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Influence of Pre-sorting and Infrared Pre-drying on Walnut Quality



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Abstract

Sequential infrared (IR) and hot air (HA) drying has been successfully tested at pilot scale level to achieve high drying rate and energy saving in walnut drying. However, there is a need to investigate the impact of IR pre-drying on walnut quality. The objective of this study was to evaluate the effect of IR pre-drying of pre-sorted walnuts prior to HA drying on the quality and shelf life of dried walnuts. Walnuts were sorted and dried with and without IR as pre-drying, followed by HA drying. An accelerated storage stability study showed that the new IR drying method produced similar product quality, in terms of color, peroxide value (PV), and free fatty acid (FFA) content, compared hot air drying.

Background

The walnut industry has identified critical needs in reducing energy use and improving drying efficiency and product quality. Pre-sorting walnuts based on moisture content (MC) could mitigate the over- and under-drying phenomena and reduce energy use. In addition, our research has also shown that IR pre-drying significantly increased the drying rate by quickly removing the surface moisture and reduced energy use. It is important to further study the effect of the new processing method by using pre-sorting and IR pre-drying on the walnut quality for transferring the technology from laboratory to commercial applications.

Objective

To evaluate the effect of pre-sorting and IR pre-drying on quality and shelf life of dried walnuts

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Materials and Methods

Walnut drying

Walnuts:

Chandler variety

Pre-sorting:

Harvested (mixed/unsorted) walnuts with average MC of 21.67% (w.b.) were sorted into high MC (MC=27.92%) and low MC (MC=18.46%) walnuts based on terminal velocity.

IR pre-drying:

High MC walnuts were heated to three kernel temperatures of 40°C, 45°C, and 50°C by using catalytic IR.

Hot air drying:

IR pre-dried, high, low and mixed MC walnuts were further dried using hot air at 41±1°C to 8% MC.



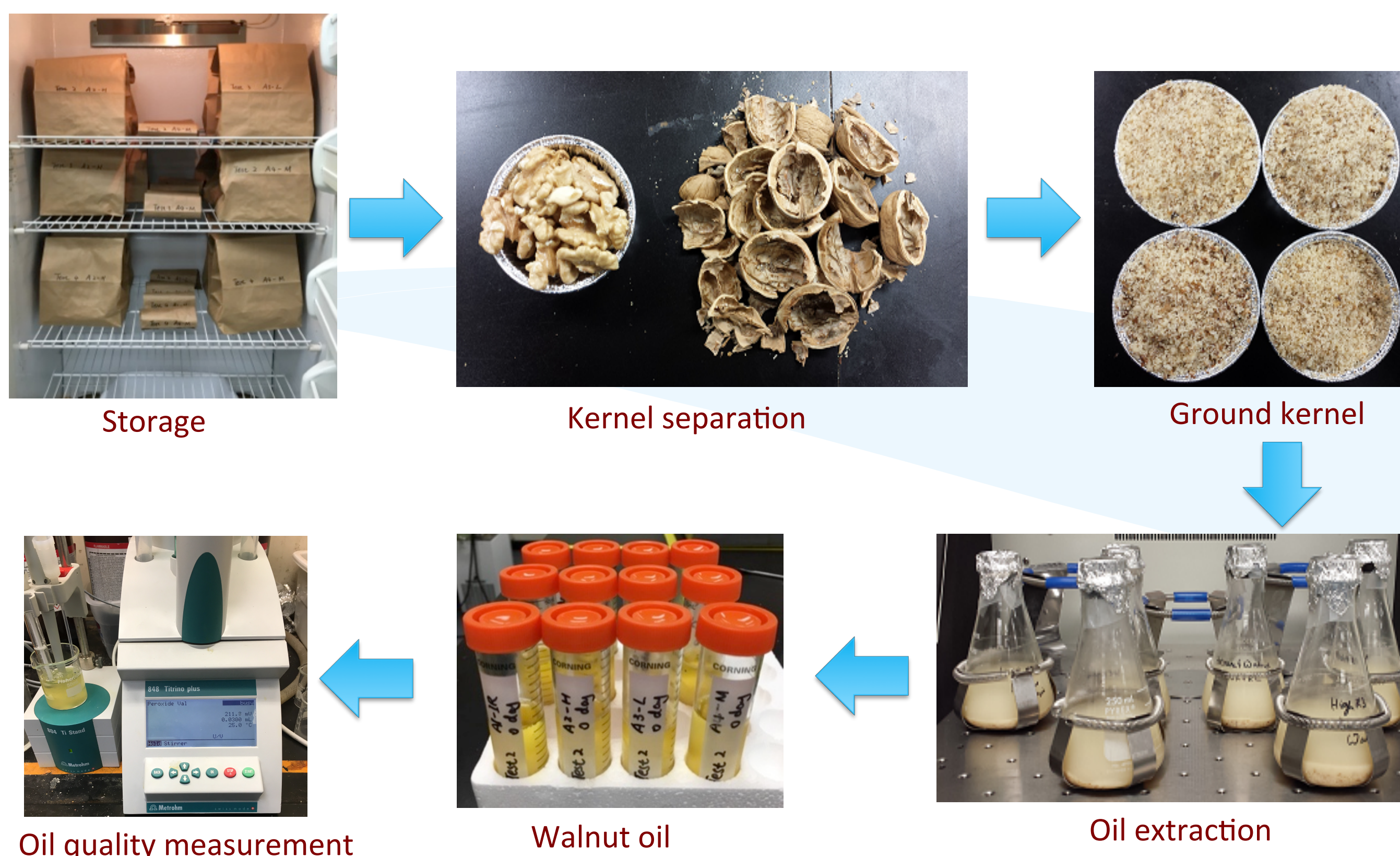
Pilot scale of infrared pre-drying system

Infrared pre-drying

Hot air drying

Shelf life study

Dried walnuts were stored in an incubator at 35°C and 53% relative humidity for 5, 10, and 20 days, which were equivalent to 0.5, 1, and 2 years of storage at 4°C. After storage, the color of kernels was measured. The walnut oil was extracted to measure the PV and FFA values to reflect the quality of walnuts.



Oil quality measurement

Walnut oil

Oil extraction

Results

The L^* values of IR pre-dried walnuts under 40, 45 and 50°C were higher than 40; the PV values were 0.544, 0.376 and 0.579 meq/kg oil after 1 year of storage; the FFA values were 0.445%, 0.430% and 0.310% after six months of storage. The values were within the requirements of walnut industry.

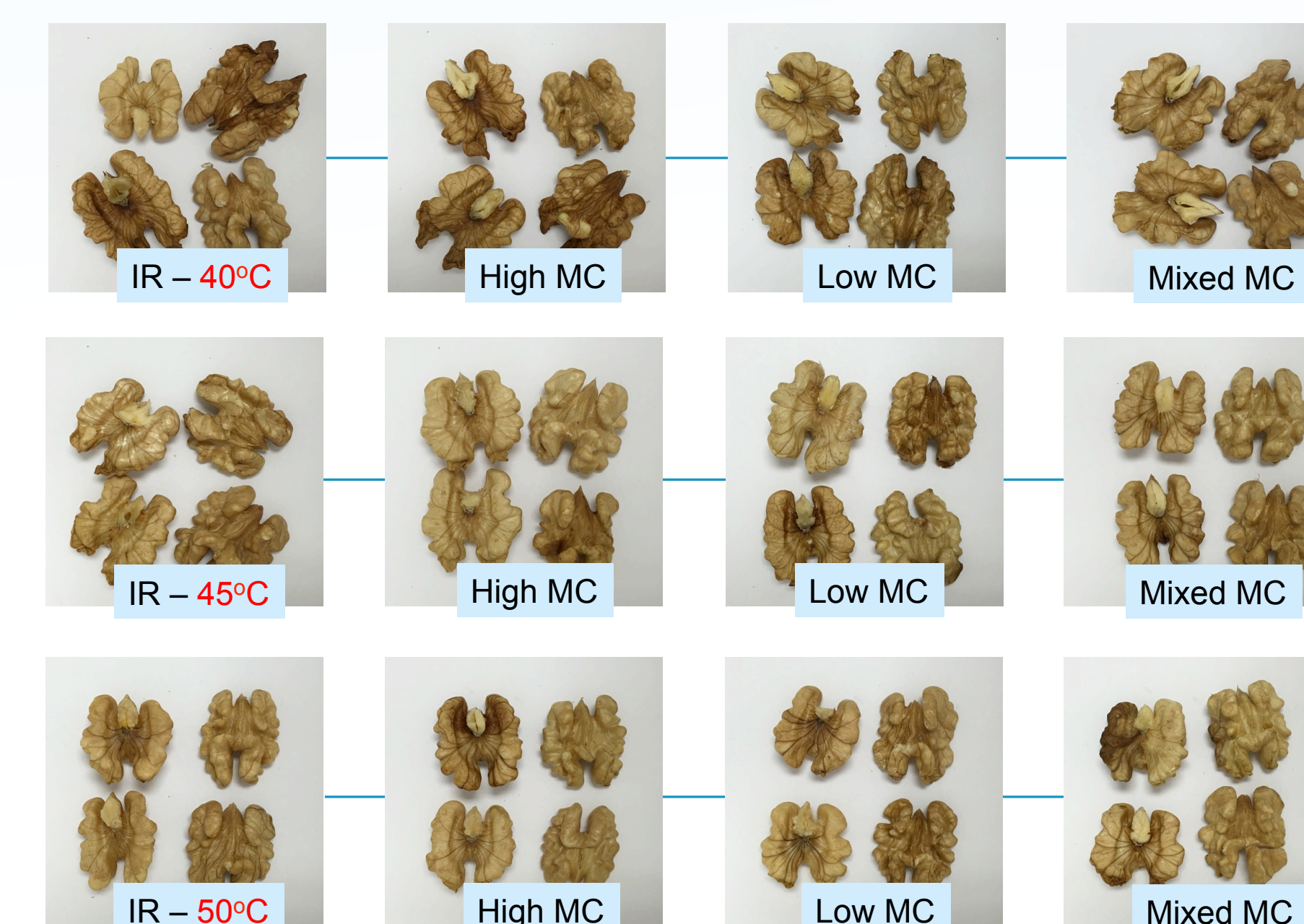


Fig. 1 Walnut kernels of dried walnuts

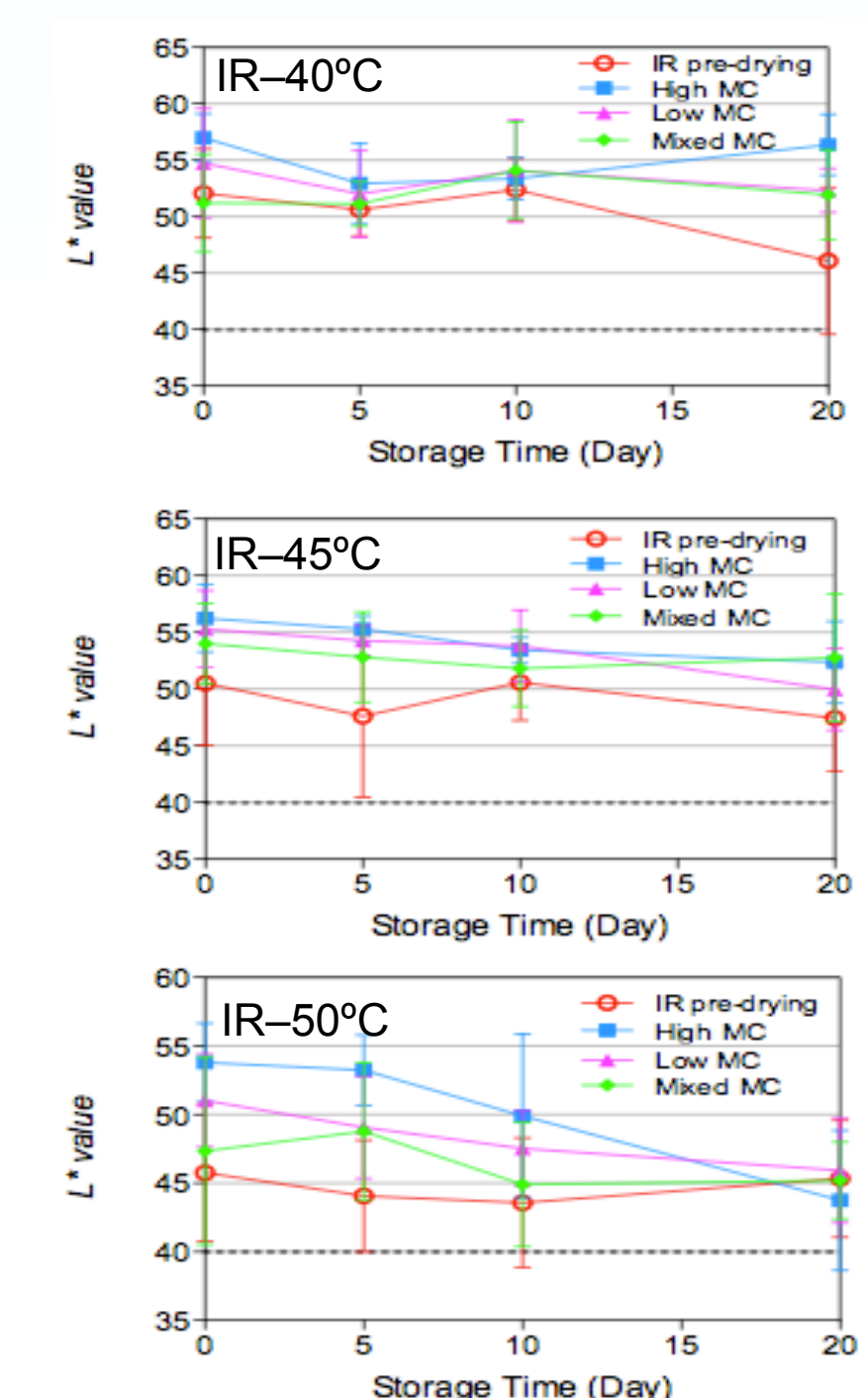


Fig. 2 L^* values of walnuts

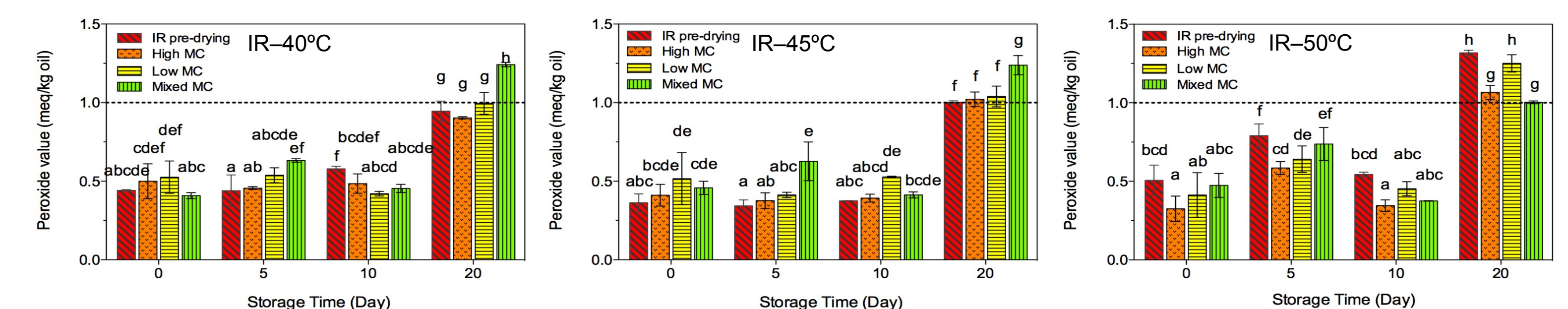


Fig. 3 Peroxide values of different dried walnuts

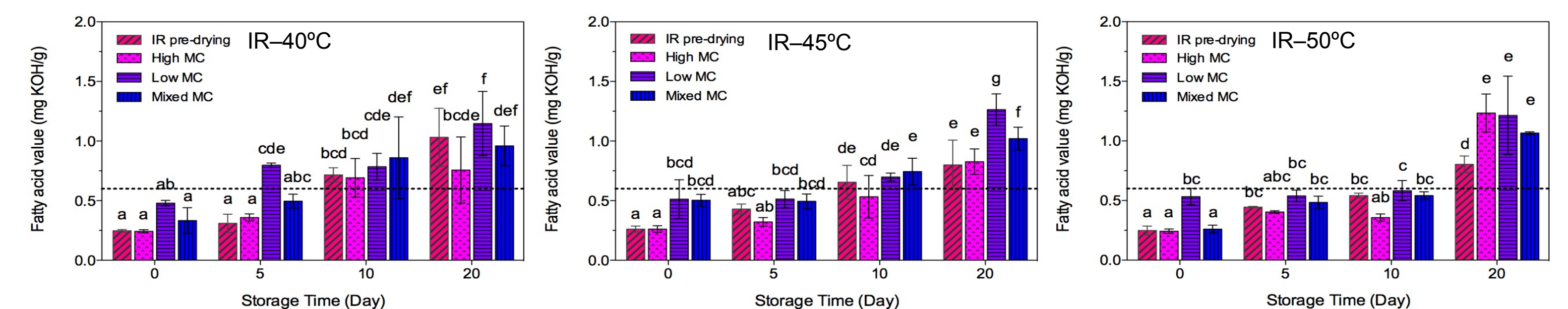


Fig. 4 Free fatty acid values of different walnuts

Conclusions

Pre-sorting and IR pre-drying of walnuts prior to hot air drying had no significant effect on kernel color, peroxide and free fatty acid values of walnut oil during storage. IR pre-drying can be used to improve the drying efficiency of walnuts without compromising the product quality.

Acknowledgments

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