

Scaling up the Extrusion Process

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Scaling up the extrusion process

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If the extrusion process being developed or studied entails the handling of hazardous volatiles, environmental and safety concerns have increased the cost of these developments. This is true whether it's in a polymer producer's or user's pilot plant or a machinery manufacturer's development laboratory. To keep the costs down smaller equipment is being used to establish process feasibility.

While costs are reduced, the extrapolation factors are increased by a significant number. Instead of a 15:1 factor it might increase to 150:1.

The following guidelines are important regardless of the pilot plant size, but they are critical when conducting investigations on very small diameter machines.

1. Establish the limiting factor of the process

A. Motor power

B. Volume capability of the extruder

C. Final product properties, i.e. volatile content, physical properties, heat degradation, etc.

Don't run the process at a low thruput just to make it work, meaningful extrapolation is the goal.

2. Obtain accurate mass and energy balances. On some processes, particularly low viscosity systems, heat transfer may be the principal energy source, and extrapolation will be heat transfer area dependent.

For multi-stage devolatilization processes, a mass balance will establish vent splits and help size vacuum and condensate systems for the various vents

3. Be careful of what may seem to be minor problems on the smaller machines. For example, in a vented extrusion system, fines or vent wall accumulation can be handled rather easily. But on a larger scale production machine, as vapor velocities increase at proportionately higher rates, vent problems become major ones.

Similarly, feed acceptance, rear seal performance, surging, etc., while tolerable on a small scale, may not be tolerable in production.

Some process engineers do not believe that large-scale extrapolations are possible. However, I believe that feasibility and reasonable production rate estimates can be established if the above guidelines are followed.

— W.N. Nissle

See also:

- Polymer devolatilization
- Solvents and thermoplastics separated in CRT extruders
- Theoretical extrusion predictions

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