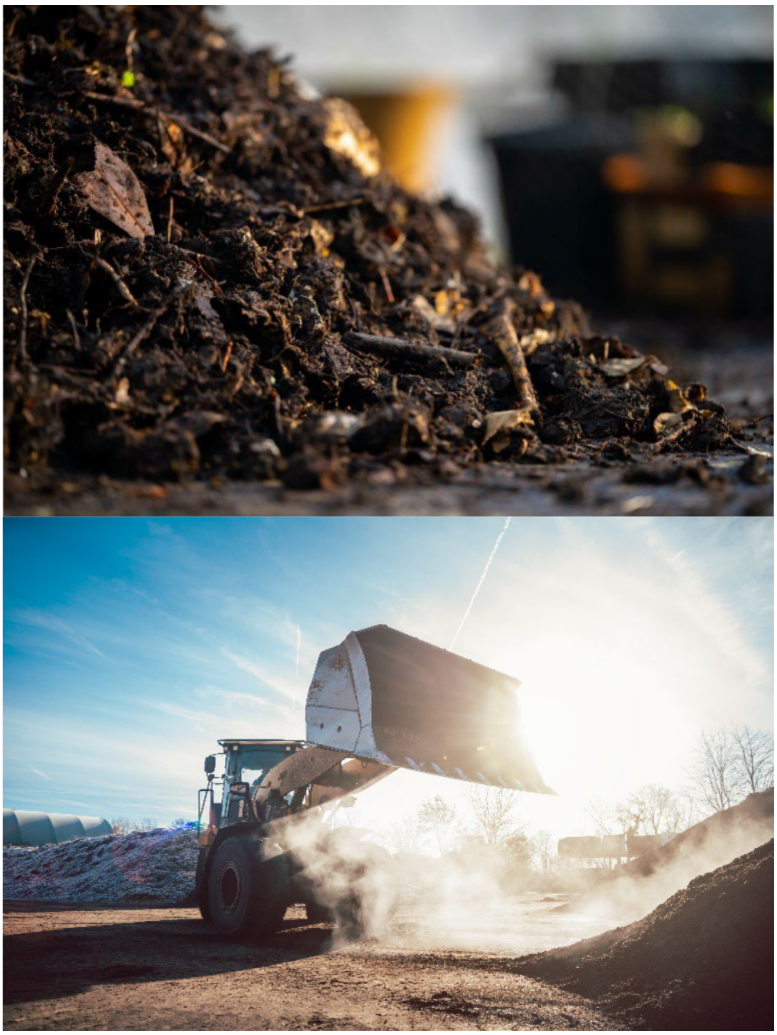
HSLU Hochschule Luzern

Practical 1:

Composting Parameters and Plant Tolerance Test



Environmental Chemistry and Biology HS2024

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1 Composting parameters and plant tolerance test

1.1 Introduction

With this laboratory we will look at the effect of different types of compost and how it affects the growth of plants.

Understanding the chemical and physical reactions that occur between composite materials and plants is essential to developing sustainable agricultural practices.

1.2 Materials and methods

Detail the materials used and the step-by-step procedure followed in the experiment.

1.3 Results

1.3.1 Preliminary parameters

We collected three samples: Fresh, Finished, and Standard, and valuated them based on several characteristics, including pH, color, texture, odor, foreign objects, and moisture content. Each sample had distinct features, which helped us assess their condition and quality.

Table 1: Results of preliminary parameters

Sample name	**pH**	**Color**	**Texture**	**Odor**	**Foreign objects**	**Moisture fist test**
Fresh	9	Light brown	Coarse	Smells ammonia	–	30% humidity
Finished	8	Dark brown	Fine	Smells ammonia	Sticks and plastic particles	20% humidity
Standard	7	Darkest brown	Clumpy	Smells earthy	–	30% humidity

1.3.2 Fresh, Finished and Standard compost

Three samples were collected, and their raw unit weight was evaluated. The mass of the empty cylinder was measured in grams, with a value of 168.24 g. The mass of the filled cylinder for each sample was then measured, obtaining values in liters. The volume of each sample was also measured in milliliters. Using these measurements, the density results were calculated in both [kg/L] and [kg/m^3] using the formulas:

$$\text{Density}\,[kg/L] = \frac{\text{Mass of filled cylinder}\,[g] - \text{Mass of empty cylinder}\,[g]}{\text{Volume of sample}\,[mL]}$$

$$\text{Density}\left[kg/m^3\right] = \text{Density}\,[kg/L] \cdot 1000\left[L/m^3\right]$$

The average values provided insight into the consistency of the raw unit weight across the different samples.

1.3.3 Fresh compost

Table 2: Results of raw unit weight in three different samples of fresh compost

Sample	**1**	**2**	**3**	**Average**
Mass of the empty cylinder in [g]	168.24			
Mass of the filled cylinder [g]	120.88	112.20	108.71	113.93
Volume of the sample in [mL]	340	330	390	353.33
Result in [kg/L]	0.356	0.34	0.279	0.325
Result in [kg/m^3]	356	340	279	325

1.3.4 Finished compost

Table 3: Results of raw unit weight in three different samples of finished compost

Sample	**1**	**2**	**3**	**Average**
Mass of the empty cylinder in [g]	168.24			
Mass of the filled cylinder [g]	214.54	202.91	202.68	206.71
Volume of the sample in [mL]	375	370	380	375
Result in [kg/L]	0.572	0.548	0.533	0.551
Result in [kg/m^3]	572	548	533	551

1.3.5 Standard compost

Table 4: Results of raw unit weight in three different samples of standard compost

Sample	**1**	**2**	**3**	**Average**
Mass of the empty cylinder in [g]	168.24			
Mass of the filled cylinder [g]	222.95	228.44	212.74	221.38
Volume of the sample in [mL]	355	370	360	361.67
Result in [kg/L]	0.628	0.617	0.591	0.612
Result in [kg/m^3]	628	617	591	612

1.4 Experiment results

Table 5: Experiment results

Group 4	**E0**	**E0**	**E25**	**E25**	**E50**	**E50**
n° germinated seeds	12	13	11	12	11	10
weight (g)	1.672	1.882	0.997	1.294	1.058	1.105

1.5 Discussion

Interpret the results, discussing and answering the questions.

1.5.1 Results discussion

1.5.2 Questions

1. What is the difference between raw unit weight and bulk density? Discuss your results based on the laboratory experiment.

   R:
   Raw unit weight measures the mass of fresh compost per volume, while bulk density includes porosity and moisture. Bulk density is essential for assessing aeration and microbial activity, impacting compost structure and decomposition efficiency.

2. How can the pH affect the compost?

   R:
   pH affects microbial activitiy in composing. Optimal pH (6-8) enhances microbial efficiency, while extreme pH values (near 1 or 14) slow down decomposition and affect nutrient availability.

3. What is the impact of immature compost on plant growth, and how can this be assessed in the lab?

   R:
   Immature compst harms plant growth due to high microbial activity, which depletes oxygen and releases toxic substances. In the lab, plant tolerance tests measure the compost's effect on germination and growth.

4. How do you calculate the bulk density of compost, and why is this measurement important in the composting process?

   R:
   Bulk density is calculated as $\frac{\text{mass}}{\text{volume}}$. It is crucial for determining porosity, air flow and moisture retention, directly affecting microbial activity and compost quality.

5. What would be the environmental impact if fresh compost is added in the plantations/agriculture or when the recommended percentage of compost mixture is not followed?

   R:
   Using fresh or excessive compost can release methane, impair growth through nitrogen depletion, and cause nutrient leaching, leading to water contamination.

1.6 Conclusion

Summarize the key findings and their implications.

1.7 References

List any sources or references used for understanding the experiment.

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