Production of bioethanol and mangiferin from mango peel waste using green technology

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The fruit industries produce large volume of wastes annually worldwide, causing a serious environmental problem. However, only a small portion of fruit waste is recycled and reutilized by animal feed, fertilizer or land spreading (Kiran *et al.*, 2014 and Kasapidou *et al.*, 2015). For these reasons, there is an urgent need to seek resource and value-added use for fruit wastes. At present, the interest in the recovery, bioconversion, recycling, and utilization of valuable constituents from fruit waste has been increased drastically (Galanakis *et al.*, 2012 and Roy *et al.*, 2014).

Mango is one of the most important fruits marketed in the world. Global production of mangoes was about 32 million tons (MT) in 2014 (FAOSTAT, 2014) and it is the second largest tropical fruit crop in the world, after banana. Major byproducts of mango processing are peels and seeds, amount of 35 and 60 % of the total fruit weight, respectively (Tunchaiyaphum *et al.*, 2013). However, mango peel waste (MPW) have high cellulose and hemicellulose contents that can be readily hydrolyzed into fermentable sugars (Carla *et al.*, 2010). It also contains a variety of bioactive compounds, mangiferin being the main active component among them. Mangiferin has attracted a lot of attention because of its various biological activities, such as antioxidative, antiviral, anticancer, antidiabetic, immunomodulatory, and analgesic effects (Zou *et al.*, 2014). MPW also has a significant potential benefit due to its powerful antioxidant properties and high content of phenolic compound. This study aimed to evaluate the potential uses of MPW for bioethanol and mangiferin production. Our integrated approach to MPW utilization is explained in Figure 1.

Figure 1. Value added products from mango peel waste

The carbohydrate content of MPW was analyzed, and the optimal conversion conditions were evaluated by varying enzyme mixtures and loading volumes for reducing sugars production. MPW was converted into bioethanol with 90% yield using separate hydrolysis and fermentation. Mangiferin extraction was also increased by 2.14-fold after complete enzymatic hydrolysis. Besides, magnetic nano particles was utilized to separate mangiferin from MPW extracts. The magnetic nano particles facilitated easy separation and purification of mangiferin. Thus, the value of MPW can be increased through reuse to produce biosugar and magiferin.

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