ABSTRACT

Mango processing waste (MPW) ranging between 25-40%, is an economical and rich source of starch, fat, crude fiber, minerals, phenolics and flavonoids. It is commonly considered that various characteristics of any product are affected by genetic, agronomic and environmental factors. However, studies regarding characterization of by-products from different mango cultivars have been rarely reported. Hence, an attempt was made to investigate the physico-chemical, functional, morphological and phytochemical properties of mango kernel from five cultivars (Chausa, Langra, Neelum, Barahmasi and Dashehari) followed by the selection of the best cultivar kernel for extraction of oil and gallic acid (GA). The HR (Hausner's ratio) and CI (Carr's index) for mango peel powder (HR>1.25-1.4; CI: 20-35) indicated their fair flowing nature, while; mango kernel powder (HR>1.4; CI: 35-45) was revealed to exhibit poor flowability. Almost all cultivars had an impressive amount of essential nutrients required for human well-being. The mineral composition suggested that potassium, calcium, manganese, phosphorus and chlorine were observed as highlighted elements in almost all samples. The micrographs of cryogenic fracture surfaces of Dashehari (MKP) at 2000 and 4000X show the lumpy structure, which might be due to its high moisture content, whereas; MPP presented a fragment like structure. Chausa and Langra kernel had highest fat content and were selected for oil extraction using different solvents (ethanol, petroleum ether and hexane). The results revealed that highest mango kernel oil (MKO) yield (6.94-8.83%) was obtained with hexane. The physico-chemical properties of MKO were within range specified by FAO/WHO for edible, pure and oxidative stable oils. The FTIR absorbance peak of oil from Chausa variety was lower in comparison to Langra, so; there are lower chances of oxidation of the Chausa variety oil. Total seven fatty acids were detected in MKO and it was also revealed that oil from both cultivars of mango showed relative higher percentage of unsaturated fatty acids as compared to cocoa butter. The antioxidant property of mango kernel oil was appreciable which might be due to its fatty acid profile as well as the non-saponifiable matter such as, tocopherols, sterols, their esters and other phenolic compounds. The mango kernel extract (MKE) of the best cultivar (Dashehari) was subjected to LC-MS/MS analysis, which indicated the presence of 50 compounds with specific retention times. After identification, GA i.e. an important industrial compound was targeted and purified using column chromatography with silica gel (230-400 mesh) as stationary phase. The purified GA confirmed by NMR (600 MHz) and

HRMS possessed high antioxidant activity (IC_{50}: 1.96 µg/ml). The defatted mango kernel cake was converted into ash, which acted as a basic medium (pH: 12.53). In order to develop an efficient and eco-friendly catalytic system, hydro extract of defatted mango kernel ash (HEDMKA) was used as a greener catalyst to synthesize the derivatives of benzylidenemalononitriles (C1-4) and iminocoumarins (E1-2) via Knoevenagel condensation reaction. In comparison to other solvent and catalysts, HEDMKA as a solvent cum catalyst gave the best yield of compounds with short reaction time and almost same catalytic power till 2-3 runs. The synthesized compound C3 showed the best antibacterial activity with MIC 93.75 µg/mL and best antifungal activity with inhibition zone of 41 mm.

Waste utilization is a promising measure from both an environmental and economic point of view. The overall outcome of the present investigation depicts that the food industries may take the opportunity to recover and utilize the valuable compounds from agricultural by-products which in turn ensures environmental safety. In this way, the industries can earn profit by cutting the transportation and dumping cost of waste. This would not only bring in extra revenue for the producer but also reduces the amount of accruing waste to be disposed of.

Keywords: Mango kernel powder, Mango kernel oil, Mango kernel extract, LC-MS/MS, Gallic acid, Mango kernel ash, Greener catalyst.