78 % (chitin) to 95 % (ChNWs). Considering the above result, the lab upscaling of the ChNWs (50 g) has been successfully achieved.

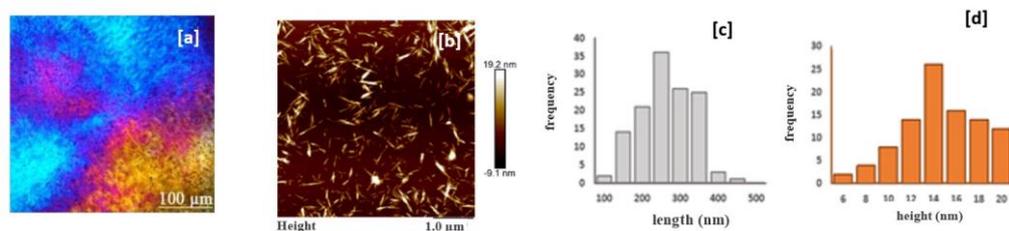


Figure 2: [a] POM image of ChNWs; [b] AFM image of ChNWs; [c] length distribution of ChNWs; and [d] height distribution of ChNWs

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