BIODEGRADABILITY OF CELLULOSE NANOCRYSTAL/THERMOPLASTIC POLYURETHANE NANOCOMPOSITE

Afkar Rabbani Hidayatullah bin Hipeni[1], Intan Syahiera binti Azli[1]
Dr Khairatun Najwa binti Mohd Amin[2]
[1]Department of Chemical Engineering, College of Engineering
[2]Faculty of Chemical and Process Engineering Technology
Universiti Malaysia Pahang

INTRODUCTION

CONVENTIONAL ISSUE

Non-renewable

Environmental Problem

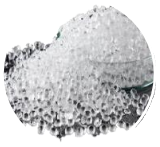
Low mechanical properties

CNC/NRL COMPOSITES FROM RENEWABLE FILLER

Carbon Filler

Replace with renewable filler

CNC from Whatman Filter Paper



Texin 990 polyether based TPU

CNC/TPU film

Strength:

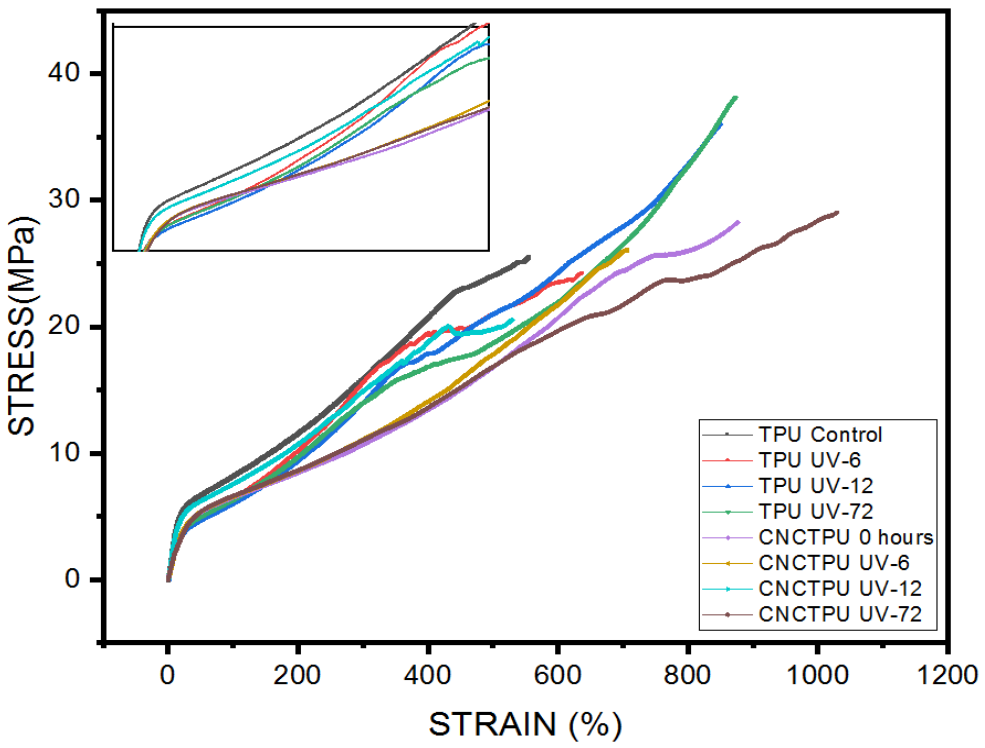
1. Improve the mechanical properties of nanocomposites
2. Maintaining environment quality
3. Low cost
4. Enhance biodegradability of nanocomposites

METHODS

ISOLATION OF CNC VIA ACID HYDROLYSIS

PREPARATION OF CNC/TPU FILM

RESULT



- 11.87% increase in tensile strength and 57.58% increase in elongation at break after incorporation of 1 wt% CNC as reinforcing agent compared to pure TPU film.
- Increased mechanical properties for TPU film after exposed to UV for 72 hours. This is due to highly ordered structure obtained by crosslinking after UV exposure.
- 1 wt% CNCTPU nanocomposites also recorded an increase after UV exposure but is lower compared to pure TPU film. Easily degradable while mechanical properties improved compared to pure TPU film.

PRODUCT

Medical Application

Automotive

Industrial Appliance

NOVELTY

The novelty of this research is the application of CNC from filter paper as filler to improve the properties of thermoplastic polyurethane and enhance the biodegradability of nanocomposites.

TARGET CONSUMER

Kami Sedia Membantu
KEMENTERIAN KESIHATAN MALAYSIA

PROTON

BOSCH

CONCLUSION

- Low concentration of acid phosphoric is used to increase the strength of the nanocomposites.
- CNC was successfully extracted from Whatman No.1 filter paper via phosphoric acid hydrolysis.
- CNC was use as reinforcing agents for TPU polymer and the CNC/TPU nanocomposite films were prepared by melt compounding.
- The mechanical properties of the nanocomposites were greatly affected by the exposure of UV radiation for various time conducted.

REFERENCE

1. Najwa, K. (2016). "Cellulose Nanocrystals Reinforced Thermoplastic Polyurethane Nanocomposites."
2. Boubakri, A., N. Guermazi, K. Elleuch and H. F. Ayedi (2010). "Study of UV-aging of thermoplastic polyurethane material." Materials Science and Engineering: A 527(7-8): 1649-1654.
3. Najwa, K. (2017). "Cellulose Nanocrystals with Enhanced Thermal Stability Reinforced Thermoplastic Polyurethane." Malaysian Journal of Analytical Science 21(3).
4. Vanderfleet, O.M., D.A. Osorio, and E.D. Cranston, *Optimization of cellulose nanocrystal length and surface charge density through phosphoric acid hydrolysis.* Philos Trans A Math Phys Eng Sci, 2018. 376(2112).
5. Meulen, B.. (1983). Industrial Tpu Applications in Europe. Journal of Industrial Textiles - J IND TEXT. 12. 148-159. 10.1177/152808378301200302.