Data Article

Background data on solar heat-assisted stripping-absorption system for ammonia recovery from food waste digestate

Lucas A.O. Melgaço\textsuperscript{a,\ast}, Erik Meers\textsuperscript{b}, César R. Mota\textsuperscript{a}

\textsuperscript{a} Department of Sanitary and Environmental Engineering, Federal University of Minas Gerais, Belo Horizonte, Brazil
\textsuperscript{b} Department of Green Chemistry and Technology, Ghent University, Ghent, Belgium

ARTICLE INFO

Article history:
Received 13 June 2020
Revised 26 November 2020
Accepted 30 November 2020
Available online 7 December 2020

Keywords:
Nitrogen recovery
Food waste
Solar heat
Stripping-absorption
Anaerobic digestate

ABSTRACT

The data presented in this paper are related to the research article "Ammonia recovery from food waste digestate using solar heat-assisted stripping-absorption" [1]. The raw and filtered data are associated to daily monitoring of \( \text{NH}_4 \) concentration of food waste digestate, \( \text{pH} \) of digestate and absorption solution and temperature of food waste digestate throughout experiments at different conditions. In addition, data of temperature monitoring in different points of solar-heat assisted stripping-absorption device are presented. The data could help further studies aiming to improve this system. The detailed data of these experiments could help to improve the performance and to reduce costs of nitrogen recovery from digestate using stripping-absorption technology.

\( \odot \) 2020 The Authors. Published by Elsevier Inc.

This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/)

DOI of original article: 10.1016/j.wasman.2020.05.047
\ast Corresponding author.
E-mail address: lucasant.melgaco@gmail.com (L.A.O. Melgaço).

https://doi.org/10.1016/j.dib.2020.106619
2352-3409/\( \odot \) 2020 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/)
Specifications Table

| Subject | Waste Management and Disposal |
|---------|-------------------------------|
| Specific subject area | Resource recovery from waste |
| Type of data | Table |
| How data were acquired | Ammonium concentration was measured by colorimetric method at 420 nm on UV–Vis Spectrophotometer device. pH were measured using a digital pH meter. Temperature was measured using digital thermocouple thermometer. |
| Data format | Raw and Filtered data |
| Parameters for data collection | The data were collected throughout experiments with the solar-heat assisted stripping-absorption device treating food waste digestate. |
| Description of data collection | Initial and daily ammonium concentration and pHs of treated food waste digestate and absorption solution (0.5 mol/L H₂SO₄) were measured at outlet of columns. The temperature of food waste digestate was measured daily, only for 45 °C experiments, at 12 pm on different points of the solar-heat assisted stripping-absorption device: (i) inside vacuum glass solar collectors, (ii) inlet stripping column and (iii) outlet stripping column. |
| Data source location | Department of Sanitary and Environmental Engineering, Federal University of Minas Gerais, Belo Horizonte, Brazil |
| Data accessibility | With the article L.A.O. Melgaço, E. Meers, C.R. Mota, Ammonia recovery from food waste digestate using solar heat-assisted stripping-absorption, Waste Management 113 (2020) 244–250. https://doi.org/10.1016/j.wasman.2020.05.047 |

Value of the Data

- This data could help to select different process parameters to improve the performance of nitrogen recovery from biogas digestate based on stripping-absorption technologies.
- This data can help to select best resource recovery technologies to manage biogas digestate and other wastes.
- This data can be used for further studies aiming to optimize and reduce costs for nitrogen recovery by stripping-absorption process.
- This data could help to improve and foster a widespread application of stripping-absorption process for ammonia recovery, mainly aiming nitrogen fertilizer recycling.

1. Data Description

The data presented in this article are associated with the article (L.A.O. Melgaço et al., [1]) and were acquired using a solar-heat assisted stripping-absorption device treating food waste digestate (Table 1). The daily monitoring of food waste digestate and absorption solution pH and NH₄ concentration at different experimental conditions (25 °C and 45 °C – G/L ratios 1700 and

| | Stripping column⁠⁻⁻ | Absorption column⁠⁻⁻ | Solar-heater |
|---|---|---|---|
| Height (m) | 1.80 | 1.20 | – |
| Diameter (m) | 0.15 | 0.15 | – |
| Total volume (L) | 30 | 17 | 33 |

^ Stripping and absorption columns were made with PVC tubes.  
^ Stripping column had a packed bed of 1.20 m height (polyethylene raschig rings - diameter: 1.5 cm; length: 5 cm; specific surface area: 300 m²/m⁻³ as packing material).  
^ absorption column did not have packing material.
Table 2
The daily monitoring of pH of the food waste digestate and absorption solution.

| Time (hours) | 25 °C – G/L 1700 pH | 45 °C – G/L 1700 pH | 25 °C – G/L 2600 pH | 45 °C – G/L 2600 pH |
|--------------|----------------------|----------------------|----------------------|----------------------|
|              | Stripping Absorption | Stripping Absorption | Stripping Absorption | Stripping Absorption |
| 0            | 8.44 0.88            | 8.61 0.99            | 8.15 0.6            | 8.01 0.6            |
| 24           | 8.57 0.8             | 8.93 1.09            | 8.72 0.78*         | 8.74 0.92           |
| 48           | 8.74 0.87            | 8.72 1.21            | 9.11 0.66          | 8.74 1.01           |
| 72           | 8.71 1.11            | 8.88 1.42            | 8.66 0.72          | 8.78 1.36           |
| 96           | 8.99 1.28            | 8.97 1.61            | 9.09 0.84          | 8.85 1.32           |
| 120          | 9.01 1.25            | 9.11 1.81            | 9.06 0.82          | 8.7 1.45            |
| 144          | 9.04 1.17            | 9.19 2.03            | 9.07 0.79          | 8.49 1.56           |
| 168          | 9.07 1.12            | 9.15 2.14            | 9.03 0.77          | 8.61 1.62           |

* replaced absorption solution.

Table 3
The daily monitoring of NH₄ concentration of food waste digestate at different experimental conditions.

| Time (hours) | 25 °C – G/L 1700 NH₄-N (mg/L) | 45 °C – G/L 1700 NH₄-N (mg/L) | 25 °C – G/L 2600 NH₄-N (mg/L) | 45 °C – G/L 2600 NH₄-N (mg/L) |
|--------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| 0            | 1302.10                        | 1241.77                        | 1385.61                        | 1275.58                        |
| 24           | 727.43                         | 746.43                         | 1139.90                        | 886.77                         |
| 48           | 461.77                         | 458.10                         | 688.47                         | 722.77                         |
| 72           | 144.43                         | 360.77                         | 313.71                         | 557.10                         |
| 96           | 102.77                         | 263.43                         | 77.10                          | 381.77                         |
| 120          | 95.30                          | 166.10                         | 65.13                          | 353.10                         |
| 144          | 83.77                          | 104.43                         | 44.76                          | 203.10                         |
| 168          | 74.77                          | 18.43                          | 31.78                          | 53.49                          |

Table 4
The temperatures at different experimental conditions.

| Time (hours) | Temperature (°C)² Sampling point² | Temperature (°C)² Sampling point² |
|--------------|-----------------------------------|-----------------------------------|
|              | I II III                          | I II III                          |
| 0            | 60 43 30                          | 63 47 31                          |
| 24           | 65 48 33                          | 62 46 33                          |
| 48           | 63 45 32                          | 63 44 29                          |
| 72           | 66 42 28                          | 65 45 34                          |
| 96           | 62 47 34                          | 61 43 30                          |
| 120          | 65 45 32                          | 60 45 29                          |
| 144          | 64 44 28                          | 64 42 32                          |
| 168          | 65 41 30                          | 62 44 30                          |

² experimental conditions: 45 °C and G/L 1700.
³ experimental conditions: 45 °C and G/L 2600.

The temperatures at different experimental conditions are presented in Table 4.

2. Experimental Design, Materials and Methods

The system was operated at an open-loop, semi-batch mode with different operational conditions (temperature 25 °C and 45 °C; gas/liquid ratios 1700 and 2600). The liquid digestate (LD) was carried to the top of the stripping column by a dosing pump, and a plastic shower inside
the column was used as an LD distribution device. The LD percolated through the packed bed inside stripping column and was collected in a reservoir at the bottom of the column for recirculation. Air was injected in the stripping column at countercurrent flow (340 L/min), and the changes in G/L ratios were achieved by decreasing LD flow rate. The top of the column was closed to prevent the release of gaseous effluent into the atmosphere. A plastic tube connected the top of the stripping column with the absorption column, where the NH$_3$-rich air entered from the bottom and left from the top. Sulfuric acid solution (0.18 mol/L) was continually recycled in countercurrent flow of 0.1 L/min using a dosing pump to recover the striped ammonia as (NH$_4$)$_2$SO$_4$. All batch runs lasted 7 days and were carried out in duplicates.

For the tests that were performed at 45 °C, a solar heater device (vacuum glass solar collectors) was coupled to the air-stripping column, replacing the liquid digestate reservoir. Liquid digestate that came out of the stripping column flowed by gravity to the solar heater and was recycled back to the top of the stripping column using a dosing pump.

Samples from the liquid fraction of digestate and sulfuric acid solution were taken daily from the bottom of each column and analyzed for pH and ammonia-nitrogen (NH$_4$–N) content. The pH was measured using a digital pHmeter (DIGIMED model DM-44) and ammonia-nitrogen analysis was made based on colorimetric phenol method described in Standard Methods for Examination of Water and Wastewater (APHA et al., 2012) [2].

The temperature were measured daily at 12 pm using a portable thermocouple digital thermometer. The measuring were made in different points of the solar-heat assisted stripping-absorption device: (i) inside vacuum glass solar collectors, (ii) inlet stripping column and (iii) outlet stripping column.

**CRediT Author Statement**

**Lucas A.O. Melgaço** Conceptualization, Methodology, Investigation, Formal Analysis, Writing–Original Draft; **Erik Meers**: Methodology, Writing–Review and Editing, Supervision, Funding acquisition; **César R. Mota**: Writing–Review and Editing, Supervision.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships, which have, or could be perceived to have, influenced the work reported in this article.

**Acknowledgments**

This paper was drafted in frame of the has received funding from the European Union’s Horizon 2020 research and innovation program under Grant Agreement No. 773682: H2020-NUTRI2CYCLE. The authors also would like to thank CAPES and CNPq for scholarships and funding this research.

**Supplementary Materials**

Supplementary material associated with this article can be found in the online version at doi: 10.1016/j.dib.2020.106619.
References

[1] L.A.O. MELGAÇO, E. MEERS, C.R. MOTA, Ammonia recovery from food waste digestate using solar heat-assisted stripping-absorption, Waste Manag. 113 (2020) 244–250, doi: 10.1016/j.wasman.2020.05.047.

[2] APHA, Association, A.W., Federation, W.E.Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington, 2012.