INFLUENCE OF MICRO MAGNESIUM DIHYDROXIDE ON THERMAL DEGRADATION AND FIRE BEHAVIOR OF POLYESTERS

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Magnesium dihydroxide (MDH) is a well-known flame retardant, particularly for polyolefins[1–3] and polyamides[4,5]. MDH decomposes through an endothermic reaction to give off water[6]. Many polymers are sensitive to the hydrolysis, such as polyamides and polyesters[7,8] which leads to an earlier thermal degradation. The phenomenon of hydrolysis could be promoted by the water release of metal hydroxides, charring can be observed that could promote flame retardancy in polyester-MDH formulations. This study was carried out to determine the influence of the chemical structure of various thermoplastic polyesters filled with MDH on thermal degradation and flammability of MDH-filled polyesters.

Various thermoplastic polymers with different chemical structures (aromatic, aliphatic and pendant ester groups) were filled with 10wt% MDH. These formulations were studied by TGA, PCFC and Pyrolysis-GC/MS to scrutinize the role of MDH on the degradation mechanisms of polyesters.

The studied polymers were divided into four series (A, B, C and D) according to their chemical structure. Series A gathers thermoplastic aliphatic polyesters (PLA, PCL, PBS, PHB and PHBV) while series B corresponds to thermoplastic aromatic polyesters (PET and PBT). Series C includes thermoplastic polymers or copolymers with pendant ester groups (EVA, EMA and PMMA). While the pure polymers from series A, B and C hardly form char during pyrolysis, Series D gathers char-forming polymers which present an ester group such as liquid crystal polyester (LCP) or a carbonate group such as polycarbonate (PC).

TGA and PCFC show that the addition of MDH significantly changes the thermal stability of studied polymers. Figure 1 shows the thermogravimetric analysis of four examples (four blank polymers and

their MDH-filled formulations). PLA, PBT, EMA and LCP are representative for the series A, B, C and D respectively.
Four behaviours in thermal stability were observed in function of the polyester chemical structure when they are filled with MDH. The polymers of the series A and B showed an earlier degradation but an interesting char is formed at high temperature (it is observed at higher temperature for series B). There is no modification in thermal stability for series C when these polymers are MDH-filled. In case of series D, MDH promoted an earlier degradation and lower char content.

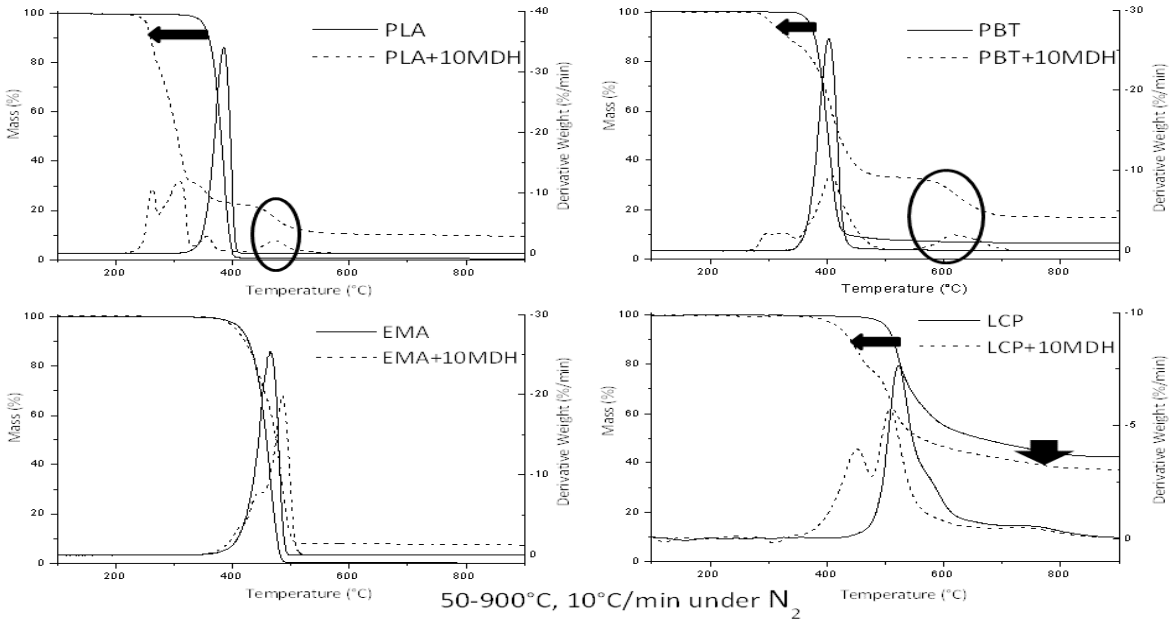

Figure 1: Mass (%) and Derivative mass (%/min) versus temperature

Hence, we could demonstrate a clear relationship between the polyester chemical structure and the thermal stability and flammability in presence of MDH. MDH seems to be particularly efficient as flame retardant in aromatic polyesters (PBT and PET).

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