

Anusha Venkataraman Ph.D., P.Eng.

My research integrates nanotechnology, materials science, and environmental sustainability to develop innovative solutions for electronics, environmental monitoring, and sustainable technologies.

Current work is organized around three major research areas:



1. Microplastics Detection:

My environmental research focuses on the detection and characterization of microplastics in environmental samples using spectroscopic and physical analysis methods, supported by computational and AI-assisted data analysis approaches. Current work in this area has focused on microplastics in compost, conducted in collaboration with Dr. Naowarat Cheeptham (TRU Biological Sciences), Dr. Kingsley Donkor (TRU Chemistry), and the City of Kamloops, and is supported through a MITACS Accelerate grant (please see images below).

This work is now expanding into the TRU campus rainwater harvesting pilot project, where rainwater collected via rain barrels will be evaluated for physical and chemical quality, as well as microplastic contamination. By investigating rainwater, this research enables examination of how rainfall characteristics and roof infrastructure influence contaminant loading, supporting TRU's sustainability and water reuse goals.

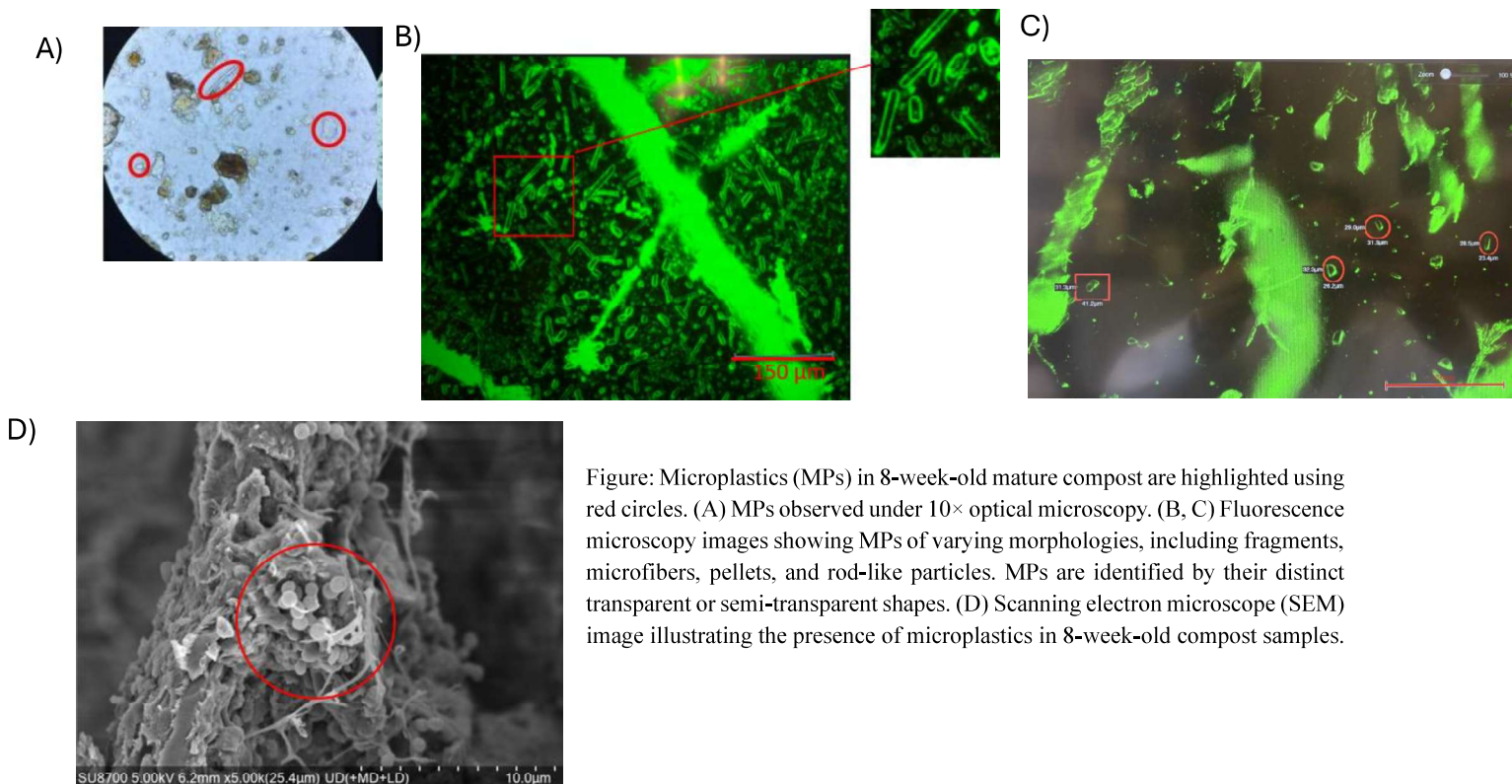


Figure: Microplastics (MPs) in 8-week-old mature compost are highlighted using red circles. (A) MPs observed under 10× optical microscopy. (B, C) Fluorescence microscopy images showing MPs of varying morphologies, including fragments, microfibers, pellets, and rod-like particles. MPs are identified by their distinct transparent or semi-transparent shapes. (D) Scanning electron microscope (SEM) image illustrating the presence of microplastics in 8-week-old compost samples.

2. **Sustainable Materials and Sensing:** My research in sustainable materials and sensing technologies includes the development of low-cost gas sensors printed with nanoinks for workplace safety, supported by a WorkSafeBC grant. I also investigate economical materials for dye-sensitized solar cells.

3. **Nanoelectronics and Molecular Networks:** My work in nanoelectronics examines self-assembled nanoelectronic networks, metal–molecular junctions, graphene-based molecular systems, and hardware security applications using the Atomic Force Microscopy and DFT simulations, with applications in quantum computing and next-generation electronics.

I am also passionate about the Transformative Integration of Research in Undergraduate Curriculum. My research and teaching are closely connected through student-led projects in quantum dots, solar cells, electric vehicle technologies, sustainability-focused materials research, and the use of Generative AI in physics education through multi-agent LLM pipelines and interactive simulations.

Links for further information:

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<https://kamino.tru.ca/experts/home/main/bio.php?id=avenkataraman>