

Effects of Far Infrared Heating on Coffee Beans Roasting

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SUMMARY

We have conducted various experiments in order to clarify how coffee beans roasted with the use of a far infrared heater as a heat source differ from those roasted by the existing methods, i.e., hot air heating and “direct heating”. The results are as follows.

- 1) When the temperature in the oven was regulated to 200°C, coffee beans roasted with a far infrared heater showed quicker increase in temperature than those roasted by hot air.
- 2) When the temperature in a roasting drum was regulated to 200°C, far infrared roasted coffee beans showed quicker decrease in moisture content than hot air roasted ones.
- 3) Analysis by ESR indicated that far infrared roasted coffee beans showed less increase in radicals in the surface thereof than hot air roasted ones.
- 4) Analysis by NMR indicated that far infrared roasted coffee beans showed more uniform distribution of moisture and a higher rate of bonded water than hot air roasted ones, thus suggesting that the former samples suffered from uniform decrease in moisture.
- 5) Compared with hot air roasted coffee beans, far infrared roasted ones showed uniform formation of brown coloured compounds.
- 6) Changes in the contents of citric acid, malic acid and formic acid were monitored with the progress of roasting. As a result, far infrared roasted coffee beans showed changes from an earlier stage than hot air roasted coffee beans did. As the roasting proceeded, the far infrared roasted coffee beans contained these acids in a smaller amount (when compared at the same roasting level). No difference was observed in the change of chlorogenic acid content.
- 7) When coffee beans of the same variety were roasted to the same level, the content of aroma components of far infrared roasted ones was larger by about 10% and by about 25% respectively than those of the hot air roasted coffee beans and the “direct heating roasted ones”. The far infrared roasted coffee beans showed no large difference in the composition of aroma components from the hot air roasted ones.
- 8) When coffee beans of the same variety were roasted to the same level, the odor intensity of the extract of far infrared roasted coffee beans exceeded that of hot air roasted one.
- 9) When coffee beans of the same variety were roasted to the same level, the taste (evaluated by Taste Sensing System) of the extract of hot air roasted coffee beans was comparable to that of “direct heating roasted ones”, while the extract of far infrared roasted coffee beans was different from them (i.e., weaker acidity).

Based on these experimental results, it is assumed that far infrared roasted coffee beans show a quick increase in the internal temperature but suffer from less damage on the surface, show a uniform and quick decrease in moisture and thus undergo uniform heating even at the core.

From the viewpoint of taste, the extract of the far infrared roasted coffee beans is distinguishable from the existing ones, since it is rich in aroma components and shows a light acidity.

In the present study, coffee bean samples of the same variety were roasted to almost the same roasting level with the use of small-sized roasters of almost the same scale. Further work is needed from the viewpoints of the structure of roaster and standardising the energy level.