Developing a process of recycling beehive foundation

A process of recycling beehive comb foundation was developed at Bio-Industrial Opportunities Section, Alberta Agriculture and Forestry. This development addressed the question raised by Alberta Beekeepers Commision: Is there a way to repurpose these plastics foundations, 3 millions annually, rather than going to landfill?

Jianbo Lu, Biomaterial Program Lead & Bioresource Engineer
Zhixiong Zhang, Senior Research Technologist
Hong Qi, Section Director
Norman Zhang, Senior Research Technologist

Bio-Industrial Opportunities Section
Alberta Agriculture and Forestry

Introduction

About 3 million comb foundations are either landfilled or burned at the end of each season. Alberta beekeepers have asked: Is there a way to repurpose these plastics foundations rather than going to landfill? Bio-Industrial Opportunities Section of Alberta Agriculture and Forestry worked with ABC to address this issue. From bench top to pilot production, a process was developed: dirty and wax of shredded waste foundation were washed out, metal and dead bee/worm bodies removed. Dried clean pieces were extruded to recycled pellets for molding test: a feeder piece back to beehive. Property of recycled plastics is in the range of virgin plastics.

Objective

To develop a process of recycling beehive foundation from shredded to recycled pellets.

Methodology

Bench top development

Detergent and wash parameters such as water temperature, stirring, and concentration were selected.

Pilot scale-up

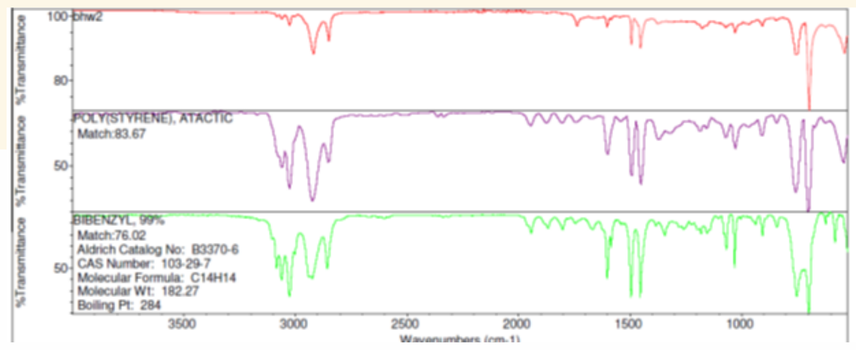
Cleaning and rinsing: A cement mixer, and Sweco were deployed for cleaning and rinsing. Air separator and metal detector were used for the removal of metal and dead worm body.
Extrusion and drying: Cleaned plastics were pelletized by extruder, followed by drying.

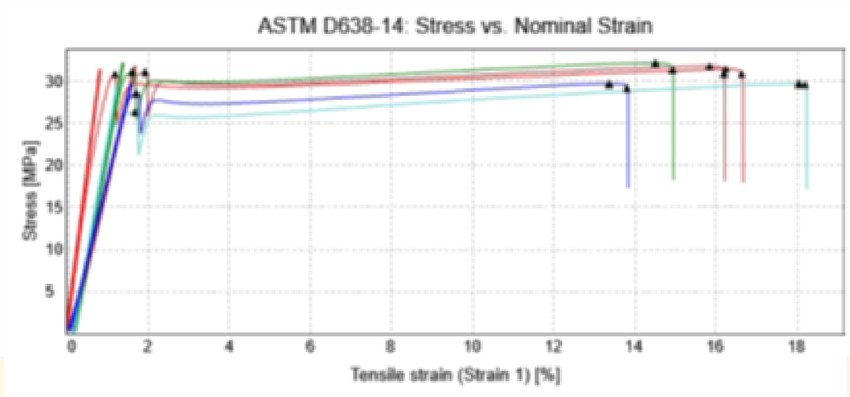
Results

•Mechanical movement helped the cleanliness of products.
•Higher processing temperature cleaned plastics better.
• Among 3 detergents, Dawn Professional performed best.
• Tensile strength of recycled is 31 MPa, and elongation at break is 15.97%; and flexural modulus is 2.190 GPa. All fall in the range of High impact polystyrene (HIPS).
• Both of bench top and pilot developments were sucessful, and 120kg recycled pellet produced for molding test at the end of this project.

Analysis

- 4% detergent, hot water, and mechnical stirring create the best washing result.
- Organic matters were dead bee/worm body, approved by LECO test.
- Raw plastics of recycled foundation were identified as polystyrene by FTIR. sorting process is necessary before recycling.
- Mechnical proerty of recyled plastics could meet requirement of similar applcation.





Conclusion

- A process of recycling beehive foundation was developed, from bench top to pilot scale, at Bio Innovation Processing Centre (BIPC), Alberta Agriculture and Forestry.
- The property of recycled plastics fell in the range of high impact polystyrene (HIPS), which was approved by FT-IR of material of the foundations in this research.

Future works:

- A survey will be helpful to figure out main suppliers, and type of polymer. Ideally, Recycle code should be marked on the beehive foundation.
- The color of the plastic foundation varies: white, black, yellow, and green. Color sorting will help the appropriate application of recycled.

Alberta Agriculture and Forestry

ALBERTA BEEKEEPERS COMMISSION