







Fig. 5. Effect of CNC loading on (a) mechanical tensile strength and (b) tensile modulus

#### IV. CONCLUSIONS

Cellulose nanocrystals from rice husk had been isolated using acid hydrolysis method. The diameter of cellulose nanocrystals recorded by transmission electron microscope (TEM) is  $12 \pm 3.04$  nm. Plasticized cassava starch/cellulose biocomposite films were successfully prepared via solution casting technique. Reinforcement effect of filler was investigated at the variation of CNC loadings (0-10wt.%). It was found that the addition of CNC enhance the mechanical properties of the nanocomposite films with the 6 wt% CNC showed the highest tensile strength. Incorporating cellulose

nanocrystals also leads to a decrease in water uptake, and increased film crystallinity.

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#### REFERENCES

- [1] M. J. John and S. Thomas, *Carbohydrate Polymer* (2008).
- [2] N. L. Garcia, L. Ribba, A. Dufresne, M. Aranguren, and S. Goyanes, *Carbohydrate Polymers*, 84, 203–210 (2011).
- [3] A. J. Svagan, M. S. Hedenqvist, and L. Berglund, *Composites Science and Technology*, 69, 500-506 (2009).
- [4] E.M. Teixeira, D. Pasquini, A.A.S. Curvelo, E. Corradini, M.N Belgacem, and A. Dufresne, *Carbohydrate Polymers* 78, 422-431 (2009).
- [5] Y. Chen, C. Liu, P. R. Chang, X. Cao and D. P. Anderson, *Carbohydrate Polymer* 76, 607-615 (2009).
- [6] H. Kargarzadeh, I. Ahmad, I. Abdullah, A. Dufresne, S. Y. Zainudin and R. M. Sheltami, *Cellulose DOI* 10.1007/s10570-012-9684-6 (2012).
- [7] J.O. Zoppe, M.S. Peresin, Y. Habibi, R.A. Venditti and O.J. Rojas, *ACS Applied Materials and Interfaces*, 1, 1996-2004 (2009).
- [8] M. N. Anglès, & A. Dufresne, *Macromolecules*, 33, 8344–8353 (2000).