Nutrient recovery in water resource recovery facilities

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Centre québécois de recherche sur l'eau
Quebec Water Research Centre

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Introduction

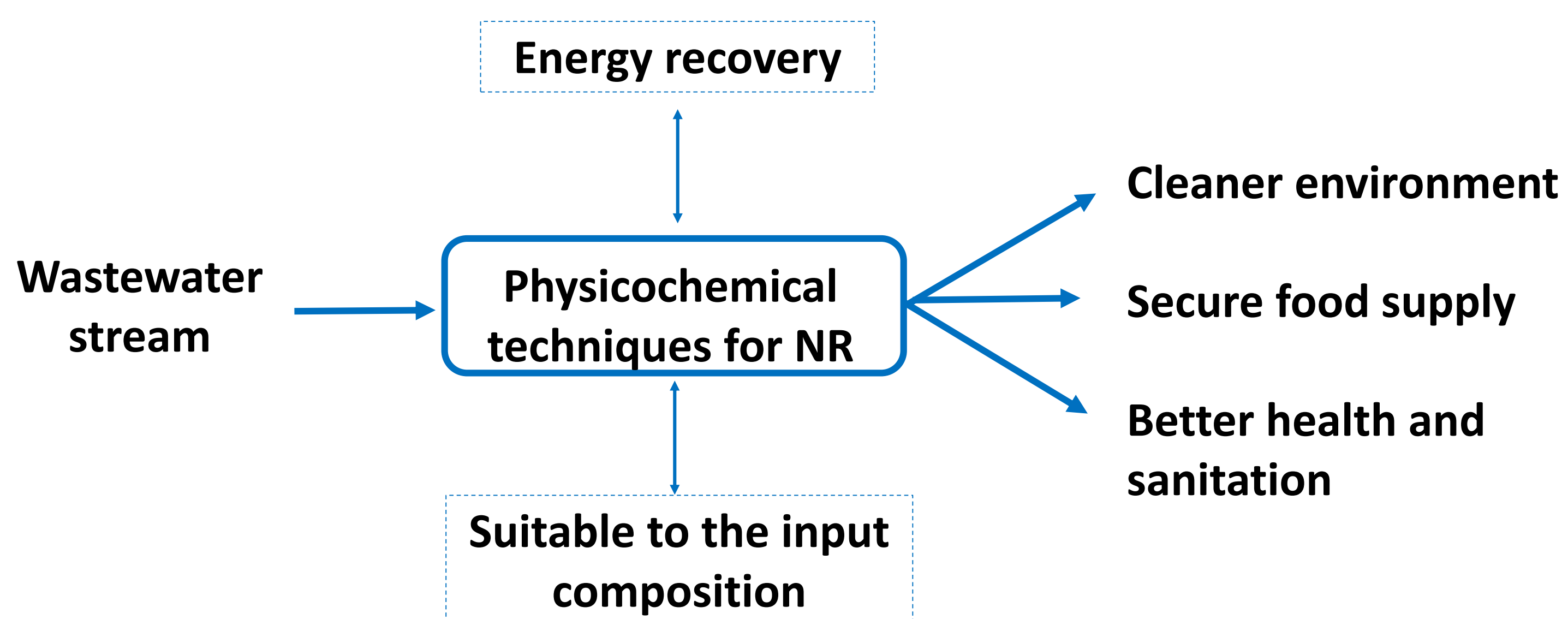1-The emission of nitrogen and phosphorus is causing significant environmental problems:

Their overload in aquatic systems leads to a severe water quality decline and provokes eutrophication.

2-An annual increase in nutrient consumption has been observed while global phosphorus (P) and potassium (K) mining reserves are limited to a few centuries.

Given the nutrient importance for all life, and the necessity to protect the environment, the recovery of these nutrients from waste and wastewaters has gained the attention of researchers.

Material & Methods

Nutrient recovery has been successful and feasible thanks to physicochemical techniques.

Energy recovery

Wastewater stream → Physicochemical techniques for NR → Cleaner environment

Secure food supply

Better health and sanitation

Suitable to the input composition

Wastewater and sludge streams are a promising opportunity for ammonia and phosphorus recovery, among others.

Overview of Nutrient Recovery Technologies

NR techniques suitable for

Solid fraction

P precipitation:
$MgNH_4PO_4.6H_2O$,
$MgKPO_4.6H_2O$,
$K_2NH_4PO_4$,
$Ca_3(PO4)_2$

Liquid fraction

NH_3 stripping and scrubbing
Membrane filtration
 (reverse/ forward osmosis)
Electrochemical
Electrodialysis
Electrooxydation
Ammonia sorption
 (ion exchange)

P crystallization

Valorization end product
Slow release fertilizer

Modelling work

Physicochemical Models

Lack

❖ Most attention has been given to biological models
❖ Simplified physicochemical models have been integrated within the existing biological models in an attempt to model nutrient recovery.

Opportunities

❖ Complete models describing the nutrient recovery treatment train.
❖ Use PHREEQC to perform speciation and saturation index calculations for reactor mass balances modelled in the WEST modelling software.
❖ Evaluate operational conditions influencing recovery efficiency.

Treatment train a compelling opportunity to optimize NR

(Céline Vaneeckhaute, 2014)
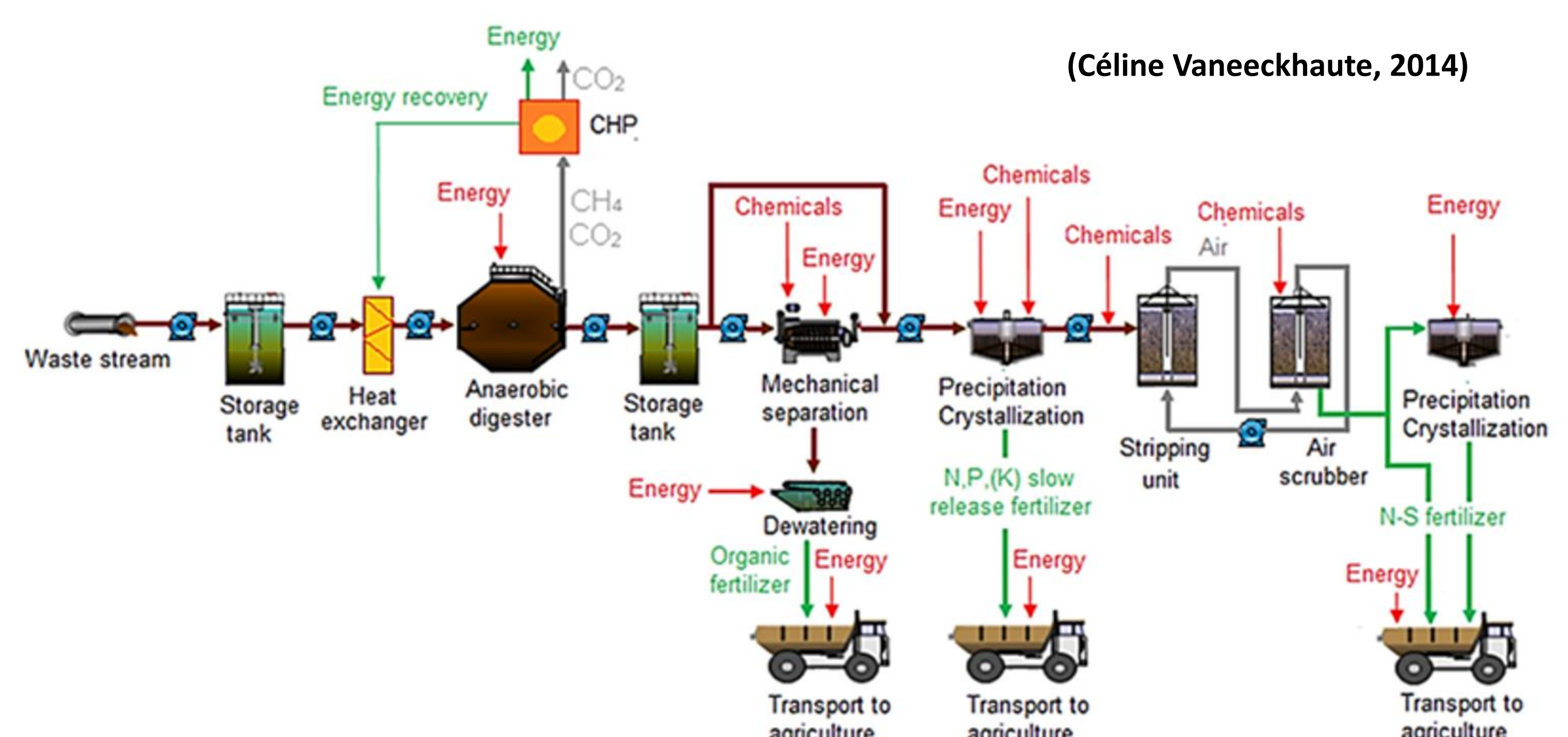
TAKE-HOME MESSAGE

Facing the current imbalance between the increase of nutrient consumption and their limited availability, a growing interest is going towards nutrient recovery from wastewater and wastes which will require adequate modelling tools for process design and optimization.

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