Properties of Nitrocellulose from Acacia mangium

ABSTRACT

Alternatives for petroleum-based products are much needed now due to the depletion of resources and the negative impact of its usage. Amongst the many renewable alternatives of cellulose-based products, nitrocellulose is the oldest and longest thriving derivatives in the world, obtaining a long line of utilization such as biodegradable plastics and film, wood coatings, nail lacquer, automotive paints, and leather finishes. The inexhaustible selection of raw materials for nitrocellulose production are easily obtainable from the copious lignocellulose materials, primarily from cotton and wood pulp. In this study, the Acacia mangium, which is a timber species that heavily populates the plantation of Sabah, in pulp form are used to produce nitrocellulose. The objectives of this research was to determine the physical and chemical attributes of the nitrocellulose from two different sizes of A. mangium particles (75 and 150 µm), such as its degree of substitution, nitrogen content, rate of efficiency and weight percentage gained. The production method of nitrocellulose includes the nitration process of the A. mangium pulp with nitric and sulphuric acid, followed by repeated stabilizing procedures using hot water, and finally the extraction process. Among the different sizes, the 75 µm sample showed a lower degree of substitution and nitrogen content compared to the other, but however showed higher rate of efficiency and weight percentage gained. This is due to the higher surface area per volume for the 75 µm samples but which contradicts in DS value due its higher affinity towards absorbing other materials more than the nitrate itself. This was further proven by the infrared and EDX spectra, where the 75 µm sized sample was absorbing more elements but at a lower concentration than the other. This goes to show that samples with a higher surface area per volume does not guarantee a better substitution of nitrate in nitrocellulose production due to the non-specific preference of cellulose absorption.