

Chemistry

Extrusion Pressure Study

Objective: To learn the basic components of an extruder, review the auger simple machine and apply the pressure/volume equation $PV=nRT$.

Materials: Section of 6” grain auger with end supports and turn crank. Playdough® extruder.

Demo: Have a student helper demonstrate the Playdough® extruder. Describe applications of this process in industry.

Notes: Review operation of auger with students. Put hand on auger to act as a follower and turn crank one revolution. Introduce and define “pitch” term. Draw picture of enclosed auger with endplate. Describe benefits of auger versus piston actuator.

- Continuous flow
- Mixing action

Student Development: Ask students to

1. Calculate the volume of material displaced in one revolution
2. Calculate the volume of that same material if it flows into a region of twice the pitch. Assume no slippage and constant temperature.
3. Assuming the fluid is all compressible, what would be the new pressure in this region of the extruder?
4. Assuming the fluid is half compressible gas and half incompressible solid, what would be the new pressure in this region of the extruder?
5. As the food product exits the extruder through the die, it returns to normal atmospheric pressure. How will the volume change and by what amount?
6. What are 5 different foods that are probably made with an extruder?