

ABSTRACT

In the fast life of cities, people often prefer processed food as it saves time and reduces workload. So, it is necessary to provide healthy options of processed food to the people. Also, as the demand of processed food is increasing rapidly, the food processing industries would grow at faster rate. India produced 92.84 million metric tonnes of fruits and 175.00 million metric tonnes of vegetables according to National Horticulture Database published by National Horticulture Board (2018-19). India currently processes less than 10% of its agri output. Food Processing sector has been growing at an Average Annual Growth Rate (AAGR) of around 10.%. As the food-processing sector is growing faster, the waste generated will be huge from food industries. However, literature revealed that by-products generated from food processing industries contains phytochemicals and dietary fiber. Presently there is very less study has been done to use this by-product for production of value-added functional foods. This waste can be converted into wealth with cutting edge research and technology, at the same time the environmental problem will also be solved.

There are traditional Indian fruits which has historical importance for its nutritional and functional food value. Gular (*Ficus Racemosa*) is one such fruit which is mentioned in various Indian historical text possessing medicinal properties, *F. racemosa* is pharmacologically studied and reported for various activities including antidiabetic, antipyretic, anti-inflammatory, antitussive, hepatoprotective, and antimicrobial activities.

In the present study, apple and amla juice processing industries by-product called apple and amla pomace respectively were studied. The various physiochemical properties, functional properties and optimization of process parameters for phytochemical extraction of Apple and amla Pomace was studied. The dietary fiber obtained from apple and amla pomace was used to develop functional biscuits enriched with apple, amla and mix pomace. Also, underutilized

gular fruit at IIT Delhi campus was studied for different physiochemical characteristics of gular fruit, which may help in designing and developing of post-harvest processing equipment. The collected fruits were dried using three different techniques, further characterization of dried gular fruit powder has been done.

Apple pomace and amla pomace was dried using different drying methods i.e., sun drying (SD), oven drying (OD) and freeze drying (FD). Dried samples were characterized for properties i.e., proximate composition, dietary fiber content, elemental analysis by using ICP-MS, functional properties (WHC, OHC, SWC, BD, HD and HD), FTIR analysis and morphological properties. The effect of drying method on above properties were studied. It is observed that functional properties of freeze-dried sample were higher followed by oven drying and sun drying.

Optimization of process parameters i.e., A : temperature (°C), B: Time (min) and C: ethanol concentration (v/v) for extraction of polyphenol of both apple and amla pomace were done using response surface methodolog. Optimized process parameters along with their responses are A: (41.98 °C), B: (50.34 min), C: (80.30 v/v) while responses was DPPH (3.41 mg GAE/g) and TPC (3.12 mg GAE/g) for apple pomace extraction. Amla pomace extraction process parameters along with their responses are A: (49.57 °C), B: (37.97 min), C: (84.84 v/v) while responses was DPPH (30.60 mg GAE/g) and TPC (246.12 mg GAE/g).

The dried apple and amla pomace was used to develop functional biscuits. The biscuits were prepared using different concentration of apple (A5%, A10%, A15%, A20%), amla (B5%, B10%, B15%, B20%) and Mix pomace apple-amlam (AB5%, AB10%, AB15%, AB20%). The rheological properties of formulated dough, sensory analysis along with various physico-chemical properties of functional biscuits were studied and found in required range.

Engineering properties of ripe and unripe gular fruits were found as follows: BD: ripe (473) > unripe (486); TD: ripe (824) > unripe (848). Also, coefficient of friction of gular fruit on

different surface was studied, for unripe fruit, the coefficient of friction was 0.48 on wooden, 0.44 on iron, 0.50 on aluminium and 0.49 on GI. While in case of ripened gular fruit, it was found to be 0.37 on wooden, 0.57 on iron, 0.47 on aluminium and 0.38 on GI.

Overall, present study concludes that pressurised liquid extraction technique (PLE) is efficient to extract phytochemicals from apple and amla pomace. The dietary fiber present in both pomace powder can be used as a wheat flour replacer (~15%) for functional biscuits preparation. Unutilized gular fruit powder can be used as a raw material (partial substitute) for functional food preparation.