



A pneumatic robotic arm for extracting citrus fruit juice and sacs

KHAZAEI J., ROSTAMI H. A. - University of Tehran, Iran
MANSOURY G. H., SAFA M. - Islamic Azad University of Saveh, Iran

In this research, a pneumatic method was used for extracting the citrus juice and sacs. The method is based on opening (with cutting) the fruit, separating it into two halves and dislodging the juice and sacs by a scanning air jet. The air under pressure is infused into the halves of the fruit so that the juice or sacs of the fruit substantially disintegrates over a predetermined time period.

For doing the tests, a prototype pneumatic robotic arm was designed and constructed. The system comprises a robotic arm controlled by a hardware system attached to a personal pc, fruit holder, air compressor and air nozzle through which compressed air is forced into the pulp to eject the juice sacs and juice from the halves of the fruits. The robotic arm moves and controls the route of the air nozzle on the surface of the halves of the fruits. The route of the air nozzle on the fruit surface was drawn in the AutoCAD software. The hardware attached to the pc, implemented based on a micro controller, acts as an intermediary between robotic arm, personal pc, and AutoCAD software. It controls the route of the air nozzle and the time period (nozzle velocity) to blow out the air on the surface of halves of the fruits.

In this research the effect of air pressure, nozzle diameter, route of the nozzle on the surface of the halves of the fruits, and number of passage of the nozzle on the surface of the fruits were studied on percentage of removing the juice sacs and juice from the citrus fruits. The air pressure of 6 bars was the maximum pressure, which was supplied by the air compressor.

The results of the experiments showed that the maximum value of the removed citrus sacs and juice was belong to air pressure of 6 bar, nozzle diameter of 3 mm and number of passage of nozzle on the surface of the fruit of 5 times. For this combination of the variables, the mean value of removed juice and sacs was equal to 88%. All the variables had a significant effect on removing the citrus juice and sacs ($p=0.01$). The best route was belonging to traveling at 8 shape route.

Some physical properties of citrus fruits same as major, intermediate, minor, geometric mean diameters, volume, mass and sphericity were determined and the correlation coefficient of the parameters were also calculated.