M.Sc. Research Work details

Research title: Process intensification of urine-to-fertilizer conversion using biochar-based nitrogen capture

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Research summary:

Urine is a nutrient-rich waste stream, but its direct use as fertilizer is limited by rapid nitrogen loss and poor storage stability. Existing methods often fail to retain nutrients during processing. This work addresses the problem by developing a controlled process that converts urine into a stable, solid fertilizer using biochar as a carrier material. The approach focuses on preserving nitrogen and transforming the liquid waste into a compact, easy-to-handle form. The outcome is a low-odour, nitrogen-rich biochar fertilizer with improved nutrient retention, better storage stability and convenient application compared to conventional urine-based products. This technology can benefit farmers, waste management systems and fertilizer industries by reducing environmental losses and supporting sustainable agriculture practices.

Key Outcomes:

- Achieved enhanced nitrogen retention and improved shelf life of the final product.
- Transformed liquid waste into an easy-to-handle, transportable solid fertilizer.
- Reduced nutrient losses and minimized environmental pollution risks.

Societal Impact:

- Promotes circular economy by converting waste into value-added agricultural input.
- Reduces dependency on synthetic nitrogen fertilizers and supports sustainable farming.
- Provides an eco-friendly and scalable waste management solution for communities.

Research Highlights:

- Innovative biochar-based nitrogen capture technology.
- Process intensification ensuring higher efficiency and nutrient preservation.
- Scalable and adaptable model integrating waste management with sustainable agriculture.