CCES 2025
Textiles & Apparel Track Session Summary

CCTC Thermal Recycling Pilot

Investigating innovative alternative pathways for textile-to-textile and fiber-to-fiber recycling, with a focus on sustainable solutions that benefit the Canadian agricultural sector. This session will delve into thermal recycling (pyrolysis) of end-of- use textiles to produce a material that enhances soil health, sequesters carbon, and contributes to circular economy initiatives.

Speaker
Jennifer Wright, Fanshawe College

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SUMMARY

Introduction

A research project titled "Testing the Efficacy of End of Use IC&I Textile Char as a Soil Amendment Across Canadian Agricultural Hotspots" is underway, supported by Fanshawe College's Centre for Research and Innovation and Western University's Institute for Chemicals and Fuels from Alternative Resources (Isfar), in collaboration with the Canadian Circular Textiles Consortium (CCTC).

The study aims to evaluate the use of char, derived from the pyrolysis of IC&I textile waste (industrial, commercial, and institutional textiles), specifically hospital linen and scrubs for this study, as a soil amendment. IC&I textiles are distinct from residential or secondhand clothing. The current IC&I feedstock is predominantly polyester (68.1%) and cotton (31.8%).

Pyrolysis is a thermal decomposition process that heats material to high temperatures (300-800°C) in the near absence of oxygen, chemically breaking it down into char, gas, and oil. Unlike combustion, this process locks carbon into a stable form, preventing CO_2 or methane release. The char produced in this study is a combination of both non-cellulosic and cellulosic feedstocks due to the cotton content.

Char as a soil amendment can improve water retention, soil structure, and microbial activity. It retains nutrients, enhances CO_2 absorption by plants, forms stable bonds with soil minerals, and protects organic matter from decomposition. Its porous structure improves aeration and water infiltration, and in acidic soils, it can raise pH.

The study is using Ethiopian kale as the test crop due to its short growing season, high market demand, and adaptability to southwestern Ontario's climate.

Timeline

The project follows a five-stage timeline from December 2024 to June 2025:

1. Experiment design: Defining protocols for soil preparation, greenhouse setup, char production, plant measurement, and lab analysis.
2. Pyrolysis and IC&I feedstock testing: Completing three pyrolysis iterations and analyzing the resulting char, gas, and oil.
3. Experiment preparation: Setting up the greenhouse and organizing supplies.
4. Actual experiment: Planting and growing kale, observing growth, collecting data, harvesting, and testing kale health and soil properties (before planting and after harvest).
5. Data analysis and reporting: Consolidating data, drawing conclusions, and preparing a final research report.

Procedure

Three sets of tests are conducted:

- Char testing: Proximate analysis (moisture, ash, volatile matter, fixed carbon), elemental analysis (C, N, H, S), pH, and ICP-OES (elemental composition, heavy metals).
- Soil and amendment testing: Soil analysis before planting and after harvest (organic matter, macro/micronutrients, pH), and compost test of the char amendment. All soil testing aligns with Ministry of Agriculture and Food guidelines.
- Plant health testing: Tissue analysis of leaves and petioles to measure nutrient levels and identify deficiencies or excesses.

Deliverables

The final deliverables will be a comprehensive report outlining the research design, protocols, results, and conclusions, intended for the CCTC to share with agricultural stakeholders across Canada for replication. A feasibility study on scalability (technical, operational, financial) will accompany the report. The gas and oil byproducts are currently being captured for future analysis to determine their content and appropriate disposal methods.