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The Measurement of Bacterial Growth

A NEW APPLICATION FOR THICK FILM PLATINUM ELECTRODES

Measurement of the number of living bacteria in a sample is a frequent requirement in microbiology. The data generated are of considerable importance, for example, in the food and related industries where they form the basis of food shelf life definitions and in the medical field where blood and urine tests are of significant diagnostic and treatment value.

Traditional methods of counting bacteria are slow and labour intensive. In many cases the techniques employed are simple extensions of the early principles defined by Louis Pasteur and cannot be automated readily. It is now well established that multiplication of bacterial cells in a nutrient medium can be monitored by measuring changes in the conductance of the growth medium (1, 2). Such changes reflect the metabolic activity of the bacteria which produces charged species.

In general, the conductance changes observed are very small. Consequently a successful instrumental method demands exceptional stability in the total measuring system. Additionally, the normal requirements of microbiology demand a robust transducer. The latter must be capable of withstanding frequent cleaning and sterilisation at 121°C, extended exposure to aggressive growth media, free of any bactericidal activity while at the same time it must be relatively inexpensive.

A transducer meeting all these requirements was recently developed by Malthus Instruments Limited in collaboration with Matthey Printed Products Limited (3). The transducer comprises two platinum thick film electrodes printed onto an alumina substrate, and two types housed in growth cells are illustrated here.

Only a small area of each electrode is exposed to the growth medium in the cell, the remainder—other than the external contacts—being insulated by means of a dielectric glass, printed and fired onto the surface.

Many materials were considered for the electrodes. However, the very high purity platinum printing preparation offers virtually unique advantages in terms of corrosion resistance, marginal impact on bacterial growth, and small polarisation impedance. Additionally the application of advanced thick film printing technology enables platinum electrodes to be mass produced at relatively low cost.

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