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Chemical Analysis of Kitchen Waste for Developing Formulae for Compost Fertilizer

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Abstract

The rapid growth of the global population and changes in food consumption patterns have resulted in issues relating to food insecurity. Improved strategic solutions are needed to allow easy access to food and also to manage large volumes of waste efficiently. From this research, a microeconomic-level solution to manage the aforementioned issues is addressed. Common kitchen waste such as peels and discarded parts of fruits and vegetables can be combined to produce compost fertilizer. Producing compost fertilizer in this manner can be considered a microeconomic-level waste management strategy. Compost fertilizer produced using kitchen waste can subsequently be used in home gardening. Many vegetables and fruits can easily be cultivated in small, confined spaces such as in home gardens. This study analyzed chemical parameters such as total carbon and other total nutrient levels (N, P, Ca, Mg and K) in ten kitchen waste and two supplementary samples using standard methods. The kitchen waste samples consisted of peels and discarded parts of fruits and vegetables. The two supplementary samples- *Tithonia diversifolia* (Wild sunflower), and *Gliricidia sepium* were chosen because they are nutrient-rich organic fertilizers. The analysis results were then fed to a computer program developed for this study. It was based on the simulated annealing algorithm. The program generated different formulae for producing 100 g mixtures of raw materials for composting, by mixing the 10 kitchen waste and 2 supplementary samples in 24 different combinations. The nutrient levels of these mixtures were expected to match or exceed a calculated "target nutrient level". It was calculated based on local compost fertilizer standards and the chemical analysis results. The target nutrient level calculated as the minimum required level by dry mass of each material was 25.00% Carbon, 1.25% Nitrogen, 0.63% Phosphorus, 1.25% Potassium, 0.88% Calcium, and 0.63% Magnesium. The program was able to generate mixtures of raw materials in which most of the levels matched or exceeded the target level. However, the phosphorus levels of all formulae fell below the target phosphorus level and in some mixtures, the magnesium level also was less than the targeted level. The actual nutrient level of one of the 100 g mixtures (combination C3) containing 0.19 g banana stem, 0.21 g discarded tea grounds, 0.41 g discarded scraped coconut, 0.57 g banana peel, and 97.34 g *Gliricidia* leaves was (% by dry mass), 85.68% Carbon, 2.20% Nitrogen, 0.25% Phosphorus, 1.32% Potassium, 2.24% Calcium and 0.71% Magnesium. This promising method can further be developed by adding more nutrient-rich raw materials to the program. The program could be a useful tool for compost fertilizer manufacturing, especially for small-scale horticultural purposes.

Keywords: Compost, Waste management, Nutrient analysis, Kitchen waste