DESIGN AND DEVELOPMENT OF POMEGRANATE JUICE EXTRACTOR

**Abstract**

**Keywords:** pomegranate fruit, physical and mechanical properties, machine capacity, extraction efficiency, extraction losses, pH, TSS, TA, total sugar, total phenol.

The name pomegranate derives from the Latin word *pomum* meaning apple and *granatus* meaning seeded. At the global level, India is the world’s largest producer of pomegranates, followed by Iran.

Freshly harvested and fully matured pomegranate fruit variety (Bhagwa) were procured from nearby private orchards and measured the physical and mechanical properties pomegranate fruit and arils are necessary in design and development of pomegranate juice extractor. The Physical properties of pomegranate fruits (var. Bhagva) and arils was found that the length, thickness, width, geometric mean diameter, sphericity, aspect ratio and surface area, with their standard deviation and mean were 76.56±3.91, 72.61±2.85, 68.81±3.55, 72.39±2, 0.948±0.049, 0.949±0.067,227.30±6.29 and 9.91±1.27, 7.81±0.93, 6.149±0.826, 7.80±0.843, 0.174±0.066, 0.80±0.09, 24.50±2.65, respectively. The other physical properties such as bulk density, true density, porosity, density ratio and coefficient of friction on glass, galvanized iron and wood surface was determined for pomegranate fruits and arils and those was found as 651.23±26.29 and 584.54±55.50 kg/m3, 980.11±26.55 and 1039.16 ± 22.47 kg/m3, 33.48±3.84, 43±5.72%, 0.66±0.04, 0.56±0.06, 0.437±0.030, 0.794±0.04 and 0.857±0.01 and 0.354±0.027, 0.523±0.016 and 0.574±0.010, respectively.

The mechanical properties of pomegranate fruit and arils an average cutting force, hardness and crushing force of pomegranate fruit and crushing force for arils was found as 22.28±1.115, 45.59±0.886, 25±0.823 and 1.65 kgf, respectively.

Developed pomegranate juice extractor was designed and fabricated with locally available material. The major components of developed pomegranate juice extractor included feed chute, carrier roller, cutting blade, crushing roller, waste outlet, juice collecting platform, juice filter, electrical motor, spur gear arrangement and chain and sprocket system, speed controller. Developed pomegranate juice extractor was operated with 0.5hp single phase electrical motor.
The performance evaluation of developed pomegranate juice extractor was carried out at different carrier roller speed to find out extraction efficiency, extraction loss and machine capacity at highest extraction efficiency rpm. The carrier roller speed level given to the developed pomegranate juice extractor was selected as 5, 7.5, 10, 12.5, 15 rpm. At every rpm three replications were taken. The carrier roller speed was control with ac drive. The maximum and minimum machine capacity was observed at 15 and 5 rpm respectively which was of the order of 356.783 and 68.932 kg/hr. The maximum and minimum extraction efficiency was observed at 10 and 5 rpm was found as 87.774 and 75.765%. The maximum and minimum extraction loss was observed at 5 and 10 rpm which was of the order of 24.235 & 12.225%.

After that Quality assessment of juice extracted by developed juice extractor and the conventional method i.e juice extracted with mixture was carried out as per the standard procedure and the comparison of both types of juice was done. The average pH, TSS, total sugar, titratable acidity, and total phenol of developed extractor juice and juice extractor with mixture was found to be. 3.23±0.025 and 3.947±0.046, 19.13±0.126 and 18.5±0.25 °Brix, 14.80±0.09 and 9.81±0.042%, 0.70±0.04 and 0.58±0.025%, and 0.209±0.008 and 0.115±0.005 %, respectively.

The developed juice extraction machine cost was estimated as Rs. 50485/. The estimated juice extracting cost was 0.25 Rs/kg while manual juice extracting cost 13.33 Rs/kg.

The developed pomegranate juice extractor, extract better quality juice as compared with conventionally used method from 230 kg/hr pomegranate with the extraction efficiency of 87% at a speed of 10 rpm. The cost of extractor is Rs. 50485/- while juice extracting cost comes to be 0.25 Rs/kg (0.09 Rs/100 ml) resulting into the saving of 98.87% as compared to manual method.