

CHAPTER V

CONCLUSION

The study of fire retarded mechanism of inorganic tin compounds zinc hydroxystannate ($\text{ZnSn}(\text{OH})_6$) and zinc stannate (ZnSnO_3) was compared with antimony trioxide (Sb_2O_3) as fire retardants in plasticized PVC. Thermal gravimetry analysis (TGA) and neutron activation analysis (NAA) were used to study the mechanism. Moreover, the effective of fire retardants on mechanical properties and flammability were also testing. From thermal gravimetric analysis at 50°C - 900°C of all flexible PVC samples, flexible PVC sample with 4 phc Sb_2O_3 had TGA diagram for weight loss (%) and TGA max ($^\circ\text{C}$) similar to base resin. It indicated that nearly all of Sb_2O_3 lost from substrate. For flexible PVC containing 4 phc of ZHS and ZS gave the same pattern of TGA diagram. The initial degradation stage occurring at a lower temperature than flexible PVC with 4 phc of Sb_2O_3 , which indicated the promotion of chloride volatilisation by ZHS and ZS. The presence of ZHS and ZS in plasticized PVC markedly increased the amount of carbonaceous char forming during combustion in air. This observation was consistent with condensed phase behaviour. Whereas the addition of antimony trioxide, a vapor phase fire retardant, has little effect on char formation. Elemental analysis by NAA technique of the residual carbonaceous char suggested that, a very

significant proportion of the zinc and the tin was volatilised from ZHS and ZS-containing polymer, which may be the indicator of vapor phase action.

This study revealed that inorganic tin compounds, zinc hydroxystannate and zinc stannate, could be used as fire retardant in plasticized PVC. The retarding mechanism was shown to be both condense and vapor phase. These fire retardants were as good as antimony trioxide in plasticized PVC, and they had small or no significant effect on mechanical properties. Moreover, the advantages of ZHS and ZS as fire retardant were their low toxicity, low tinting strength and low level of smoke and carbon monoxide emission.



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