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Processing Polyethylene Terephthalate on a Single Screw Extruder with Hopper- and Melt Degassing

Walter Michaeli, *Torsten Schmitz, Henning Seidel

Institute of Plastics Processing at RWTH Aachen University, Germany

Producing PET film on single screw extruders using dried resin is state-of-the-art. This conventional way of processing, however, entails high energy- and investment costs as well as low flexibility due to high material residence times in the dryer. Melt degassing, as a means for continuous water removal during processing, represents an alternative to the drying technology. This process has already been developed to readiness-for-market by producers of co-rotating twin screw extruders. The circulation of twin screw extruders among producers, however, is very low. Resulting from its specific advantages like lower price and simple operability, the single screw extruder is usually the machine of choice among processors. Therefore, the current paper investigates the processing of undried PET resin on a single-screw degassing extruder. A 60 mm extruder with hopper- and melt degassing is set up in the IKV laboratory and the influence of production and process parameters is investigated. Further trials, among others, deal with the feasibility of different lengths of the degassing zone. The analysis of the process is carried-out by means of melt viscosity, intrinsic viscosity and acetaldehyde content. The plant configuration chosen for the trials enables processing of undried virgin PET and the achieved quality is almost identical to the conventional processing of dried resin. The hopper degassing is mainly suitable for reducing thermo-oxidative degradation; the water can be efficiently removed by melt degassing. Operating the extruder with a degassing zone length of 3D is not possible due to vigorous foaming, whereas the 6D and 9D configuration lead to almost similar results. At a throughput of about 110 kg/h, the degassing technology leads to 30 % energy savings compared to the conventional process. Based on the investigations presented in this paper, a concept for controlling the average molecular weight is introduced.