Abstract

Tests were conducted on healthy (H) apples and apples with internal browning (IB) using a low-cost, low-field (5.55 MHz) magnetic resonance (MR) sensor. Apples were transported, one at a time, through the sensor by a conveyor belt system as a Carr–Purcell–Meiboom–Gill (CPMG) pulse sequence was applied. Relaxation signals acquired from the H and IB apples were compared. The CPMG signals acquired from healthy apples decayed at slower rates than those acquired from apples with internal browning. Effects of conveyor speed and sample position on the CPMG signals were also investigated. Both movement and misalignment affected the duration of the signals. The duration of the CPMG decay curve at a conveyor speed of 250 mm/s was less than half the duration at 50 mm/s. At speeds of 150 mm/s or slower, when there was no sample misalignment, there were statistically significant differences in the decay rates of CPMG curves from H and IB apples. Classification errors of 12% or less were achieved at 50 mm/s. However, classification error increased as conveyor speed increased. Sample misalignment also increased classification error. The results indicate that it should be possible to use the MR sensor and conveyor system for on-line sorting of apples with internal browning at conveyor speeds below 100 mm/s if precise control of the conveyor speed and apple position at the time of interrogation can be maintained. Good performance at faster conveyor speeds may be possible if improvements such as better pre-magnetization are implemented.