

Recovery of ammonium crystals and water by condensation during solar drying of sludge. Effects of mixing dried and fresh sludge

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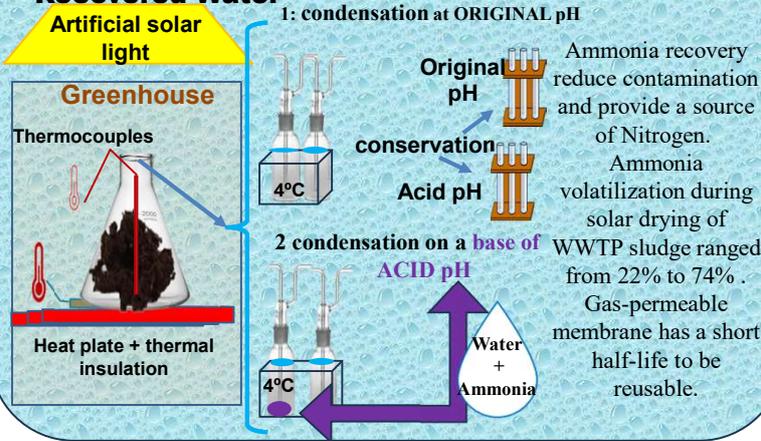
Biomass unit, Ceder-Ciemat, E-42290 Lobia, Soria, Spain. 1

Thermal Conversion Process unit, Ceder-Ciemat, E-42290 Lobia, Soria, Spain. 2

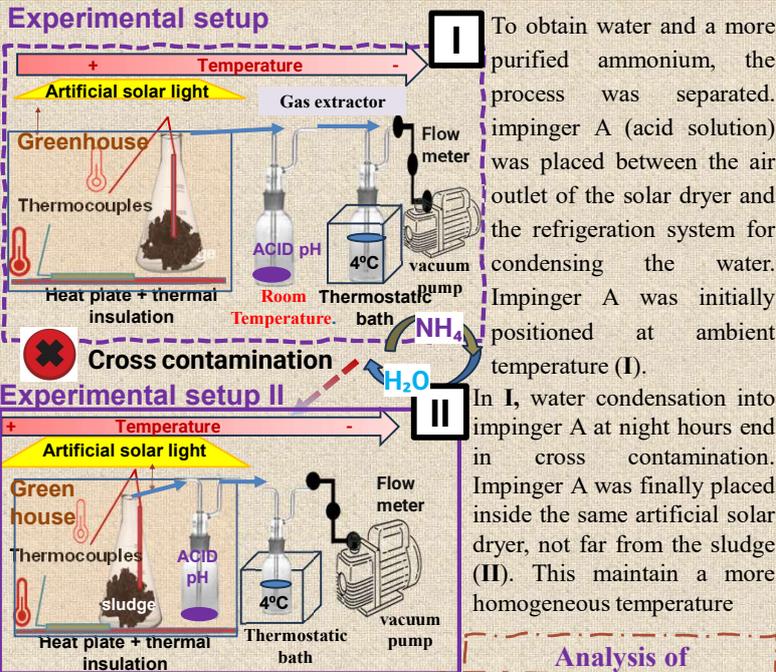
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INTRODUCTION & AIM

PH Influence on VOC and GHG Retention in Recovered Water



METHOD



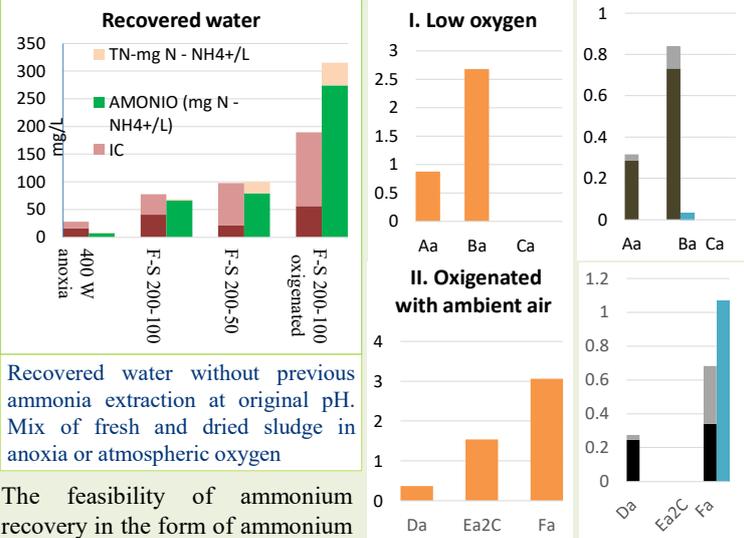
Analysis of

Total Carbon: Inorganic carbon (IC), Total organic carbon (TOC). Total nitrogen, TN: Inorganic nitrogen (IN) and ammonia (NH₃).

Apparatus: Shimadzu TOC-VCSH analyzer (Japan) equipped with a TNM-1 chem luminescence module. While ammonia concentration was determined following the Kjeldahl method with a Buchi Dist Line - Steam.

Sludge drying VARIANTS	fresh/dried sludge	Aeration	O ₂	
			Atmosph eric	Low
Aa	1:00	Ambient air	Low	Low
Ba	2:01		Low	Low
Ca	4:01		Low	Low
Da	1:00	Recirculate d dried air	Low	Low
Ea	2:01		Low	Low
Fa	4:01		Low	Low
Ha	1:01	Recirculate d dried air	Low	Low
Ia	2:01		Low	Low

RESULTS & DISCUSSION



Recovered water without previous ammonia extraction at original pH. Mix of fresh and dried sludge in anoxia or atmospheric oxygen

The feasibility of ammonium recovery in the form of ammonium sulfate crystals using the heat stored in the dryer was demonstrated, and the subsequent recovery of water through condensation.

The loss of ammonium and total nitrogen from fresh sludge during the solar drying prototype measures were 2.103 g N - NH₄ / kg dried sludge and 11,64g N /kg dried sludge, respectively. Our laboratory setup was able to recover up to 3.3 g N - NH₄ / kg dried sludge in form of (NH₄)₂SO₄ mixing fresh and dried sludge with oxygenation.

I. Ammonium recovered with low oxygen mixing fresh and dried sludge.
II. Ammonium recovery with ambient air oxygenation mixing fresh and dried sludge.
III. Ammonium recovery with low oxygen and recirculated air from dried sludge emissions Mix of fresh and dried sludge.

CONCLUSION

The reuse of heat stored in the solar dryer combined with an air extraction and condensation system enhances the multiple recovery of elements such as ammonia and water simultaneously. The system still has areas for improvement, such as reducing contamination from the acidic residues and determining an optimal extraction flow to prevent cross-contamination

REFERENCES

1- EU LIFE PROJECT: <https://dry4gas.portales.ciemat.es/en/>
2- A Comprehensive Review on Wastewater Nitrogen Removal and Its Recovery Processes. Yifan Zhou, Yingying Zhu, Jinyuan Zhu, Chaoran Li and Geng Chen.