PRODUCTION OF POLYMERS BASED ON FURANIC DICARBOXYLIC ACID THROUGH POLYCONDENSATION REACTIONS – EFFECTS OF POLYMERIZATION CONDITIONS ON POLYMER STABILITY

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The environmental concern is leading to increasing interest in the production of polymers from renewable resources. Particularly, furanic compounds (more specifically, 2,5-furandicarboxylic acid - FDCA) constitute promising raw materials because of the structural similarity with derivatives of terephthalic acid.

Previous studies have shown that it is possible to synthesize poly(ethylene 2,5-furandicarboxylate) - PEF - successfully from FDCA and ethylene glycol[1,2,3]. However, polymerization conditions affect the final properties of the resin very significantly, including molecular weight distributions, characteristic transition temperatures, color and thermal stability. For this reason, this work evaluates the influence of reaction conditions on the thermal stability (in inert and oxidizing atmosphere) of polyesters synthesized through reaction of 2,5-furandicarboxylic acid with different diols, including ethylene glycol, 1,2-propanediol and glycerol.

PEF syntheses can be performed in three steps. First, esterification is carried out in a mixture containing the diacid (FDCA) and a mixture of diols. The reaction is conducted in slurry, at different temperatures and catalyst concentrations, under constant nitrogen flow. Nitrogen is used as a carrier gas for removal of volatiles and to keep the inert atmosphere. Then, transesterification of oligomers obtained in the first step is conducted in the melt phase in presence of catalysts under increasing vacuum. Finally, the obtained polyesters are subjected to solid state polycondensation under reduced pressure at different temperatures.

When thermograms of PEF and PET homopolymers are compared to each other (Figure 1a), it can be observed that PEF is less stable to temperature increase than PET resins obtained in the melt phase and after solid state polymerization. TGA analyses also show that the increase of the reaction temperature leads to decrease of thermal stability, while the increase of catalyst concentration leads to appearance of a point of maximum stability (Figure 1b). TGA analyses also show that the increase of the comonomer concentrations leads to decrease of thermal stability (Figures 1c and 1d).

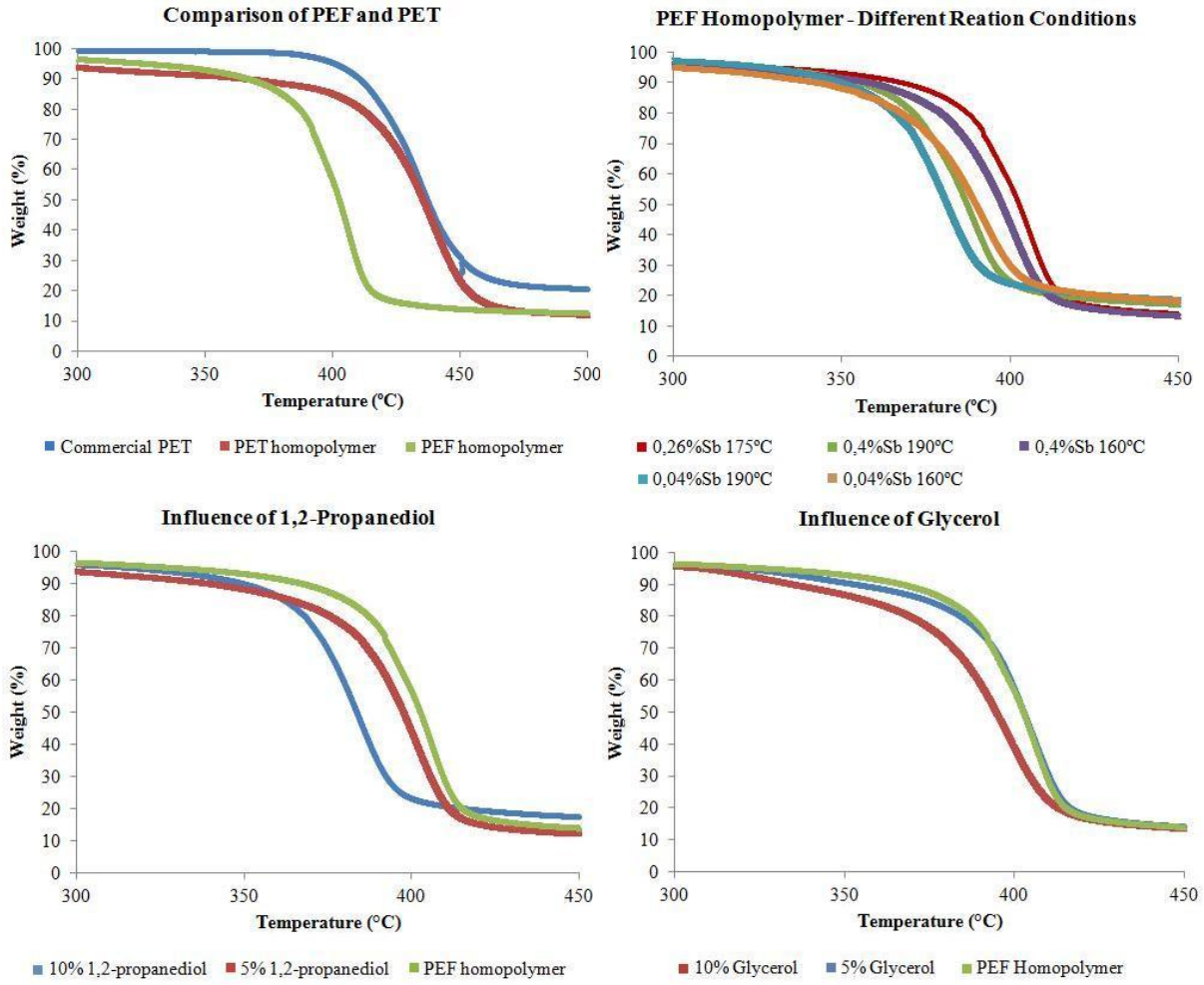

Figure 1. TGA thermograms for different PEF samples obtained under inert atmosphere.

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