

Mechanism of Volume Expansion in Coffee Beans During Roasting

R. GEIGER, R. PERREN¹, S. SCHENKER², F. ESCHER*

Institute of Food Science, Swiss Federal Institute of Technology (ETH),
CH-8092 Zurich, Switzerland

*Tel: +41 1 632 32 85, Fax: +41 1 632 11 23, E-mail: felix.escher@ilw.agrl.ethz.ch

¹Present address: Keme Food Engineering AG, CH-5001 Aarau, Switzerland

²Present address: Nestec Ltd., CH-1350 Orbe, Switzerland

SUMMARY

The mechanisms involved in volume expansion during roasting of coffee were investigated by means of thermal analysis. A state diagram adapted to the roasting process was determined. Roasting processes were analysed and changes of the physical state of coffee beans were set in relation to the observed volume expansion and to changes of apparent density.

The final apparent density of roasted coffee beans depends on roasting conditions, in particular on temperature, but is not related to initial moisture content. As a consequence, depending on the roasting temperature a lower initial moisture content leads to an accelerated reduction of apparent density in the first phase of the roasting process. Coffee beans with low initial moisture content roasted at a temperature above 260°C showed a pronounced tendency for oil release already at the beginning of storage.

In order to reduce mass transfer during subsequent storage, the roasting process for coffee beans is preferably carried out at product temperatures below 240°C. Furthermore, the temperature of the coffee beans should be reduced at the end of the roasting process in order to prevent temperature driven excessive reduction of apparent bean density, which would lead to an increased loss of volatiles and access of oxygen during storage.