Processing Effects on Poly(Ethylene Terephthalate) From Bottle Scraps*

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Processing of virgin and recycled poly(ethylene terephthalate) (PET) in a twin screw extruder evidences the degradative effect caused by thermal decomposition of poly(vinyl chloride) (PVC) and other impurities, e.g. adhesives, at the processing temperature. Lower melt viscosity and molecular weight, along with higher carboxylic end group concentration, were observed for recycled PET, the extent depending on PET purity. In an attempt to investigate the correlation between the kinetics of degradation phenomena and the level of thermomechanical stress, a novel dynamic method of evaluating thermal stability in processing conditions was developed. Such a method allows the achievement of long equivalent residence times while using lab-scale extruders. As a result of these experiments, PVC-rich recycled PET was shown to reach very low melt viscosity after less than 10 min in processing conditions, while virgin PET retained high viscosity even after 30 min.

INTRODUCTION

Recently, increasing interest has been focused on the recycling of plastic wastes, especially poly(ethylene terephthalate) (PET) scraps (1, 2). The main problem faced during processing of recycled PET is degradation resulting from the simultaneous presence of retained moisture (3) and contaminants [adhesives and poly(vinyl chloride) (PVC)]. The latter generate acidic compounds at processing temperatures (4), catalyzing hydrolytic ester bonds cleavage, leading to lower molecular weights and higher amount

a rheometer. We report on the development of an innovative method able to estimate physical changes on thermomechanically stressed PET, using a laboratory-scale apparatus, but operating as a continuous recirculating system.

EXPERIMENTAL

Materials

Virgin PET (V-PET) of 0.77 intrinsic viscosity