Pyrolysis and co-composting of municipal organic waste in Bangladesh: A quantitative estimate of recyclable nutrients, greenhouse gas emissions, and economic benefits(Article)

- Mia, S.,
- Uddin, M.E.,
- Kader, M.A.,
- Ahsan, A.,
- Mannan, M.A.,
- Hossain, M.M.,
- Solaiman, Z.M.
- View Correspondence (jump link)
- [a]Centre for Carbon, Water and Food, The University of Sydney, Camden, Australia
- [b]Department of Agronomy, Patuakhali Science and Technology University, Bangladesh
- [c]Department of Agricultural Extension and Rural Development, Patuakhali Science and Technology University, Bangladesh

View additional affiliations

Abstract

Waste causes environmental pollution and greenhouse gas (GHG) emissions when it is not managed sustainably. In Bangladesh, municipal organic waste (MOW) is partially collected and landfilled. Thus, it causes deterioration of the environment urging a recycle-oriented waste management system. In this study, we propose a waste management system through pyrolysis of selective MOW for biochar production and composting of the remainder with biochar as an

additive. We estimated the carbon (C), nitrogen (N), phosphorus (P) and potassium (K) recycling potentials in the new techniques of waste management. Waste generation of a city was calculated using population density and per capita waste generation rate (PWGR). Two indicators of economic development, i.e., gross domestic product (GDP) and per capita gross national income (GNI) were used to adopt PWGR with a projected contribution of 5–20% to waste generation. The projected PWGR was then validated with a survey. The waste generation from urban areas of Bangladesh in 2016 was estimated between 15,507 and 15,888 t day^{-1} with a large share (~75%) of organic waste. Adoption of the proposed system could produce 3936 t day^{-1} biochar blended compost with an annual return of US $210 million in 2016 while it could reduce GHG emission substantially (−503 CO_2 e t^{-1} municipal waste). Moreover, the proposed system would able to recover ~46%, 54%, 54% and 61% of total C, N, P and K content in the initial waste, respectively. We also provide a projection of waste generation and nutrient recycling potentials for the year 2035. The proposed method could be a self-sustaining policy option for waste management as it would generate ~US$51 from each tonne of waste. Moreover, a significant amount of nutrients can be recycled to agriculture while contributing to the reduction in environmental pollution and GHG emission. © 2018 Elsevier Ltd

Author keywords

Agricultural and environmental sustainabilityBiocharCompostingGHG emissionOrganic waste recycling

Indexed keywords

Engineering controlled terms:	Agricultural pollutionDeteriorationEconomic and social effectsGas emissionsGreenh gasesNutrientsPopulation statisticsPyrolysisRecyclingSustainable developmentWast
Engineering uncontrolled terms	Agricultural sustainabilityBangladeshBiocharEnvironmental sustainabilityGreenhous waste recyclingOrganic wastesPer capitaWaste generationWastes recycling
Engineering main heading:	Composting
EMTREE drug terms:	carbonnitrogenphosphoruspotassium
GEOBASE Subject Index:	biocharcompostingestimation methodgreenhouse gasmunicipal solid wastepyrolysi analysisrecyclingsustainability