Thrown, but Will It Break Down? - A Study of the Correlation of the pH of Soil and Its Effect on the Rate at which Biodegradable Materials Decompose and the Application of the Findings of this Experiment in Landfills

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Each year, 60 million tons of biodegradable and organic matter are thrown into landfills, where they are unable to decompose and continuously produce greenhouse gases. Despite a proposed correlation between biodegradable materials' (i.e. organic matter) decomposition and soil pH, the correlation has not been explored with human-made biodegradable products. Addressing this, in this experiment, the rate of decomposition of human-made biodegradable materials (egg cartons) was measured at 4 different pH levels (5, 6, 7 and 8), with earthworm decomposers being added in each pH level. This study found that biodegradable material within the pH of 5 had the fastest rate of decomposition (89.75%) in 6 weeks, followed by the biodegradable material within pH 6 (78.83%), the pH 7 (68.24%), and the pH 8 exhibiting the slowest rate of decomposition (60.08%). The higher rate of decomposition in the more acidic pH can be attributed to the high concentration of hydrogen ions, disrupting intermolecular bonds and more efficiently breaking down matter. Additionally, at alkaline pH levels, nutrients are strongly bound due to a high anion and cation exchange capacity; preventing these nutrients from being utilized by the earthworms, unlike acidic pH levels. The application of such results will be vital for landfills, particularly in developing countries, where the soil pH of landfills can be altered, and the optimal conditions for decomposition implemented. This study proposes a simple and cost-effective method that can drastically improve the decomposition of biodegradable materials in landfills in developing countries.

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Second Award of $2,000

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