Comparing Ion Exchange and Electrochemical Nitrogen Recovery from Source-Separated Urine

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Introduction

- Urine: majority of nutrients
- Extract nitrogen as ammonia
- Create fertilizers or disinfectants

Problem parameters
Dependable, efficient N recovery
Urban scaling
Minimal behavior change
Technology 1: Ion Exchange Cartridges

Ammonium Solution
\( \text{NH}_4\text{Cl} \)

Synthetic Urine
\( (\text{NH}_4, \text{K}, \text{Na})\text{Cl} \)

Real Urine
\( (\text{NH}_4, \text{K}, \text{Na})\text{Cl} + \text{COD} \)
Technology 2: Electrochemical Stripping

Ammonium Solution: $(\text{NH}_4)_2\text{SO}_4$

Synthetic Urine: $(\text{NH}_4,K,\text{Na})_2\text{SO}_4$

Real Urine: $(\text{NH}_4,K,\text{Na})_2\text{SO}_4 + \text{COD}$
Preliminary Conclusions and Future Work

Preliminary Lab Data

Secondary Market Data

Electrochemical stripping is more cost-competitive than ion exchange in Kenyan context

Future Work

More realistic urine solutions
Field trial performance
Primary market assessment
Life-cycle assessment