Decomposition of waste materials in surface and subsurface soil

Patty Hernandez, Evelyn Leon, Christian Uribe, and Daniel A. Bair
EnvironMentors-AggieMentors
University of California Davis / Woodland High School

Introduction

In 2012, more than 251 million tons of municipal solid waste was generated in the United States. Paper and cardboard accounted for 27 percent of the total waste and plastics comprised about 13 percent (EPA, 2012). Each of these waste materials has a different decomposition rate in the environment. We studied the microbial degradation of different waste materials in Argonaut silty loam soil. This soil is typical of the Sierra Foothills. We studied the differences in decomposition rates in surface and subsurface soil. We also learned about microbes, and their impact on decomposition. Microbes play a significant part in breaking down materials and producing CO₂. Our hypothesis is that the use of topsoil will decompose the materials at a faster rate.

Objective

The purpose of this experiment was to determine which waste materials decomposed the fastest in surface and subsurface soil.

Materials and Methods

- 32 mason jars were separated into groups of 8 by the type of packaging material inside then separated into 2 sub-groups based on the type of soil
- Types of soil: Argonaut surface (0-15cm) soil and subsurface (16-30cm) soil
- 3 types of typical waste materials were used: paper, plastic (grocery bags) and cardboard - 0.5 grams of waste material were added to respective jars
- 10 grams of distilled water added to each jar to give microbes an ideal habitat
- Sealed air tight and kept at room temperature for one week
- Used a device that measures the concentration of CO₂ in each jar. We then recorded the data in an Excel document comparing our numbers

Results

Our data results concluded that the jars that had surface soil stimulated more levels of CO₂ concentration than the jars that contained subsurface soil. The rate of decomposition of waste materials was greatest for cardboard followed by paper. Plastic was not different from the blank in each soil treatment.

Discussion

About half of the microbial biomass is located in the upper 15cm of a soil profile and therefore, this is where higher decomposition rates would be expected (Murphy et al., 1998). Although no waste material was added to the blanks, we saw CO₂ accumulation likely due to the decomposition of organic matter originally in the soil. Of the samples where waste materials were added, CO₂ levels were greatest in the cardboard and paper treatments in the surface soil and the cardboard treatment of the subsurface soil. CO₂ levels were no greater in plastic treatments than the blanks. These results signify that there is greater decomposition in surface soil than subsurface soil due to the presence of more microbes and that paper products are more easily degraded than plastic.

Summary

In using Argonat surface and subsurface soil, we found the microbes aided in decomposing the cardboard and paper waste materials. However, the group of jars that showed the highest levels of CO₂ concentrations were the jars with topsoil decomposing cardboard.

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Works Cited