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# RESIDENCE TIME MODELING OF HOT MELT EXTRUSION PROCESSES

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## ABSTRACT

The hot melt extrusion process is a widespread technique to mix viscous melts. The residence time of material in the process frequently determines the product properties. An experimental setup and a corresponding mathematical model were developed to evaluate residence time and residence time distribution in twin screw extrusion processes.

The extrusion process was modeled as the convolution of a mass transport process described by a Gaussian probability function and a mixing process represented by an exponential function. The residence time of the extrusion process was determined by introducing a tracer at the extruder inlet, and measuring the tracer concentration at the die. These concentrations were fitted to the residence time model, and an adequate correlation was found. Different parameters were derived to characterize the extrusion process including the dead time, the apparent mixing volume and a transport related axial mixing. A $2^3$ design of experiments was performed to evaluate the effect of powder feed rate, screw speed and melt viscosity of the material on the residence time. All three parameters affect the residence time of material in the extruder.

In conclusion, a residence time model was developed to interpret experimental data and to get insights into the hot melt extrusion process.

## KEYWORDS

Mathematical Model, Residence Time Distribution, Hot melt Extrusion, Twin Screw Extruder