IP-I-6

WASTE OIL REFINERY CATALYST IN THE PRODUCTION OF FLAME-RETARDANT FORMULATIONS

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High safety standards in fire protection and expanding plastics markets are leading to a steady rise in the consumption of flame retardants, while environmental criteria are assuming increasing importance in all phases of product development. Hence, the increasing focus on health and environment compatibility of flame retardants has resulted in much controversy in the use of the highly efficient and widely used halogen systems[1]. This way, halogen-free, intumescent formulations seem like a promising means to comply with statutory regulations and satisfy the new demands imposed by the market.

Concurrently, the discharge of waste materials from oil refineries also gives rise to environmental hazards. The FCC unit alone is responsible for the world-wide annual demand of 300 thousand tons of zeolite-based catalyst[2]. It has been demonstrated that zeolites have a synergistic effect with ammonium polyphosphate (APP) / pentaerythritol (PER) intumescent systems[3] thus indicating that the waste FCC catalyst may provide a way to produce intumescent materials that meet standards while reducing both the cost of the final product and the environmental hazard due to waste discharge.

The present study deals with the intumescence of a poly[ethylene(70%)-co-methyl acrylate(30%)] copolymer (PEMA) used in, amongst other areas, the cable and automobile industry. The FCC waste catalyst was submitted to ball-milling and sifting, where the -635# mesh fraction (MEC) was collected and used for testing. Formulations containing 30wt.-% of an APP/PER (3:1)[3] mixture and varying amounts of MEC were added to the PEMA matrix and mixed in a Brabender Laboratory Mixer operating at 160°C and 50rpm during 15 minutes. The obtained mixture was then heat pressed in order to produce standardized sheets. The flame retardancy properties of the materials were compared by LOI (ISO 4589-2) and cone calorimetry (ASTM 1356-90), both Stanton Redcroft instruments, and classified according to the UL-94 standard.

Figure 1 shows that the addition of MEC to the APP/PER formulation increases the limiting oxygen index, indicating an increase in the material's flame extinguishing ability. The best results were obtained for mixtures containing APP/PER and 2.5wt% of MEC. This apparent increase in APP/PER flame retarding performance was confirmed by the maximum values attained for the rate of heat release (RHR), detected by cone calorimetry (Figure 2). However, no effect can be observed due to MEC alone, regarding LOI values and RHR, indicating a synergistic effect between MEC and APP/PER. All systems containing APP/PER, regardless of the presence or absence of MEC, presented V0 rating in the UL-94 classification, while those that did not contain APP/PER were non-classified.

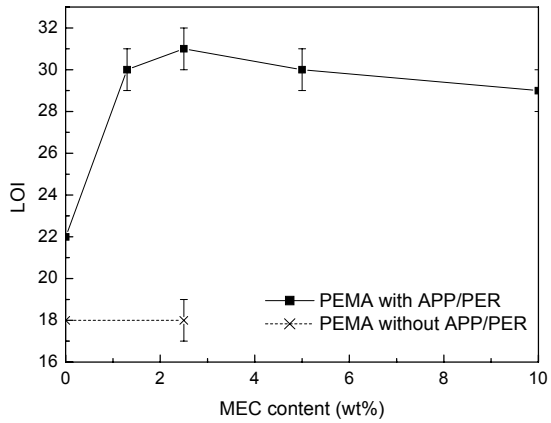

Figure 1. LOI values obtained for PEMA formulations containing MEC.

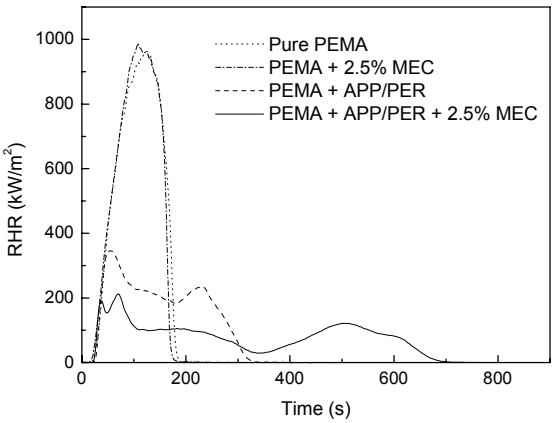

Figure 2. Rate of Heat Release obtained by cone calorimetry for PEMA formulations.

The results presented indicate that the addition of MEC greatly enhances the fire performance of APP/PER flame-retardant formulations. Hence, the use of MEC in association with APP/PER, may provide a way to produce materials that meet safety standards at low cost, allowing these products to find their way into residential and commercial markets.

References:

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