A DEVELOPMENT OF AN ELECTRICAL ANALOGUE FOR THERMAL PROCESSING

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I. SUMMARY

The objective of this study was to investigate some general principles in thermal processing and some methods for following this processing experimentally. The emphasis of the investigation was to develop a simple electrical analogue system for following the progress of a single stage irreversible thermal processing reaction.

Documented data and principles of the kinetics of thermal processing of biological material showed that such process reaction could be approximated by the kinetic model of a single stage irreversible reaction. Temperature dependency of the thermal processing rate could also be approximated by the Arrhenius equation.

Functional principles of electrical analogue computers were applied to develop the electrical analogue system. The structure and mode of operation of this system is described. The relationship between the output voltage of the analogue system and the progress of the thermal processing are derived for different known thermal processing reactions, following the kinetic model of a single stage irreversible reaction.

The performance of the electrical analogue system in this study was tested. The results indicated that the electrical analogue system so constructed could approximate the function described in theory. Non-ideality of the electrical circuitory, however, restricted the application of the electrical analogue system for its qualitative value only. The parameter governing

the temperature dependence of an irreversible reaction rate could be generated with error of approximately $\pm$ 4.55%. The error associated with application of the analogue integrator for integrating the generated reaction rate was approximately $\pm$ 7.25%. The overall error in application of the analogue system for detecting thermal processing varied with the time span of processing cycle, and processing effect achieved at temperatures other than the set temperature of processing.