PURDUE UNIVERSITY

CAPSTONE EXPERIENCE 2014

Agricultural & Biological ENGINEERING

Production of Soy Pharmaceutical Tablets

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Background Information

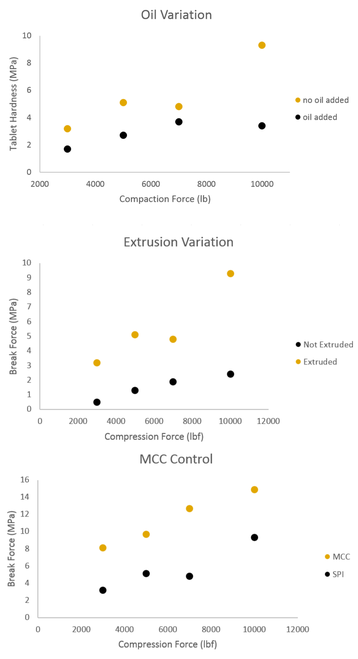
Microcrystalline cellulose (MCC) is the most widely used pharmaceutical binding/filling excipient. Previous research within the ABE department has been done on the possibility of using soy protein derivatives as an alternative binder/filler. The studies have shown that soy protein isolates (SPI) have weak binding abilities, resulting in tablets with low tensile strengths.

Objectives

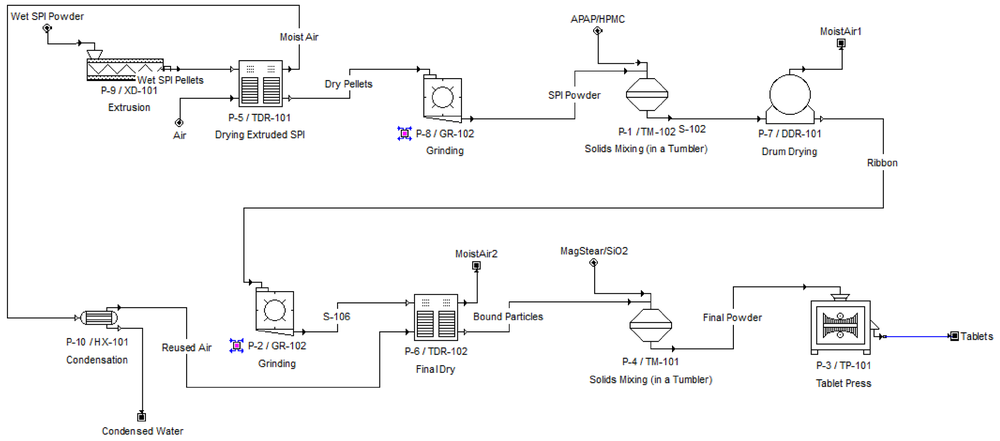
- Develop tablet formula that uses SPI as the main binder/filler
- Determine the effect of using soy powders with nonzero oil content
- Explore the effects of SPI extrusion on final tablet tensile strength
- Design and scale up a process for manufacturing tablets that use SPI as the main binder/filler

Laboratory Results

- Small scale experiments showed:
  - Lower oil content led to higher tensile strength
  - Extrusion of SPI led to higher tensile strength
  - Extruded SPI yielded lower tensile strength than MCC
- Future work should include:
  - Further experimentation with extrusion shear rate
  - Further experimentation with extrusion temperature control

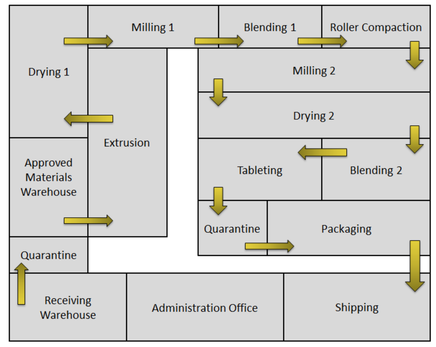


Process and Plant Design



Alternative Solutions

- Wet granulation
- Alternative equipment options
  - Roller compacter → granulator
  - Dryer → spray dryer
- Develop continuous process



Indiana Impact

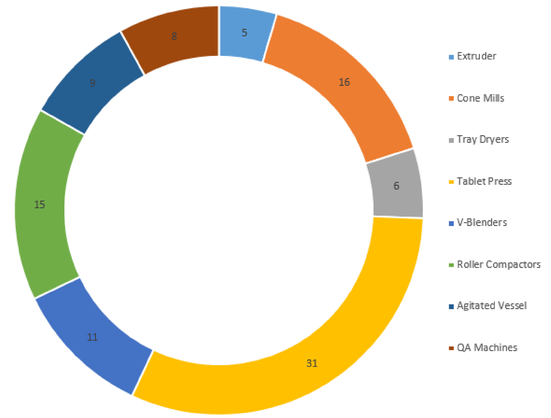
- Per year 1,233 acres of soy needed
  - Average Indiana farmer owns 135 acres
  - Equivalent to 9.1 Indiana soy farms
- Reduces soybean waste
  - 230,000,000 bushel surplus of soy in 2011 (US)
  - Projections through 2021 predict continued surplus
  - Process increases soy demand

Sustainability

- North central Indiana plant
  - Reduce raw material shipping footprint
  - Reduction of distribution costs across U.S.
- Recycling exit air stream from first dryer
  - Recycle hot air to second tray dryer
  - Recycle water into initial extruder feed
  - Reduces energy used to heat air
  - Reduces amount of water needed

Economic Analysis

Summary	
Total Capital Investment	$7,163,385
Revenue Per Year	$9,295,658
Operating Cost Per Year	$6,994,109
Return on Investment	20%
Breakeven Point	5 years



Annual Raw Material Cost		
Material	Amount (kg)	Total Cost ($)
APAP	327,846	224,615
SPI	578,250	44,923
HPMC	23,253	190,583
Mg Stearate	357	10,210
SiO2	893	102,098

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Indiana Soybean Association

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