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ORIGINAL RESEARCH

Utilization of agro-wastes to produce biofertilizer

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Abstract The objective of this study was to develop a simple and cost-effective method to produce biofertilizer using agro-wastes. There were five types of agro-wastes being used in this study. They were wastes from watermelon, papaya, pineapple, citrus orange, and banana. Solid-state fermentation method was used to produce biofertilizer, which was then applied into vegetable plantation. Physical property tests were done on the plant samples of 5 weeks of age in order to determine the effectiveness of the biofertilizer. The results of the experiment showed that the plant samples treated with biofertilizer from watermelon, papaya, and banana wastes had promising physical characteristics. Other tests such as analyses of pH values and potassium content in the biofertilizers were also done in this research. It was found that watermelon biofertilizer had the highest pH value (5.15). The banana biofertilizer had the highest content of potassium with a content of 3.932 g K/L.

Keywords Agro-wastes · Biofertilizer · Solid-state fermentation

Introduction

Agro-waste is defined as waste which is produced from various agriculture activities. These agro-wastes include manures, bedding, plant stalks, hulls, leaves, and vegetable matter. Agro-waste is usually produced through farming activities. In farming situation, the agro-waste is often useless and will be discarded [1]. The accumulation of agro-waste may cause health, safety, environmental, and esthetic concern. Thus, this represents a problem which requires safe disposal [2].

According to Subba Rao [3] and Caprara et al. [4], agro-wastes contain insoluble chemical constituents (e.g., cellulose and lignin) and soluble constituents (e.g., sugar, amino acids, and organic acids). Other constituents are fats, oil waxes, resins, pigment, protein, and mineral. The agro-wastes such as decaying part of plants are the primary source of organic matter in soil [3]. Therefore, agro-wastes are the cheapest source that can be used by farmers to improve the fertility of soil.

Biofertilizer is commonly referred to as the fertilizer that contains living micro-organisms and it is expected that their activities will influence the soil ecosystem and produce supplementary substance for the plants [5]. Recently, many studies and research have been focussed on developing and commercializing agro-waste-based biofertilizer. In Malaysia, the use of microbial inoculants in industry started in late of 1940s, and the most accepted biofertilizer product is the mycorrhiza inoculums [6]. There is proposed MINT-MAH joint research during the year 2002–2004 by Rahim [6] and other biofertilizer manufactures such as IBG Manufacturing Sdn.Bhd.

Over the years, there are plenty of interests of using solid-state fermentation (SSF) process in development of various bioprocesses and products. SSF can be defined as a process that occurs in the absence of free water using solid substrates or support [7, 8]. In SSF, microbial growth and product synthesis are affected by various environmental factors such as water activity, moisture

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