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Data Article

Dataset of the preparation and characterization of an artificial sludge for ecotoxicological purposes

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ABSTRACT

This work describes the protocol developed for preparing an artificial digested sludge to be used for the ecotoxicological evaluation and risk assessment of chemical substances that are previewed to attain the soil through sewage sludge applications for fertilization (e.g. pharmaceutical compounds). Such evaluations have been made with standard protocols for ecotoxicological tests with terrestrial species in which the chemical substances are directly spiked to the test soil. This procedure lacks ecological relevance in terms of the role the sludge organic matter plays on the bioavailability and fate of chemical substances. Here we describe the protocol and the composition for obtaining the artificial sludge, prepared with commercial pet food and eggs white to mimic the composition of domestic sewage sludge in terms of proteins, carbon hydrates, fat and fibers content. Further, the conditions ascertained for the anaerobic digestion of the

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organic mixture are described, and the final properties of the sludge are presented, after repeating the procedure twice.

Specifications Table

Subject	Environmental Science and Agricultural and Biological Sciences (General)
Specific subject area	Soil ecotoxicology
Type of data	Table Figures
How data were acquired	Data were acquired with a bioreactor for anaerobic digestion and with a Hanna Instruments photometer C214 and a C9800 reactor, as well as with a bioreactor BIO Controller ADI 1010.
Data format	Raw
Parameters for data collection	Water content (%), chemical oxygen demand (g L^{-1}), and pH.
Description of data collection	The general physical and chemical characterization of the artificial sludge samples was made after 7 days of anaerobic digestion of the sludge, at 37 °C and 250 rpm.
Data source location	Faculty of Sciences of the University of Porto, Portugal.
Data accessibility	Data are included in this article.

Value of the data

- These data can be used by other authors to prepare an artificial sludge for being used as a carrier of chemical substances to soils, in soil ecotoxicology, and to validate the stability of their final properties.
- This sludge can potentially be applied as control sludge in standard ecotoxicological tests aiming to assess the risks of chemical substances to soil.
- The protocol provided could be integrated in future updates of standard protocols to enhance environmental reliability of the tests.

1. Data

The data presented corresponds to the composition of the artificial sludge (Table 1) and of the general characterization of two anaerobic digested samples [water content (%), pH and chemical oxygen demand (g L^{-1})] obtained by two independent repetitions of the protocol described (Table 2).

Table 1
Nutritional composition of the solid mixture of the artificial sludge, the components and the amount of each one used to prepare 100 g organic solids mixture.

Composition per 100 g[a]				
Nutrients (%)	Cat food	Rabbit food	Eggs white[b]	Composition of the organic mixture of the artificial sludge per 100 g
Protein	40.0	15.5	86.0	47.2
Fiber	1.5	15.0	0	4.8
Fat	18.0	4.0	0.1	8.6
Carbohydrates	18.4	57.31	0.13	24.1
Amount weighted (g) per each 100 g sludge	41.3	28.1	30.6	–

[a] Products with a similar nutritional composition should be used.
[b] Eggs white in powder.

Table 2
General characterization of the artificial sewage sludge (average ± standard deviation of triplicate measurements). COD-chemical oxygen demand (See table with raw data in Supplementary data.).

Water content (%)	COD (g O_2 L^{-1})	pH
90.06 ± 0.35	119.50 ± 7.04	6.10 ± 0.51

2. Experimental design, materials, and methods

Following the composition of sewage sludge described by Drinan and Spellman [1] and presented in Fig. 1 as reference, two types of commercial pet food and eggs white were weighted and mixed to get a similar proportion of proteins, carbohydrates and fats in the solid phase of the artificial sludge. Tap water was then added in a proportion of 2:8 (m:v) and the mixture homogenized with a soup hand blender.

An inoculum of a digested sludge, obtained from a local wastewater treatment plant (WWTP), was added to this homogenized mixture in a 10% proportion of the mass weight, in order to inoculate a consortium of microorganisms able to carry out the anaerobic digestion process. This proportion was decided so as to have a balance between the efficiency of the anaerobic digestion and the potential addition of the contaminants to the artificial sludge. Anaerobic digestion is the process selected by many WWTP for dealing with sludge from the treatment of municipal wastewaters, as among other benefits, it is more effective in pathogens removal and in producing a better fertilizer for plants, thus allowing to reduce landfilling of organic wastes (e.g. Ref. [2]). The anaerobic digestion was carried out in a bioreactor BIO Controller ADI 1010 (see Fig. 2). The pH and temperature were measured and controlled in the bioreactor throughout the anaerobic digestion process. In order to prevent a large pH decrease, 2% in weight of calcium carbonate was added at the beginning and NaOH (6 M) was used during the digestion process, for pH adjustment to values close to neutrality (7.0 ± 0.5). The mixture was maintained in the reactor for 7 days, at 37 °C and 250 rpm. Upon 7 days, it was removed and the chemical oxygen demand (COD) was determined.

Chemical Oxygen Demand (COD): this parameter was measured through the adaptation of the EPA 410.4 [3] approved method for residual wastewaters, using a Hanna Instruments C214 photometer and following the protocol of the vendor. A dilution of the digested artificial sludge, was placed in the presence of dichromate, at 150 °C for 2 h, and the reduced dichromate was measured colorimetrically (Hanna Instruments instructions Manual).

Water content determined by weight loss, at 105 °C, for 24 h.

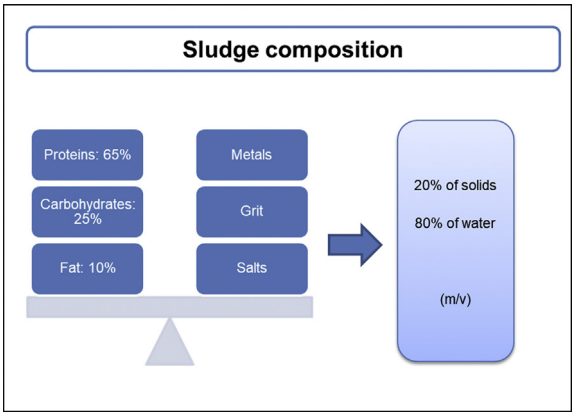

Fig. 1. Raw Domestic sewage sludge composition according to Drinan and Spellman [1].

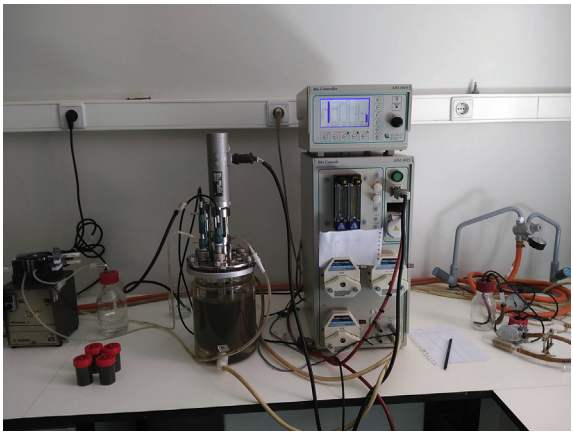

Fig. 2. Bioreactor used for artificial sludge anaerobic digestion process.

Measurements were made in triplicated for two artificial digested sludge samples obtained independently following the above described procedure. After the anaerobic digestion process the artificial sludge was dried at 80 °C, for 5 days, to be used on ecotoxicological tests.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104385.

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