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SOME FACTORS AFFECTING THE ULTRASONIC DISINTEGRATION OF MICROORGANISMS

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Some difficulties we encountered in using an ultrasonic disintegrator for microbial cell suspensions have been partly resolved, and while the information needed may be well known to physicists it is not clearly documented for biotechnologists.

In experiments on the ease of disruption of microbial cells (Nesaratnam et al.,1982; Wase et al. 1982 and unpublished) we have used ultrasonic disintegration. In particular, yeast cells have been intensively studied, and their toughness has proved a severe test for the available equipment (Patel and Wase, 1981). The experiments required the cell suspension to be pumped through a continuous-flow disruption vessel (Rosett,1965), with holding times varied by changing the pumping rate, and plating out from the influent and effluent streams. From plots of the numbers of survivors against holding times, the "killing curve" could be compared for different systems of microbial cultivation.

First experiments used a 150W Ultrasonic Disintegrator (MSE Scientific Instruments) and suffered difficulties because of problems in resetting the instrument to uniform power output. More recently the manufacturers introduced a newer version of this device, the Soniprep 150, in which the transducer output is monitored and feedback control applied to ensure that the output remains constant once set, irrespective of fluctuations in the instrument temperature or mains supply voltage. However we still experienced difficulties in reproducibility, though less severe, and were able to trace, and solve, one further problem.

The titanium half-wave probe of the disintegrator, which transmits power to the liquid, must be machined to an exact length to vibrate in sympathy with the transducer output. We have already described how with prolonged use the end of the probe can become seriously eroded, adversely affecting performance (Patel and Wase, 1981), and our first steps at alleviating this difficulty involved replacing the entire titanium probe, an expensive and rather unsatisfactory solution.

Further experiments showed that while the efficiency of a new probe declined rather rapidly at first, measurements of the probe length showed no signif-

-icant change. However the end of the probe had become slightly pitted, with erosion of small amounts of titanium; somewhat surprisingly, grinding the end of the probe flat, and repolishing, restored almost all the initial efficiency. We found the length of the probe to be less critical than we had first thought; length variations of up to 0.25 mm do not significantly affect power output provided that the end of the probe is plane, at right angles to the probe body, and highly polished.

Given this information, the manufacturers very kindly agreed to produce a special probe. This was of identical dimensions to the normal probe, but the tip could be unscrewed and replaced with a spare. If after each set of experimental readings the tip was unscrewed and replaced with a freshly polished spare, constant power output could be assured provided that each experiment was not so long that the tip was appreciably eroded.

Thus, while the length of a half-wave ultrasonic probe is clearly important, this can be outweighed by the condition of the tip - which in most practical arrangements is very easily overlooked.

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References

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