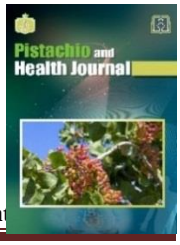

Pistachio Waste Management for Sustainable Development

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Every activity in the modern world is associated with waste production. Produced waste, if not managed, poses many problems for communities in terms of public health [1]. Proper management of production waste is an important step towards promoting public health and enhancing sustainable development [2]. Agricultural-related activities are among those activities that sometimes produce large amounts of waste [3]. Agricultural wastes often contain highly degradable organic compounds that, if not properly managed, can produce large volumes of leachate, which contributes to breeding microorganisms, the production of sludge, and harmful odors in the environment [4].

Conventional waste disposal methods such as incineration, storage, and sanitary landfilling are not suitable for agricultural waste and can have adverse effects on health, the environment, and biodiversity by producing toxic compounds and hazardous gases [5, 6]. Outcomes such as climate change and ultimately upsetting the environmental balance are the consequences of mismanagement of agricultural waste [6].

Among agricultural activities, the pistachio processing or peeling industry is one of the processes that add a large amount of organic waste and wastewater to the environment [7]. If these wastes are left in the environment, they can create a large volume of chemical and biological pollutants that have adverse effects on both the environment and public health [8]. Poor management of production waste in the pistachio peeling industry can pollute the environment and produce Aspergillus fungus whose release into the environment causes the production of unpleasant odors and the growth and reproduction of flies [9, 10]. Release of waste from pistachio processing in pistachio fields can stop plant growth by damaging the roots [9]. High concentrations of organic and phenolic compounds in the waste from pistachio processing cause major problems in pistachio waste management [11].

Agricultural waste recovery has many environmental, health, and economic benefits [12]. The use of biotechnology processes in the management of agricultural waste and processing of production waste has many advantages including the high speed of the process, ease of control, low cost, usability in different sizes, and acceptance in terms of health and environment [13].

In addition to waste disposal, biotechnology processes can lead to the production of products useful for increasing agricultural productivity and sustainable development.

One of the effective biotechnological processes in waste management and increasing productivity in the agricultural industry is co-composting [4]. The co-composting process has been introduced as a suitable strategy for recycling agricultural wastes including wastes from pistachio processing [14]. Compost is an environmentally friendly biological process that uses thermophilic and mesophilic aerobic microorganisms to decompose organic compounds into organic compounds such as CO_2, H_2O, NH_4, and stable organic compounds such as humic compounds [15]. The final products of the composting process can be used as fertilizer in agricultural lands or as a modifier for weak soils [8, 16].

The correct implementation of the composting process and growth of mesophilic and thermophilic microorganisms in this process are highly dependent on the initial waste composition and process management conditions. Since agricultural wastes including those produced by pistachio processing industries are mostly organic and have a high carbon ratio, so correcting the initial composition and adjust the C/N ratio to perform the composting process is essential. The composition of the waste required for the composting process is modified by adding the required materials. Extensive studies have so far been conducted in the field of pistachio processing waste modification to optimize and increase the efficiency of the composting process in pistachio processing waste. For instance, the addition of sludge from the aerobic process of municipal wastewater treatment by activated sludge, cattle manure, or the use of vermicompost instead of a co-compost process for the aerobic decomposition of waste from pistachio processing has been suggested in previous studies [4, 17].

The results suggested that the use of cattle manure and vermicompost process can increase the efficiency of proper compost production while modifying the initial composition [4]. Compost prepared via co-composting modified with cow manure and also vermicompost is fully mature and has suitable final compounds for use as fertilizer in farms [16]. Research has also shown that the final compost was free of toxins and biological contaminants [4, 7].

As an environmentally friendly biological process, the composting process can prevent the entry of large volumes of chemical and biological contaminants into the environment by removing the waste produced in pistachio processing. The composting process can also reduce the need to use chemical fertilizers by producing suitable fertilizers to increase agricultural productivity and produce suitable products. The use of composting process with the production of useful and useful products from wastes whose improper management can lead to environmental pollutants can play an effective role in the sustainable development of agricultural areas that are based on pistachio crop.

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