

Determining the extraction conditions and phytotoxicity threshold for compost maturity evaluation using the seed germination index method

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The germination index (GI) is a widely used, sensitive, and reliable biological marker for evaluating compost maturity and phytotoxicity (Zhan et al., 2021). The phytotoxicity of the compost depends on the content of toxic substances (Said-pullicino et al., 2007; Young et al., 2016). Therefore, to appropriately analyse the phytotoxicity variations of compost and clarify the comparability of phytotoxicity with varied moisture levels, it is necessary to exclude errors caused by moisture content. To make compost phytotoxicity assessment more reliable and comparable to the seed GI method, the moisture content and extraction ratio of the compost samples must be regulated. Previous studies have focused on the key phytotoxic substances affecting seed germination and analyzed the response relationship between these phytotoxic substances and GI; however, few studies have systematically identified the core phytotoxic substances and determined their safety thresholds of these substances (Ansari et al., 2021; Milon et al., 2022).

Therefore, this study analyzed the effects of different extraction condition of compost samples on GI, and established the relationship between phytotoxicity and GI. The results showed that the moisture content and extraction ratio of the compost significantly affected the GI. The extraction ratio for the compost with 60–70% moisture content was 1:10 (ratio of compost mass to extract volume). However, commercial compost, which must have a moisture content of 30–45%, had an extraction ratio of 1:30 (w:v). More importantly, compost extraction based on dry weight, with a moisture content of 10–15%, more effectively reflected the phytotoxicity variations during composting. In such cases, the extraction ratio should be at least 1:30 (w:v) but not exceed 1:50 (w:v). The relationship between phytotoxicity and GI showed that dissolved organic carbon and dissolved nitrogen were the most important factors influencing GI, followed by NH_4^+ , electrical conductivity, K, volatile fatty acids, Zn, and Cu. For composts with a GI greater than 70%, the dissolved organic carbon, dissolved nitrogen, and NH_4^+ concentrations were below 257, 164, and 73 mg/L, respectively. These findings provide an optimized standard method for compost maturity evaluation using GI and a concentration threshold of key phytotoxicity is proposed to achieve accurate control of compost maturity.

Keywords: Composting, Germination index, Extraction ratio, Moisture content, Phytotoxicity.

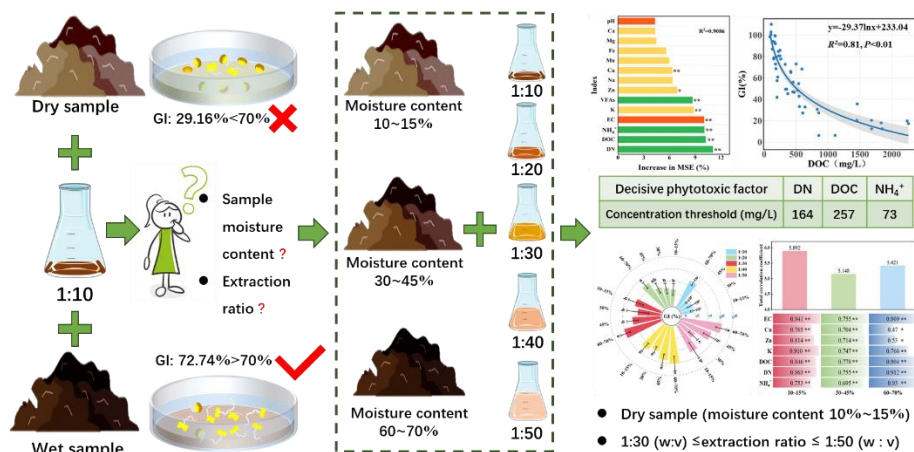


Figure 1. Graphical abstract

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