

Co-composting of Sludge and Rice Straw in Full Scale Windrow Piles

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The amount of sludge generated from wastewater treatment plants in Egypt is about 5800 ton of dry solids per day. This amount is expected to increase as a result of the new and planned wastewater treatment plants to be operated for wastewater treatment in Egypt. Sewage sludge can be used as a soil fertilizer/amendment after being composted. Composting process requires, in addition to other design parameters, the adjustment of the carbon to nitrogen ratio (C:N ratio) to obtain a good quality compost in optimum time. The composting requires also the addition of bulking materials. Rice straw is an agricultural solid waste that results from harvesting of rice. The amount of rice straw in Egypt is about 5 million tons/year; around 3.1 million tons/year are unutilized and ultimately burnt in open field (Abdelhady et al. 2014). This practice causes the seasonal air pollution problem in Egypt from the black cloud that is formed. Rice straw is rich in carbon which makes it ideal for co-composting with sludge which is rich in nitrogen and moisture. Rice straw can work also as a bulking agent to produce a high quality compost. Iranzo et al. 2004 concluded the suitability of using rice straw in the composting process. However, very little data is available on the full-scale applications of the system.

The current study aims at investigating the possibility of using rice straw, which causes seasonal air pollution problem in Egypt, as a source of carbon and co-composting with sludge from wastewater in Egypt. Field experiments were carried out on a full scale level using 9 windrow piles at El-Berka treatment facility (El-Gabal El-Asfar, Egypt). Table 1 shows the composition and analysis of different parameters in the materials used in the compost mixtures namely, sludge, rice straw and recycled compost. During the experiments, the mixing ratio of sludge: rice straw: recycling compost (MR) and turning frequency were investigated. Six MR were investigated. They include sludge: rice straw: recycling compost of 1:3:0, 1:1:0, 3:1:0, 2:1:1, 2:0:1 and 1:0:0. Photo 1 shows a pile of rice straw and sludge before mixing them. In addition, three turning frequencies were investigated. They include turning the piles once, twice and three times every week during the composting process. Photo 2 shows a windrow during turning using a turning machine. During the composting process, different parameters were measured with time. These parameters include temperature inside the piles, moisture content, pH, electrical conductivity, total nitrogen, organic matter, ammonia, nitrate, total phosphorus, total potassium and pathogens of the compost.

The results showed that the optimum MR is (1:1:0) with a turning frequency of two times per week for 8 weeks in active composting and 4 weeks in maturation to obtain a safe product. The analysis of the produced compost showed that all metals were way below the acceptable limits.

References

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Iranzo M., Canizares J.V., Roca-Perez L., Sainz-Pardo I., Mormeneo S. and Boluda R. 2004 Characteristics of rice straw and sewage sludge as composting materials in Valencia (Spain). *Bioresource Technology*, 95, 107-112.

Table 1. Analysis of different parameters in the materials used for composting.

Parameter	Sludge	Rice Straw	Recycled Compost
Total Nitrogen (%)	2.5	0.7	1.8
Ash (%)	39.8	18.4	55.0
Total Carbon (%)	34.9	47.3	26.1
Total Phosphorus (%)	0.83	0.11	1.33
Total Potassium (%)	0.31	1.08	0.51
Moisture contents (%)	75	10	30
pH	7.38	7.00	7.80



Photo 1: A pile of sludge mixed with rice straw



Photo 2: A pile during turning.