

Comparison study between the methods for compost maturity determination

Soon Ik Kwon^A, Kwon Rae Kim^B, Seung Gil Hong^A, Woo Kyun Park^A and Deog Bae Lee^A

^ADepartment of Agro-environment, National Academy of Agricultural Science, RDA, Suwon, Korea, Email sikwon@korea.kr

^BDivision of Environmental Science & Ecological Engineering, Korea University, Seoul, Korea, Email Kimkr419@korea.ac.kr

Abstract

Manure-based composts can have detrimental effects on the agricultural lands and crops if they are applied without a proper stabilization process. Composting is a well-known method for stabilization of manure-based composts and it can be examined by a maturity test. Among various maturity tests, two mechanical methods (Solvita and CoMMe-100) were compared with germination test. The mechanical methods are considered as relatively objective compared to other methods. Also they are cost and time efficient. Ten commercially available composts collected in Korea were used for this study. Despite some differences between the extents of maturity determined by the two methods, it was possible to adjust the measurements to be in good agreement between two methods through extending the reaction time for CoMMe-100 and adjusting the index level for maturity determination in the standard color chart. Also both methods were in good agreement with results of the seed germination test.

Key Words

Compost maturity, Solvita, CoMMe-100, germination index.

Introduction

Manure composting is a well established approach for the stabilization of nutrients and the reduction of pathogens and odours in manures (US Composting Council 2000), which can be evaluated as compost mature. Compost maturity is one of the significant parameters to evaluate the quality of compost and hence a wide range of maturity test has been developed and applied. Maturity can be estimated by self-heating reaction, seed germination rate, oxygen consumption rate, respiration rate, earthworm response, and generation of CO₂/NH₃. Each method has disadvantages such as being time consuming, less accuracy, and high cost. Also, in most cases, maturity test using only one method does not reflect the actual extent of maturity. Hence, application of multi methodologies is recommended. The current study was conducted to compare the commercially available maturity testers Solvita and CoMMe-100 in association with a comparison with a seed germination test. Solvita and CoMMe-100 use colorimetric methods to examine the amount of generated CO₂ and NH₃ from sample compost.

Methods

Composts

Commercially available composts in Korea were collected for this study. The composts consisted of about 50 % animal manure and the rest of organic materials such as hulls and saw dusts. From the preliminary test, ten composts at different stage of composting were selected and measured by selected methods for determining maturity.

Measurement

Solvita measurement: Moisture adjusted compost (100 mL) was incubated in 200 mL container with solvita reactor for 4 hours and then the extent of collar change was measured using DCR (Digital Color Reader, Solvita®). The maturity was determined through comparison between measured DCR value and the standard color chart. **CoMMe-100:** Measurement using CoMMe-100 was similar with the procedure of Solvita but for comparison study, the measurement was conducted at different reaction times (one, two, and 4 hours). **Seed germination test:** Radish and lettuce seeds were germinated in the water extracts from composts. Five days after germination, root elongation and germination rate were measured.

Result and Conclusion

Both methods color reaction testes indicated similar trends in maturity for ten samples even if there was some difference in the absolute maturity level. For example, CoMMe-100 indicated the compost was be fully matured for C2 sample while Solvita showed it was in the last stage of composting. The discrepancy between the two methods could be corrected by adjusting the reaction time and changing the index level in the

standard color chart. In the seed germination test, lettuce seed was more sensitive than radish seed but the trend of germination rate to reflect compost maturity was similar. Also the results of the chemical methods were in good agreement with those of the seed germination test.

Table 1. Comparison of two methods using color reactions of ammonia and carbon dioxide for testing compost maturity.

Sample	Solvita								CoMMe-100				
	←raw				mature→				←raw		mature→		
	1	2	3	4	5	6	7	8	1	2	3	4	5
C1		•										•	
C2						•							•
C3					•								•
C4			•									•	
C5					•								•
C6					•								•
C7							•						•
C8		•								•			
C9		•							•				
C10							•						•

Table 2. Seed germination index for compost maturity.

Sample	radish			lettuce		
	GR	RE	GI	GR	RE	GI
C1	9.2	8.9	0.8	79.5	0.0	0.0
C2	101.1	89.4	90.4	86.6	93.6	81.1
C3	95.3	58.5	55.7	66.8	55.6	37.2
C4	100.0	71.6	71.6	91.6	59.8	54.7
C5	101.1	77.4	78.2	88.0	51.9	45.6
C6	101.1	74.5	75.3	83.7	67.7	56.7
C7	101.1	70.8	71.6	75.3	47.0	35.4
C8	102.3	100.0	102.3	2.9	0.0	0.0
C9	75.8	52.7	40.0	0.0	0.0	0.0
C10	98.9	79.4	78.5	57.0	61.7	35.2

GR : Germination ratio, RE : Root elongation, GI : Germination index

GR = (germination rate/germination rate of control) × 100

RE = (root length/root length of control) × 100

GI = GR × RE / 100

Table 3. Pierson correlation coefficient between compost maturity tests.

	Solvita	CoMMe-100	Radish GI
CoMMe-100	0.830**		
Radish GI	0.586	0.196	
Lettuce GI	0.675*	0.724**	0.498

Reference

Changa CM, Wang P, Watson ME, Hoitink HAJ, Michel Jr. FC (2003) Assessment of the reliability of a commercial maturity test kit for composted manures. *Compost Science and Utilization* **11**,125-143.