

Biodegradable plastics processed from natural, renewable resources

Dr. Maria Baboi
Research Scientist

Presentation Outline

- **Objectives**
- **Experimental**
- **Results**
- **Conclusions**
- **Impacts**

IOWA STATE UNIVERSITY

Department of Agricultural & Biosystems Engineering

Biomass Processing Laboratory

Objectives

- **Produce natural alternatives to petroleum plastics from renewable resources such as soybean, corn**
- **Cost structure for many products competitive with conventional plastics**
 - **Relies only on standard, off-the-shelf equipment**
 - **Processing techniques not complicated**
 - **All raw materials and ingredients are common, commercially available products**

Experiment -Materials

- **Soy bean co-products**
 - Soy flour
 - Soy protein concentrate
 - Soy protein isolate
- **Plasticizers**
 - Water
 - Glycerin
 - Others

Experiment -Materials

Soy Flour:

- **Product obtained by finely grinding full-fat dehulled soybeans or defatted flakes made from dehulled soybeans.**
- **Protein content ~45%**
- **To be called soy flour –at least 97% of the product must pass through a 100-mesh standard screen.**
- **Classified according to their lipid content:**
 - **Defatted soy flour –from solvent extracted flakes- <1% oil**
 - **Full-fat soy flour –from unextracted, dehulled beans -18-20% oil**
 - **Low-fat soy flour –by adding back oil to defatted soy flour ~5% oil**
 - **High-fat soy flour –by adding back oil to defatted soy flour ~15% oil**

Experiment -Materials

Soy protein concentrate

- Prepared from dehulled, defatted soybean seeds by removing most of the oil and water soluble non-protein constituents.
- Protein content ~70%
- There are 3 major methods of extracting these constituents:
 - ◆ Aqueous alcohol wash process
 - ◆ Acid wash process
 - ◆ Heat denaturation/water wash process

Experiment -Materials

Soy protein isolate

- Prepared from defatted soy flour
- The protein is first solubilized in water
- Protein content ~90%
- The solution is separated from the solid residue
- The protein precipitated by acidification to the isoelectric point -pH 4.5- from the solution, separated and dried

Experiment -Processing

- **Demonstrated ability to convert resins to molded products in standard commercial equipment common to the petroleum plastics industries:**
 - **extrusion**
 - **compression molding**
 - **thermoforming**
 - **sheet extrusion**
 - **injection molding**

Results – Selected Prototype Products



Conclusions

- **Bio-renewable and biodegradable plastics:**
 - ◆ **One of the keys to a cleaner environment**

Impacts

- **Derivation from a renewable source**
- **Reduced generation of solid waste**
- **Animal edible formulas possible**
- **Degradation by-products non-toxic**
- **Safely biodegrades in sea and fresh water; harmless to marine life**
- **When NOT disposed of properly, soy-based plastics simply disappear**
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