Effect of Ultrasound on the Extraction of Gallic Acid from Labisia pumila (Kacip Fatimah) for the food applications

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The changes in consumer habits of eating and related health problems have led to a growing demand for herbal based products. Recently, ultrasound-assisted extraction (UAE) has been increasingly reported for extraction from, medicinal plants and herbs due to its economic and green technology. The advantages of using ultrasound for extraction include: enhanced mixing, facilitated energy and mass transfer, and also faster start-up processes, with all of these factors lead to increased production. Ultrasound can also enhance existing extraction processes and enable new commercial extraction opportunities and processes. UAE involves mechanical vibrations derived from sound waves with high power and intensity. Ultrasound can increase in the permeability of the cell wall through mechanical stressing and cavitation effect during the extraction process. This study was carried out to determine the performance of UAE in the extraction of gallic acid from Labisia Pumila (Kacip Fatimah). Labisia pumila is a small herbaceous shrub that roots from the stem with a few leaves pointing upwards white or pink flower. Labisia pumila contains phenolic compounds which have been proven to have multiple biological effects, such as high antioxidant properties and anti-inflammatory activity. The main function of antioxidants is to delay the oxidation processes of other molecules by inhibiting the initiation or propagation of oxidizing chain reactions by free radicals. One important phenolic compound with such antioxidant properties is gallic acid (3,4,5-Trihydroxybenzoic acid). The effect of processing parameters, time and sonication regiments (power intensity and duty cycle) have been studied along with the extraction performance of gallic acid from Labisia pumila. Extraction was conducted by using an ultrasonic processor Q700 (700 watts, 20kHz) provided by QSonica, Newtown, U.S.A with a replaceable flat tip ultrasonic probe (sonotrode) made of titanium alloy that had a tip diameter of 12.7 mm and 127 mm length. The sonication regiments (power intensity and duty cycles) were varied to find the maximum extractable gallic acid concentration. The sonication intensity was calculated using equation I=P/A where A (cm^2) was the area of the sonotrode tip. The A value was 1.27 cm^2. The power intensity was varies (0 - 73.23 $W/cm^{2)}$ for the power level tested and sonication duty was set at 10% , 20% and 100%. A 20% of duty cycle at low power intensity (8.66 W/cm^2) was found to accelerate the extraction process and gave the highest extraction of gallic acid. For the 8 hours extraction, with 20% of duty cycle, the extraction performance was increased by 2-fold. In addition, the processing time was shortened from 8 to 3 hours using a 20% duty cycle to achieve the maximum productivity. This extraction has been successfully done without any chemical aid. In conclusion, ultrasound assisted extraction is an efficient method to improve the extraction efficiency due to its sonochemical effect on the molecular and microstructure of the cell walls of plant.