

Abstract

As an attempt to develop the properties and uses of poly vinyl chloride (PVC) material, the present work has been carried out in three stages: The first stage is concerned with the effect of the addition of polypropylene (PP) or high density polyethylene (HDPE) on the mechanical and physical properties of binary polymer blends (PP- PVC and HDPE- PVC), at different ratios (5, 10 and 15wt %) as the first and second group of the polymer blends. The second stage is concerned by studying addition effect of acrylonitrile butadiene styrene (1%ABS) or ethylene propylene diene monomer (1%EPDM) to these binary polymers blends as the third, fourth, fifth and sixth groups respectively. The properties of the six groups have been studied, the optimum samples have been selected from the fourth and fifth groups which was (5%HDPE: 94% PVC: 1%ABS) and (5%PP: 94%PVC: 1%EPDM). And a third stage is concerned by studying the effect of adding nano titanium dioxide (Nano-TiO₂) particles in different ratios (0,1,3,5 and 8 wt%) to the optimum samples of ternary polymer blends, as a seventh and eighth group of polymer blend nano composites [(PP-PVC-EPDM):TiO₂] and [(HDPE-PVC-ABS):TiO₂].

Polymer blends have been prepared as plates by using twin screw extruder, and the samples are prepared according to ASTM specification. The mechanical, physical and morphological properties for all the prepared samples are studied.

- In the first stage the results show, for all samples in the first six groups, the mechanical properties are decreased with increasing PP and HDPE content in polymers blends. While the physical properties including thermal characteristics and melt flow index increase with increasing PP or HDPE content in polymer blend.
- The second stage the results show improving the mechanical properties. While in physical properties the addition of (1%ABS) to the base

polymer blend (PP-PVC) increases the thermal characteristics, but with this addition the thermal characteristics for the polymer blend (HDPE-PVC-ABS) was decreased. While the addition of (1%EPDM) to the base polymer blends (PP-PVC) and (HDPE-PVC) decreases the physical properties.

- In the third stage the result shows:-
 1. The mechanical properties increased to both type of polymer composites after the addition of nano-TiO₂.
 2. Physical properties increased with increasing TiO₂ content.
 3. The DSC test shows the emergence of two values of T_g and this indicates the presence of two separate phase for prepared polymer blends and its composite, whereas the addition of 1%EPDM to the polymer blend (5%PP: 95%PVC) led to emergence only one value of T_g.
 4. Morphology tests, for the best polymer blends and its composites give a homogeneous morphology and free from cracks. As well as the surface morphology shows a good dispersion of nanoTiO₂ particles between the different components of the polymers blends composite, which gives a better combination of strength, rigidity and toughness to these polymer blends composites.