CHAPTER VI
COMPARATIVE STUDY

6.1 Optical property

The color of PVDF-HFP/Cellulose with different sources of Cellulose; extracted microcrystalline cellulose (MCC) from sugarcane bagasses and extracted bacterial cellulose (BC) from Nata de coco, were compared. For PVDF-HFP/MCC, the increasing of MCC content the composite film became more yellowness which could be due to the degradation process of the residual lignin which is a consequence of alterations in the physiological and biochemical processes and has resulted in yellow color of the matrix (Win *et al.*, 2006). In contrast, Figure 6.2, PVDF-HFP/BC composite film did not exhibit yellow color because BC free of lignin and hemicelluloses in the structure. It can be concluded that using filler from BC has better color than using MCC.

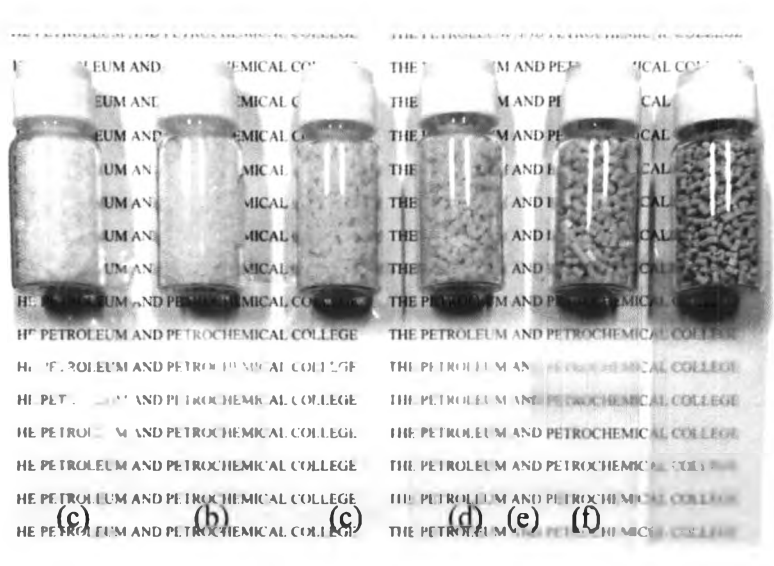

Figure 6.1 The visual appearance of extruded pellet and casted film of (a) PVDF-HFP, (b) PVDF-HFP/MCC (1 wt.%), (c) PVDF-HFP/MCC (3 wt.%), (d) PVDF-HFP/MCC (5 wt.%), (e) PVDF-HFP/MCC (10 wt.%), and (f) PVDF-HFP/MCC (20 wt.%).

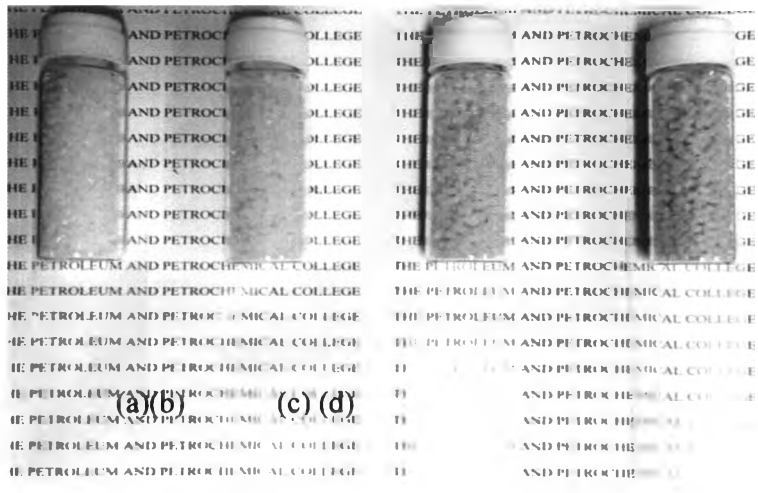

Figure 6.2 The visual appearance of extruded pellet and casted film of (a) PVDF-HFP, (b) PVDF-HFP/BC (1 wt.%), (c) PVDF-HFP/BC (3 wt.%), and (d) PVDF-HFP/BC (5 wt.%).

6.2 Dielectric Properties

Figure 6.3 showed the dielectric constant and dissipation factor comparative between PVDF-HFP/MCC and PVDF-HFP/BC composite film as a function of filler content. As observed, at the same cellulose content, the PVDF-HFP/BC gave higher dielectric constant than PVDF-HFP/MCC. It can be concluded that using from BC gave higher dielectric properties than using MCC at the same filler content.

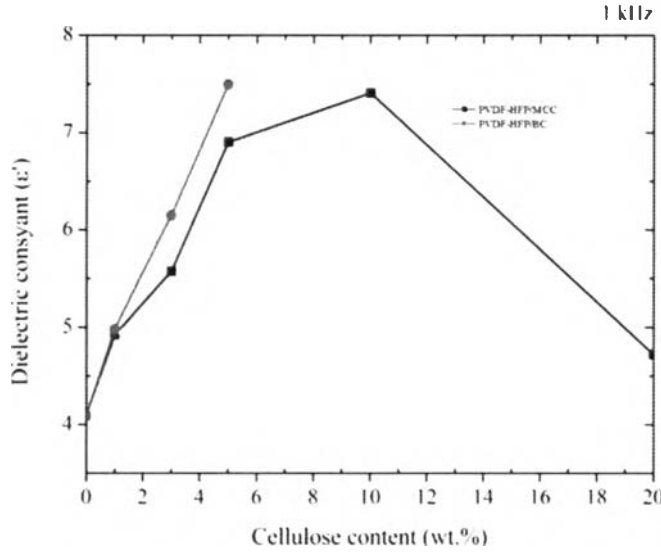

Figure 6.3 The Dielectric constant comparative between PVDF-HFP/MCC and PVDF-HFP/BC composite film at 1 kHz (T = 20°C)

6.3 Mechanical property

Comparing of the Young's modulus and tensile strength of PVDF-HFP/MCC and PVDF-HFP/BC composite film were shown in Figure 6.3 and 6.4, respectively. This exhibited that introduction of BC into PVDF-HFP matrix have higher Young's modulus and tensile strength than MCC in both of transverse and machine direction. Moreover, the elongation at break in machine direction of PVDF-HFP/BC composite film also higher than PVDF-HFP/MCC (Figure 6.5). On the other hand, there is no difference of the elongation at break in transverse direction as shown in Figure 6.5a. Thus, using BC as a filler lead to get better mechanical properties than using MCC.

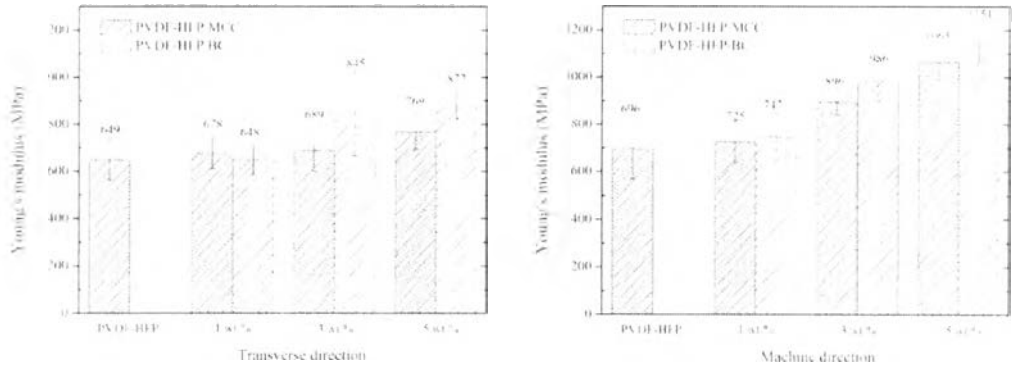

Figure 6.4 Young's modulus of neat PVDF-HFP and composite films (comparison between PVDF-HFP/MCC and PVDF-HFP/BC composite film) in (a) Transverse and (b) Machine direction.

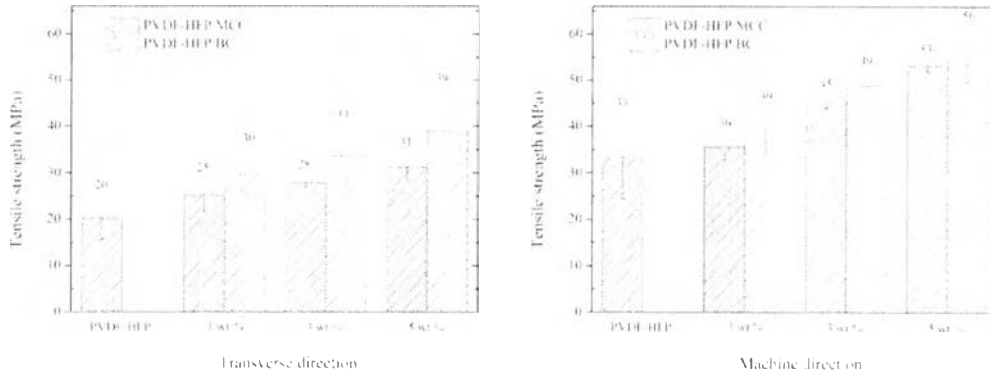

Figure 6.5 Tensile strength of neat PVDF-HFP and composite films (comparison between PVDF-HFP/MCC and PVDF-HFP/BC composite film) in (a) Transverse and (b) Machine direction.

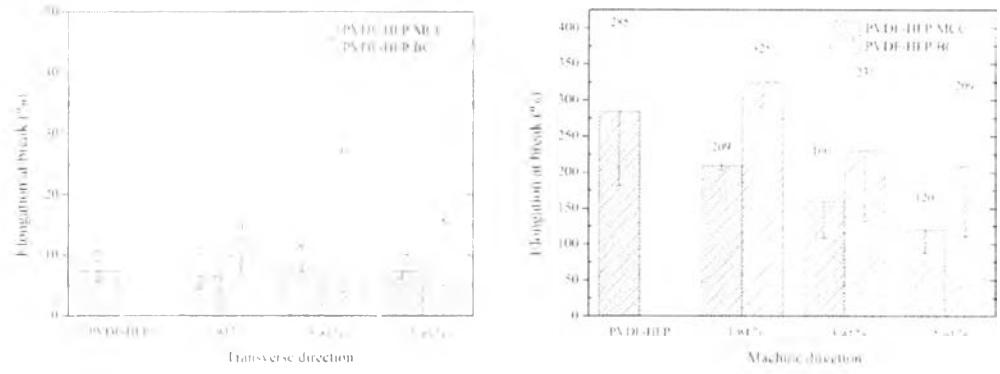

Figure 6.6 Elongation at break of neat PVDF-HFP and composite films (comparison between PVDF-HFP/MCC and PVDF-HFP/BC composite film) in (a) Transverse and (b) Machine direction.

6.4 Thermal shrinkage

The neat PVDF-HFP and its composite film were annealed at 130 °C for 2 hours to further compare their thermal stability at high temperatures. The dimensional changes of neat PVDF-HFP film in the machine direction is 5% and no shrinkage happens in the transverse direction. For high MCC content 5wt.%, no dimensional changes can be observed at 130 °C. On the other hand, just 1 wt.% of additional BC, there are no dimensional changes can be observed. From the result, it can be conclude that BC exhibits excellent dimensional thermal stability better than MCC.

6.5 Conclusion

From overall result, PVDF-HFP/BC has better color, higher dielectric properties, and better mechanical properties than PVDF-HFP/MCC. It can be concluded that at the same cellulose content, using cellulose from BC gave better properties than MCC.