CHAPTER 6 CONCLUSIONS AND RECOMMENDATION

6.1 Conclusions

In the first part of the study quantitative evaluation of the microstructural changes of carrots, which were used as a test material, during hot air drying was performed. The results showed that deformation of the microstructure tended to increase due to the moisture loss of the sample during an earlier period of drying. However, at the final stage of drying most deformation of the microstructure existed, while the moisture content did not change much. When comparing the results at the same X/X_0, the effect of drying temperature within the interested range was not significant on the deformation of the microstructure.

The relationships between microstructural and apparent physical changes (i.e., shrinkage and hardness) were also investigated. It was found that either $\Delta FD/FD_0$ or $\overline{\Delta D}/\overline{D_0}$ was capable of monitoring the physical changes of the sample during drying. For other food products with obvious porous structure, however, pore size and its distribution may be used to calculate $\overline{\Delta D}/\overline{D_0}$ instead of the use of the cell diameter since the results may be different if the paths to arrive at the final moisture content of a sample are different.

In the second part of the study experiments and analysis were performed to determine if it would be possible to develop a generalized indicator that could be used to monitor microstructural changes of carrot cubes undergoing three representative drying methods,

i.e., hot air drying, vacuum drying and low-pressure superheated steam drying. The results showed that either $\Delta FD/FD_0$ or $\overline{\Delta D} / \overline{D_0}$ seemed to be an adequate generalized microstructural change indicator and correlated well with the loss of moisture during drying. However, $\Delta FD/FD_0$ seemed to be a more generalized structure-quality indicator than $\overline{\Delta D} / \overline{D_0}$ and could be used to correlate the quantitative microstructural changes to selected apparent physical characteristic changes (shrinkage and hardness).

$\Delta FD/FD_0$ should prove useful for on-line monitoring of a drying process. For example, if a simple computer vision system is used to assess the volumetric shrinkage of a sample during drying, the shrinkage data can be used to obtain the moisture content, hardness and even quantitative microstructural change information of the sample. On the other hand, if the sample moisture content is known, other important information can be obtained. This represents the first attempt to develop and utilize a generalized structure-quality indicator in this fashion.

6.2 Recommendation

Further study should be made to test the applicability of the developed correlations over other temperature range. Use of other test materials should be attempted as well.