Title Study on kinetics of browning reaction for coffee beans

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Abstract

Roasting of coffee beans induces browning through complicated reactions. Although certain reactions such as the caramelizton of sucrose and the Maillard reaction have been discussed for a long time, details of chemical structure and formation process of the brown pigments are not well known. The objectives of this study are to evaluate the Arrhenius relationship of roasting indicators and to find the most suitable indicator. Roast degrees were estimated by color difference (ΔE) and brightness different (ΔL*) of ground beans, those of extract, and absorbance difference at 400 nm (ΔA400) of the extract between green or preheated and roast beans. Roasting temperature of coffee beans were varied from 100 °C to 240 °C. We assumed that the amount of browning precursor residue (Sc) was estimated from the amount of accumulated brown pigments and saturated roast degree. Based on this assumption, we calculated correlation coefficient R2a from the relation between heating time and Sc at each temperature, and R2b from another relation between heating temperature and consumption rate of the browning precursor. The coefficients calculated from the ΔE of the ground beans were R2a=0.95 and R2b=0.97. The relation curve from ΔL* between the preheated and roast ground beans also showed high linearity with the value of R2a=0.96 and R2b=0.90. But, the other curves from the extracts showed poor relationships; calculated values were R2a=0.63 and R2b=0.41 from ΔE between the green and roast beans. From these results, we conclude that ΔE of the ground beans could be described by first-order kinetics.