

Recent Developments in Coffee Roasting Technology

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SUMMARY

Roasting of coffee beans leads to considerable changes in microstructure and structure resulting in a remarkable bean volume expansion. The extent of the volume expansion influences mass transfer during storage and has to be considered as important for bean quality changes during storage.

Therefore, a concept for the mechanism of volume expansion was developed. During roasting, structural cell wall polymers such as mannan, arabinogalactan and cellulose are changing to a rubbery state allowing limited changes in volume, but preventing the beans from disintegration. From DMTA data, a state diagram of cell wall polymers and coffee beans was developed and the conditions for an elastic behaviour allowing volume expansion were identified.

Besides structure resistance forces, driving forces are required in order to achieve a volume expansion. During roasting, a considerable quantity of moisture and dry mass is evolved. The quantity of carbon dioxide and moisture evolved during High-Temperature-Short-Time (260°C 170 s) and Low-Temperature-Long-Time (228°C 720 s) roasting process was determined online in the exhaust roasting air using Near-Infrared-Absorption technique (NIR). In both processes a maximal moisture evaporation rate caused by the evaporation of initially present moisture was observed before the roasting process was stopped. Under HTST conditions, carbon dioxide evolution rate increased exponentially at temperatures above 180-200°C, whereas under LTLT conditions, carbon dioxide evolution rate was rather constant above 180-200°C until the end of the roasting process. Finally, the weight ratio of carbon dioxide and moisture in the total roast loss were calculated and a mass balance for the roasting process was developed.