ALBERTA INNOVATES

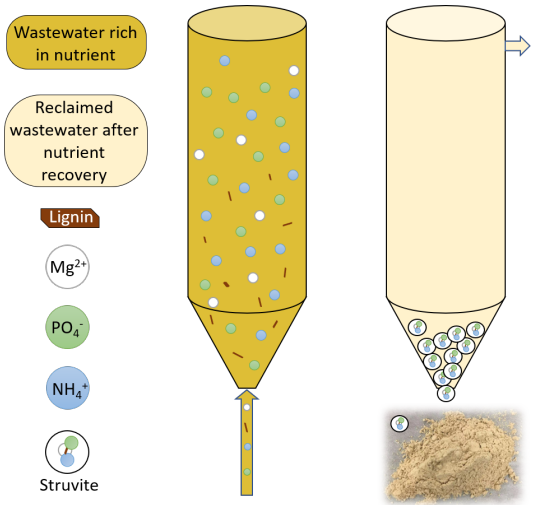
CLEAN RESOURCES

BIOINDUSTRIAL INNOVATION

LIGNIN PURSUIT

Development of A Novel Lignin-Assisted Wastewater Phosphorous Recovery Process: Path towards Circular Economy for Nutrients

Phosphorous is one of the non-substitutable fertilizers necessary for agricultural production. With the rapid depletion of economically exploitable phosphorus deposits, alternative strategies to recycle phosphorous are being investigated. One option is to recover phosphorous from the phosphorous-laden domestic wastewater through struvite precipitation. In this study a novel process, utilizing lignin to promote phosphorous recovery from municipal wastewater via struvite precipitation, is proposed. This project will be accomplished via a series of experimental evaluations and model simulations. The successful completion is expected to create new nutrient recovery strategies addressing the shortage of phosphorous resources.



FUNDING DETAILS

RECIPIENT:
University of Alberta – Yang Liu

PARTNERS:
University of Calgary
EPCOR Water Services

TOTAL BUDGET:
$300,000

AI FUNDING:
$300,000

PROJECT DATES:
July 2019 – December 2021

PROJECT TRL:
Start: 3
End: 5

APPLICATION

A new process to promote struvite precipitation will be developed using the alkaline lignin as the seeding materials to assist struvite precipitation. This is distinct from the conventional method which uses fine struvite particles as the seeding materials for precipitation. This new process has the potential to address the urgent need to recover phosphorus by enhancing phosphorus recovery from wastewater. This method reduces the cost of chemicals that are usually needed to adjust pH to alkaline conditions.

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PROJECT GOALS

- Develop a novel process that enhances phosphorous recovery from high phosphorous-laden municipal wastewater via lignin assisted struvite precipitation.
- Validate the optimal conditions for lignin assisted struvite precipitation and phosphorous recovery in wastewater of different characteristics.
- Couple experimental research with modeling framework to develop mathematic kinetics modeling for process simulation for struvite precipitation to facilitate design and efficient operation of reactors.
- Evaluate continuous operation strategies of struvite reactors to maximize struvite production and nutrient recovery, as well as to minimize contamination risks.

BENEFITS TO ALBERTA

- New designs of a struvite crystallizer system will be made available for demonstration and will provide alternative solutions to wastewater treatment industries for nutrient recovery from municipal wastewater.
- The process will help overcome the acute shortage of natural phosphorous deposits and cultural eutrophication by providing a closed-loop solution for the recovery of used non-substitutable phosphorous nutrients.
- Additional opportunities will be created to commercialize the lignin products in the wastewater treatment industry and increase Alberta's competitivity in the market of wastewater treatment industries.

2 Publications

3 Students Trained

Indirect Project GHGs Reduction

1 New Process

CURRENT STATUS

APRIL 2020

This project is proposed to be accomplished in three phases. To date, the team has completed Phases I and II. Specifically, the impacts of various wastewater characteristics on struvite precipitation and phosphorous recovery were evaluated and the wastewater chemistry that best accommodates phosphorous recovery was identified. Reactors designed for lignin-assisted struvite precipitation and collection have been procured and are ready for continuous operation and optimization.