LIST OF PUBLICATIONS

Publications from thesis:

1. Devi, J., Deb, U., Barman, S., Das, S., Bhattacharya, S. S., Tsang, Y. F., ... & Kim, K. H. Appraisal of lignocellusoic biomass degrading potential of three earthworm species using vermireactor mediated with spent mushroom substrate: compost quality, crystallinity, and microbial community structural analysis. *Science of the Total Environment*, 2020, *716*, 135215

2. Devi, J., Pegu, R., Mondal, H., Roy, R., Bhattacharya, S. S. Earthworm stocking density regulates microbial community structure and fatty acid profiles during vermicomposting waste: Unraveling the microbe-metal and mineralization-humification interacctions. Bioresource Technology, 2022.

Papers presented in seminar and conference

1. Devi, J and Bhattacharya, S.S. Vermiremediation of Spent Mushroom Substrate with Three Earthworm Species. In international conference on 6th India Biodiversity Meet 2019, organized by Indian Statistical Institution, Kolkata, 14th -16th February,2019.

2. Devi, J and Bhattacharya, S.S. Comparative assessment of three earthworm species and nutrient mobility based analysis. In national seminer on Current Perspectives in Environment Pollution: Challenges and Opportunities ,organized by Department of Environmental Science ,Tezpur University, Tezpur,Assam, 7th-8th June,2019.

Annexure A

Table 1: Relative standard deviations for various elements analyzed in UV Visiblespectrophotometer (Chemito 2600) and Flame photometer (Specord)

Instrument	Parameter	Method Detection Limit	Relative standard deviation
UV-VIS spectrophotometer	Phosphorus	0.5 mg kg^{-1}	1.60%
	Sulphur	0.5 mg kg^{-1}	1.20%
	Reduced Glutathione (GSH)	0.3 mg $^{-1}$protein	1.34%
Flame Photometer	Potassium (K)	0.5 mg kg^{-1}	6.20%
	Sodium (Na)	0.5 mg kg^{-1}	4.18%

Table 2: Relative standard deviation (RSD) for various elements analyzed inICP-MS with mean detection limit

Parameter	Method Detection Limit	Relative standard deviation
Cd	0.02 mg L^{-1}	3.12%
Cr	0.01 mg L^{-1}	4.83%
Zn	0.01 mg L^{-1}	6.20%
Pb	0.01 mg L^{-1}	3.87%
Fe	0.01 mg L^{-1}	5.20%
Cu	0.02 mg L^{-1}	4.21%
Mn	0.01 mg L^{-1}	4.82%

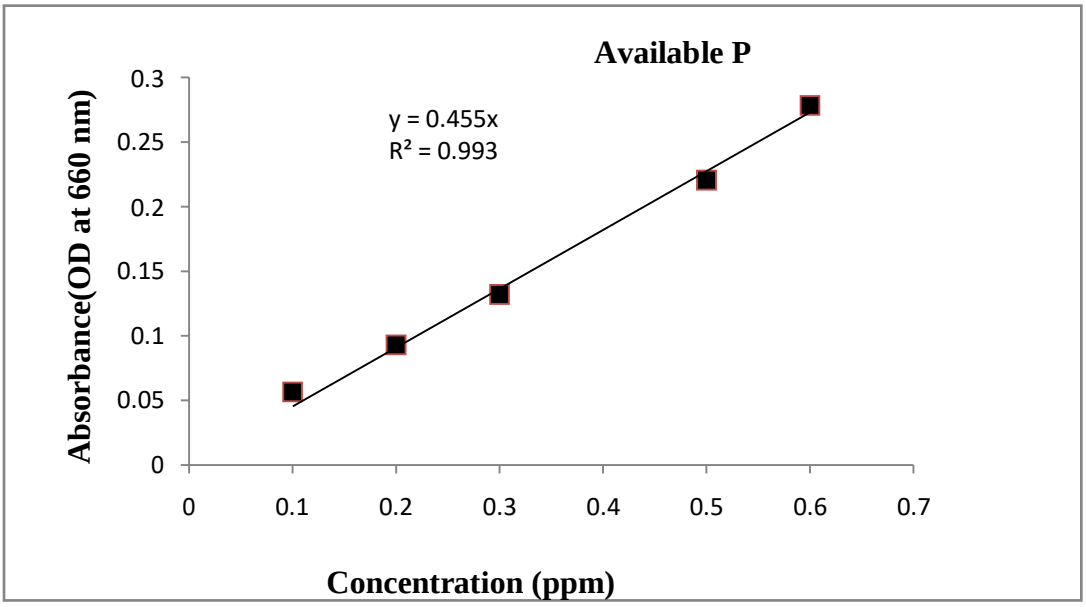

Fig 1: Standard curves for available Phosphorus

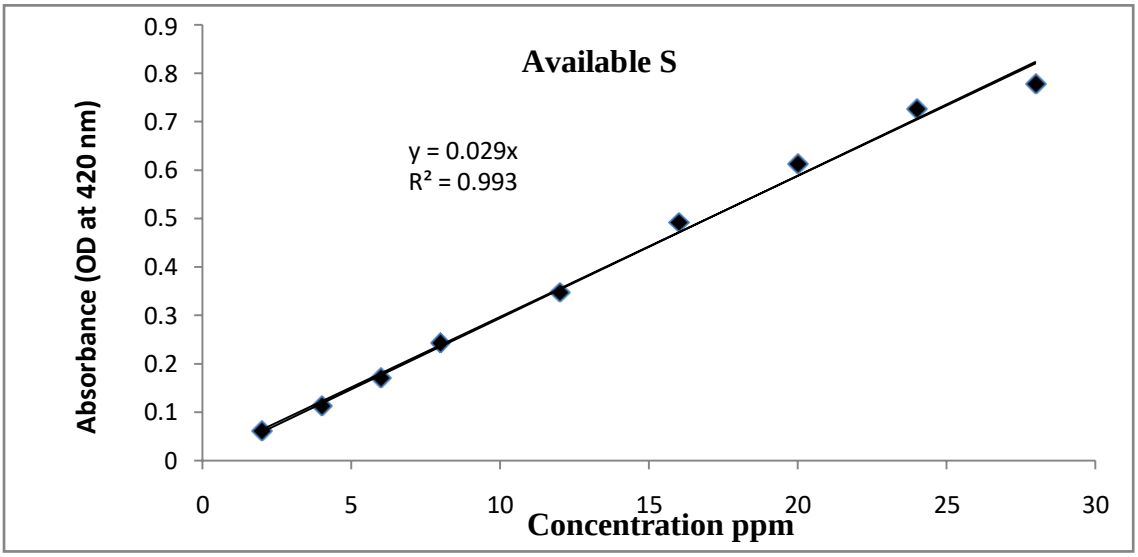

Fig 1: Standard curves for available Sulphur

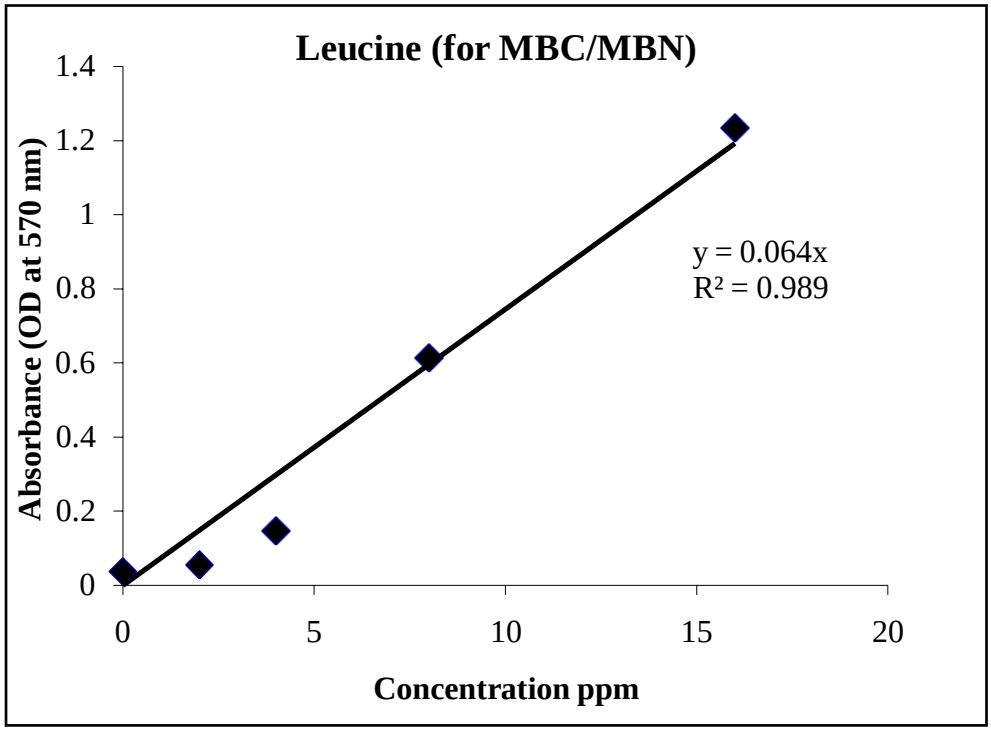

Fig 1: Standard curves for leucine for microbial biomass C

PHOTOGRAPHS

Photo 1: Photographs of Spent Mushroom substrate (SMS)

Photo 2: Pot experiment and large scale vermicompost production

Photo3: Clay and paper paste made perforated-walled truncated cone shaped vermireactor (CPVR)

Photo4 ; Mechanized with shredder and watering device incorporated vermireactors (MSVR)

Science of the Total Environment 716 (2020) 135215

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Appraisal of lignocellusoic biomass degrading potential of three earthworm species using vermireactor mediated with spent mushroom substrate: Compost quality, crystallinity, and microbial community structural analysis

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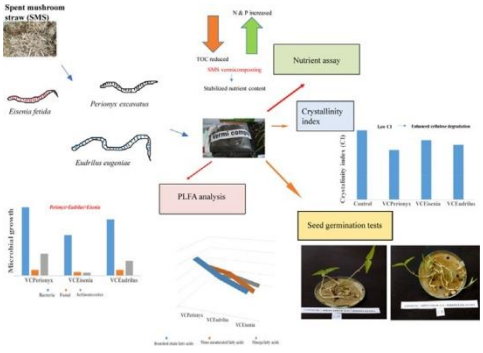
highlights

- SMS degradation greatly varies depending on earthworm species during vermicomposting.
- Biomass degradability of earthworms was first assessed via XRD-crystallinity index.
- PLFA assay revealed greater microbial diversity in *Perionyx* vermibeds than others.
- Vermicomposted SMS was effective enough to greatly boost seed germination and vigor.

graphical abstract



article info

Article history:
Received 14 September 2019
Received in revised form 18 October 2019
Accepted 24 October 2019
Available online 23 November 2019

Editor: Daniel CW Tsang

Keywords:
Spent mushroom substrate (SMS)
Vermicomposting
XRD crystallinity
Microbial community shift

abstract

Spent mushroom substrate (SMS) is a recalcitrant lignocellulosic waste. Recycling of SMS through composting has been reported; however, the process is lengthy due to its complex biochemical composition. Although vermitechnology is known for its high efficiency, it has rarely been applied to recycle SMS. In this study, the qualitative value of vermicomposted SMS mediated by three earthworm species (i.e., *Eisenia fetida*, *Eudrilus eugeniae*, and *Perionyx excavatus*) was evaluated on the basis of nutrient availability, microbial activity, phospholipid fatty acid (PLFA) profiles, and seed germination assays. Degradation profiles of the lignocellulosic substrate in the vermireactors were assessed by monitoring the changes in crystallinity and distribution of functional groups using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy, respectively. Total organic carbon decreased by 1.4–3.5 folds with approximately 2.1–2.4 folds increase in nitrogen and phosphorus availability in all vermibeds. Interestingly, pH declined in the *Eisenia* and *Eudrilus* systems but increased in the *Perionyx*-vermibeds. XRD-derived crystallinity index was reduced significantly by 1.37 folds in *Perionyx*-vermicompost with concurrent microbial enrichment. Further, profuse abundance of vital functional groups (C@O, NH, and OH) was clearly

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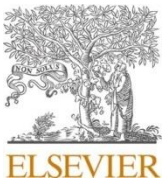
https://doi.org/10.1016/j.scitotenv.2019.135215

Bioresource Technology 367 (2023) 128305



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Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Earthworm stocking density regulates microbial community structure and fatty acid profiles during vermicomposting of lignocellulosic waste: Unraveling the microbe-metal and mineralization-humification interactions

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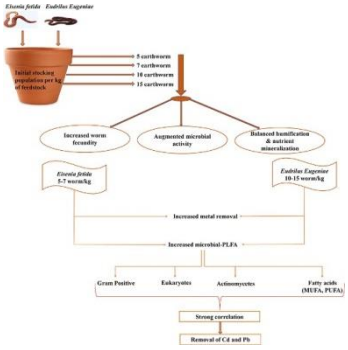
HIGHLIGHTS

- Thin earthworm stocking promotes degradation of lignocellulosic vermibeds.
- 5–7 earthworm/kg stocking improved fecundity, humification, and NPK availability.
- Thin *Eisenia* stocking and dense *Eudrilus* stocking enriched microbial-PLFA profiles.
- Metal removal efficacy of *Eisenia fetida* enhanced by thin initial stocking density.
- Microbial-PLFA strongly regulated metal availability in lignocellulosic vermibeds.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Stocking density
Earthworms
Lignocellulosic waste
PLFA-assay
Metal removal

ABSTRACT

Earthworm-induced microbial enrichment is the key to success in vermitechnology, yet the influence of initial earthworm stocking density on microbial community profiles in vermibeds is unknown. Therefore, vermicomposting of lignocellulosic feedstock was performed with different stocking densities of two earthworms (*Eisenia fetida* and *Eudrilus eugeniae*) compared with composting. Eventually, earthworm growth, microbial (activity and community profiles), and physicochemical dynamics were assessed. The earthworm population significantly increased under low stocking, while denser stocking (15/kg) was stressful. The XRD-based crystallinity assessment revealed that comminuting efficiency of *Eisenia* and *Eudrilus* was prudent at 7 and 10 worm/kg stockings, respectively. Moreover, the 5 and 7 worm/kg stockings effectively mobilized microbial activity, promoting NPK-mineralization and C-humification balance. Correlation statistics indicated that earthworm stocking density-driven microbial community shift and fatty acid profiles strongly influenced metal removal in vermibeds. Hence, the findings implied that 5–7 worm/kg stockings of earthworms produced high-quality sanitized vermicompost.

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https://doi.org/10.1016/j.biortech.2022.128305
Received 26 September 2022; Received in revised form 2 November 2022; Accepted 5 November 2022
Available online 9 November 2022