

## THE APPLICATION OF A MICROPROCESSOR AS AN AUTOCLAVE CYCLE INTEGRATOR FOR THE EVALUATION OF A COEFFICIENT OF STERILIZATION

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The kinetic approach by integration of the two physical parameters applied to the load, time and temperature produces a single coefficient of sterilization. The coefficient may be used to ensure consistency of processing when the interdependent factors of lethality and safety margin may be balanced against thermal degradation of the product (Hoskins 1979).

Two methods have been described for assessing a coefficient of sterilization. The calculation of a  $F_0$  value as proposed for adoption by the F.D.A., (Report 1976) and the evaluation of  $\nabla$  or nabla value, Deindoerfer and Humphrey (1975). The integrator displayed is capable of being programmed for evaluation of either of these values.

As demonstrated the integrator evaluates the nabla value  $\nabla$  from the expression

$$\nabla = \sum_0^T A \exp (-E/R\theta(t)) \cdot \Delta t$$

where  $A$  = Arrhenius constant ( $10^{36.2} \text{sec}^{-1}$ ),  $E$  = energy of activation ( $67.7 \text{Kcal mole}^{-1}$ ),  $R$  = universal gas constant ( $1.9865 \text{cal mole}^{-1}$ ),  $\theta$  = temperature,  $^{\circ}\text{K}$  at time,  $t$ ,  $\Delta t$  = time in seconds,  $T$  = total cycle time in seconds.

A Motorola 6802 microprocessor forms the basis of the instrument with its associated programme memory. A copper constantan thermocouple with cold junction compensation device provides an e.m.f. which is sampled at one second intervals and converted to a corresponding temperature rounding down to the nearest half degree Centigrade. For simplicity a look-up table stored in the instrument is used to convert the calculated thermocouple temperature to the corresponding value to be summed to give nabla, thereby saving the time which could be spent on evaluation of the exponential term in the equation given. The size of the memory, including the look-up table is about  $1\frac{1}{2}$  K bytes and is implemented using re-programmable components (EPROMS) so that the function of the instrument may be easily changed to display  $F_0$  values if required.

Digital displays provide: 1. the total value of  $\nabla$  evaluated from the start of the present cycle for all temperatures above  $80^{\circ}\text{C}$  (below this temperature the contribution of  $\nabla$  is negligible.) 2. the instantaneous temperature of the autoclave probe to a tenth of a degree. Additionally, at a press of a control button there is displayed 3. The accumulated time for which the probe temperature has been above  $80^{\circ}\text{C}$  in the present cycle, 4. The accumulated time for which the probe temperature has been above  $121^{\circ}\text{C}$  in the present cycle.

The integrator is designed for expansion to monitor more than one autoclave and to produce hard copy records. Development is continuing with a research grant from the South East Thames Regional Health Authority.

Deindoerfer, F. H., Humphrey, A. E., (1975), Applied Microbiology, 7: 256-264  
 Hoskins, H. T., (1979), J. Clinical Pharmacy 4, 1: 9-20  
 The Gold Sheet Quality Control Reports, (1976), 10, No. 9