

Combination of NMR and MRI quantitation of moisture and structure changes for convection cooking of fresh chicken meat

Abstract

This study demonstrates that a combination of bulk NMR and magnetic resonance imaging measurements of the T2-values of water protons can be used to determine the heat-induced changes in the structure and moisture content of fresh chicken meat which had been cooked in a convection oven at 200 °C for a range of times. The gravimetric moisture content was also determined for both the raw and cooked meat. Multi-exponential fitting of the bulk NMR T2 relaxation time data demonstrated three distinct water populations T21 (39–43 ms), T22 (82–99 ms) and T23 (2–3 ms) for raw meat which changed to 18–31 ms (T21), 61–208 ms (T22) and 3–7 ms (T23) after the meat had been cooked. The T1 and T2 values obtained by MRI for cooked meat decreased progressively with increased heating time. There are highly significant correlations between the T2 values from MRI and the T21 values from bulk NMR measurements of cooked meat ($r = 0.986$; $p < 0.01$), and also between the normalised M0 values from MRI and the gravimetric moisture content ($r = 0.953$; $p < 0.01$).