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Effect of storage conditions on vermicompost quality

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To study the effects of storage conditions on vermicompost, an experiment was conducted with freshly prepared, un-dried fresh vermicompost (60% moisture), and pre-air dried vermicompost (30% moisture) stored in polythene bags for a period of four weeks under different moisture and aeration conditions. Three different storage conditions were tested by placing fresh and pre-dried vermicompost in: (1) open bags, (2) holed bags and (3) sealed bags. Vermicompost properties were analysed weekly for four weeks after storage. The moisture content declined in both fresh and pre-dried vermicompost, with a maximum decline under open bag condition, followed by holed and sealed bags. In the sealed airtight bags with fresh vermicompost, a rapid decline in total organic carbon, nitrogen and electrical conductivity was observed during the first and second week of storage, possibly due to microbially-triggered volatilization losses. However, such decline was lacking in pre-dried vermicompost. In open and holed bags, the carbon and nitrogen were retained and rather increased during storage, possibly due to ongoing aerobic decomposition and no volatilization losses. The highest nutrient quality was observed under predried holed bag conditions, possibly due to optimal microbial activity releasing nutrients, combined with no volatilization losses. It was concluded that fresh vermicompost must be air-dried before its storage in bags. Storage of air-dried vermicompost under aerobic conditions using open/holed bags appears to be the best option for retaining nutrients and quality of vermicompost.

Keywords: Carbon, electrical conductivity, nitrogen, quality, storage conditions, vermicompost.

VERMICOMPOST is widely used as an organic source of nutrients and carbon due to its high availability of nutrients and also for improving soil aeration, water-holding capacity, buffer capacity, and cation exchange capacity of soils[1,2]. Application of agrochemicals for

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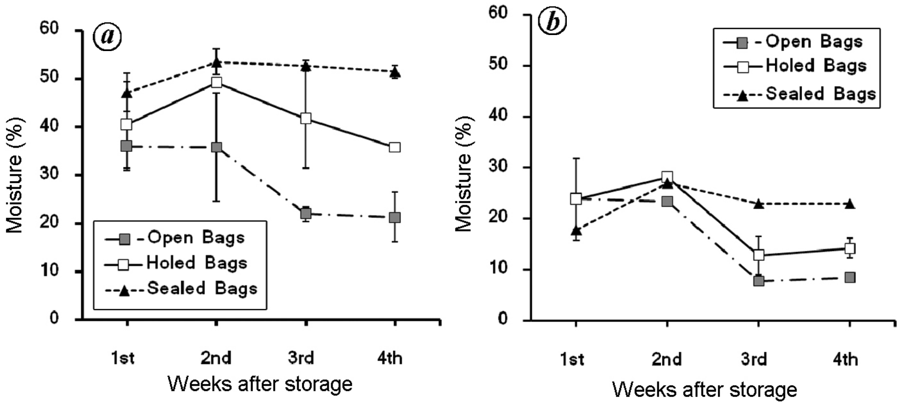

Figure 1. Changes in moisture percentage during storage of fresh vermicompost (***a***) and pre-dried vermicompost (***b***) stored under different condition of open, holed and sealed polythene bags across storage time. (Bars indicate ± 1 standard deviation.)

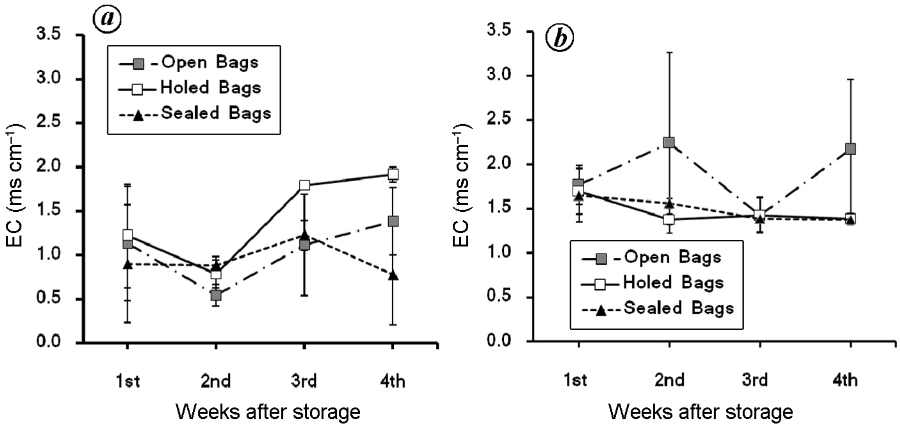

Figure 2. Changes in electrical conductivity during storage of fresh vermicompost (***a***) and pre-dried vermicompost (***b***) stored under different condition of open, holed and sealed polythene bags across different storage time. (Bars indicate ± 1 standard deviation.)

growth and yield enhancement of crops produce harmful consequences to the environment[3]. Organic farming systems using compost or vermicompost heavily rely on the nutrients of biological origin in the soil. Vermicompost is excreta of earthworms with high amounts of humus, nitrogen (N), phosphorous, potassium, micronutrients and beneficial soil microorganims[4,5]. Previous studies have shown that vermicompost can positively affect soil physical and chemical properties[6,7]. However, in farmers' fields, vermicompost is stored under a wide range of conditions before its field application. Changes occurring in the nutrient concentration and other qualities of vermicompost during storage are unknown, although a few studies have reported major changes[8,9]. In the present study, we therefore investigated the effects of various storage conditions on vermicompost quality.

The vermicompost used in the present work was generated from cow dung and the epigeic species *Eisenia foetida*. The polythene bags used for storage of vermicompost had a capacity of 1 kg, length of 25 cm and a width of 18 cm. In each bag, 0.5 kg of vermicompost was stored.

Freshly prepared vermicompost, (A), and vermicompost air-dried for 20 days, (B), were kept at room temperature under different storage treatments: (1) Open bags (bags kept open during storage), (2) Holed bags (bags punched with about 30 holes of 0.3 mm each all over), and (3) Sealed bags (sealed airtight after adding vermicompost). The six storage treatments of vermicompost were replicated 12 times leading to a total of 72 bags. Every week, three bags of each treatment were taken and analysed for physico-chemical properties and nutrient status. Moisture in the vermicompost was determined by gravimetry. Electrical conductivity (EC) was measured in suspensions of samples in water (1 : 2, w/v) using a EITM 611E EC meter (Elico, Hyderabad, India). Total N and carbon (C) in vermicompost were analysed by a CHNS Analyzer (Elementar Analysensysteme GmbH, Langenselbold, Germany).

The initial moisture of the storage treatments during week 1 was much higher (30–50% moisture) in fresh undried vermicompost (A), as compared to the pre-dried vermicompost (B; 20–30% moisture) (Figure 1 *a* and *b*).

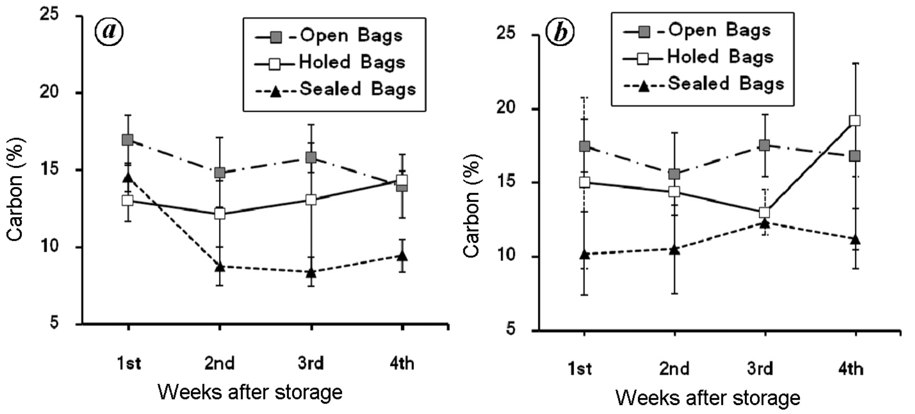

Figure 3. Changes in percentage of carbon during storage of fresh vermicompost (***a***) and pre-dried vermicompost (***b***) stored under different condition of open, holed and sealed polythene bags across storage time. (Bars indicate ± 1 standard deviation.)

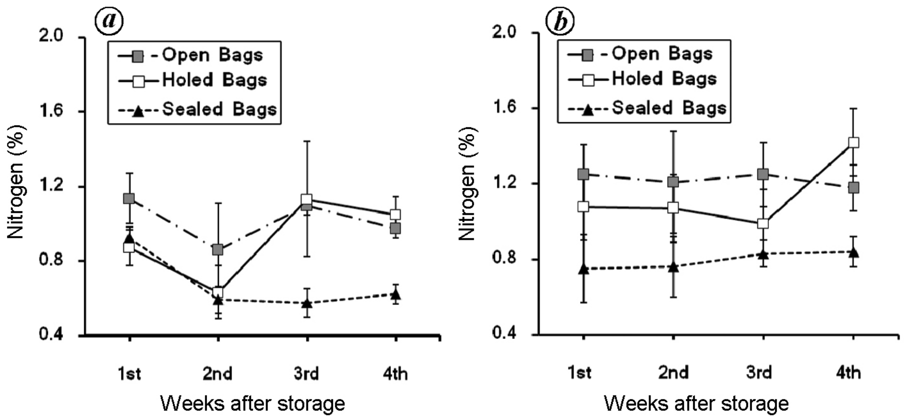

Figure 4. Changes in percentage of nitrogen during storage of fresh vermicompost (***a***) and pre-dried vermicompost (***b***) stored under different conditions of open, holed and sealed polythene bags across different storage time. (Bars indicate ± 1 standard deviation.)

There was a sharp decline in moisture in open bags followed by holed bags and sealed bags up to week 3, which stabilized in week 4. Storage treatments significantly affected the EC until week 2 with the maximum increase in holed bags, which stabilized during the next two weeks. Thus, the EC of vermicompost declined for two weeks across all treatments, but increased in open and holed bags during week 3 and week 4 (Figure 2 *a* and *b*). Total organic C and N declined significantly in sealed bags with fresh vermicompost (Figures 3 *a* and 4 *a*), whereas no such decline was observed in sealed bags with dried vermicompost (Figures 3 *b* and 4 *b*). Organic C and N remained stable in holed and open bags during week 2–3 and increased slightly in holed bags during week 4 in both fresh and pre-dried vermicompost (Figures 3 and 4).

The results clearly showed that the moisture and aeration conditions during storage affect vermicompost's quality. The change in EC might reflect the uptake or release of mineral nutrients by microbial activities under higher moisture and aeration as reported earlier[10]. The C and N losses under anaerobic conditions in sealed bags may be caused by increased microbe-induced volatilization/denitrification. Such losses have also been reported during composting of farm residues[11]. On the otherhand, increase in C and N during storage in holed and open bags may be caused by aerobic decomposition of organic substances and conversion of ammonical nitrogen to nitrates or nitrites due to nitrification and it may improve nutrient quality. Vermicompost is rich in microbial and soil enzyme activities[12,13] and the moisture, aeration or anaerobic conditions during storage play a major role in maintaining its quality.

In vermicompost, there is a continuous process of C mineralization, which, under aerobic and moist conditions enhances nutrient release from undecomposed organic matter, whereas under anaerobic conditions leads to N volatilization losses[8,11]. Therefore fresh vermicompost should be air-dried to reduce microbial activities before its storage. It should be stored under dry and aerobic conditions in order to maintain its quality. Long term storage studies should be conducted to investigate the optimum timing and storage conditions of vermicompost for enhanced benefits in field application.

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A comparative study of antioxidant activity and total phenolic content of fresh juices of some common Indian fruits with their commercial counterparts

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Oxidative stress caused by overproduction of free radicals has been implicated in the pathogenesis of various chronic diseases like cancer, diabetes, cardiovascular diseases, and neurodegenerative and immunological disorders. Physiologically, these free radicals are scavenged continuously by numerous beneficial substances known as antioxidants. Fruits are rich in antioxidants such as ascorbic acid, flavonoids and polyphenols that strengthen our immunity and help us maintain good health. In recent times, there has been an increasing trend to supplement our diet with packaged fruit juices. In light of this, the present study aims to compare the antioxidant activity and total phenolic content (TPC) of commonly available fresh juices of some fruits found in the Indian subcontinent with their commercial counterparts, available in two popular brands. Folin–Ciocalteu method was used to determine TPC, while ferric reducing antioxidant power assay was performed to evaluate the antioxidant activity of fruit juices. Among fresh juices, the highest antioxidant property and TPC was found in pomegranate followed by litchi. Amongst packed fruit juices, the antioxidant property and TPC was highest in pomegranate and lowest in apple. However, when compared with fresh fruit juices, the antioxidant activity as well as TPC of commercial juices were observed to be significantly less in all cases. These observations prompt serious rethinking on the use of commercial juices as a source of antioxidants.

Keywords: Antioxidant activity, fresh fruits, packaged juices, total phenolic content.

REACTIVE oxygen species are known to cause various types of damages to biological systems leading to many non-communicable diseases[1–3]. Several epidemiological studies as well meta-analysis have revealed the protective effect of fruit juices against cancer, stroke and other non-communicable diseases that can be related to the antioxidants found in these fruits. These antioxidants play a crucial role in the maintenance of health and prevention of various pathological conditions such as cardiovascular and neurological diseases, age-related disorders, cancer, etc.[4–6]. A report published in 2003 by the World Health

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