Title Aroma detection and control in passive and dynamic food systems for superior product

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Citation Thesis, Doctor of Philosophy (BioresourceEngineering), McGill University. 205 pages. 2008.

Keywords Food processing; Aroma detection

Abstract

Passive (static) and dynamic studies have shown aroma to be an important aspect of food quality, which can be used to differentiate, classify, and grade foodstuffs, and in some cases it can be used to predict other quality characteristics. Monitoring and control of food aroma changes during food processing can significantly improve the quality of the final product in terms of flavour, color, taste, and overall appearance. Hence, it is a prominent and urgent field of study in the post production systems.

Passive aroma detection of unprocessed foods and dynamic aroma detection during food processing was undertaken using a fast GC analyzer - zNose. During the study on the passive aroma detection, the aroma of Chinese spirits (Fenjiu) and mango (*Mangifera indica* L.) fruits, (i.e., liquid and solid states, respectively) was analyzed. In the study of Chinese spirits, aroma profiles of Fenjiu liquor samples of different quality levels were acquired and used for quality classification and prediction. Measurements of dielectric properties of the samples were also conducted to estimate alcohol concentration. In the study of mango fruits, aroma changes of mango samples were monitored during their shelf life and used to evaluate mango quality. Ripening and rots were detected with 80% and 93% accuracy, respectively.

During the study of dynamic aroma detection, a real-time aroma monitoring and control system was developed for use during microwave drying. Aroma signals of a processed food item were detected with zNose and analyzed with a fuzzy logic algorithm to determine the optimal food drying temperature. Phase control was used to adjust the microwave power level to meet temperature requirements. Carrot (*Daucus carota* L.) and apple (*Malus domestica* Borkh) were selected as representatives of vegetables and fruits. In carrot drying, samples could be dried in a short time at high temperatures but the interior of some sample cubes was burnt. Drying at a lower temperature extended the drying process, but led to a great loss of aroma in the finished product.' The best results were obtained at 60°C. Based on these results, a fuzzy logic controller was designed and employed to control the drying process according to carrot aroma changes. To investigate the possibility of aroma improvement without zNose assistance, a linear control method was developed whereby a temperature control profile imitated the fuzzy logic control, but aroma

control was not included. With these new control strategies, the carrot color and flavour were significantly improved and less time and power were consumed. Similar results were achieved when apple was microwave-dried. Apple aroma was monitored online during microwave drying processes and controlled with similar fuzzy and linear control strategies. Apple color, aroma, and overall appearance remained intact with the new strategies and less time and power were consumed. In contrast to the carrot drying, a different linear temperature profile was required for apple drying in terms of aroma retention.