out and the enzyme shows properties similar to that already obtained from several other plant tissues (McCrae, 1971), suggesting that the two pathways for malate oxidation may be a general property of higher-plant mitochondria. The operation of these two pathways may be of importance in controlling the redox equilibrium of NAD in the mitochondrial matrix and in the cytosol.

This work was supported by grants from the Scientific Research Council and the Central Research Fund, University of London.

- Coleman, J. O. D. & Palmer, J. M. (1971) *FEBS Lett.* **17**, 203–208
 Ikuma, I. & Bonner, W. D. (1967) *Plant Physiol.* **42**, 1535
 McCrae, A. R. (1971) *Phytochemistry* **10**, 2343
 Palmer, J. M. (1967) *Nature (London)* **216**, 1208
 Palmer, J. M. & Passam, H. C. (1971) *Biochem. J.* **122**, 16P

The Role of Component C₁ in Cellulolytic Systems

By G. HALLIWELL, M. GRIFFIN and R. VINCENT (*Sub-Department of Microbiology, Department of Botany, University College, Swansea SA2 8PP, U.K.*)

Over the years, biological attack on cellulose has been variously attributed to a single enzyme, CM-cellulase (Whitaker, 1953), or to a prime component called C₁ thought to produce shorter chains for a more conventional hydrolysis by CM-cellulase (Reese *et al.*, 1950). Other workers support a modified version of the last scheme in which the combined action of both CM-cellulase and component C₁ is believed to be essential, since no specific function has so far been assigned to component C₁ (Selby, 1968).

Recent evidence from this laboratory showed that component C₁ hydrolysed native cellulose to cellobiose in a solubilizing reaction promoted more effectively by cellobiase than by CM-cellulase (Halliwell & Riaz, 1971). Later preparations of component C₁ indicate that the stimulation of cellulolysis so achieved can be increased even further by up to 80%. Prolonging the incubation beyond the usual period of 7 days had little effect on cellulolysis by component C₁ alone. The additional presence of cellobiase, however, proved beneficial in enabling up to 70% solubilization of cotton to be attained in 21 days. The only products recognized chromatographically in the two systems were cellobiose and glucose respectively. The ability of cellobiase, which itself had no action on cellulose, to promote saccharification of the substrate by component C₁ suggested that this component was inhibited by its product cellobiose. Inhibition was competitive, being dependent on the relative concentrations of cellulose

and cellobiose and overcome completely by increasing the substrate concentration. CM-cellulase behaved similarly. Component C₁ exhibits maximum activity and stability at pH 5 and 37°C with K_m approx. 0.05 mg/ml. With cellulose and its derivatives component C₁ apparently acts as a cellobiohydrolase with a preference for the ends of chains and in the vicinity of terminal non-reducing groups.

- Halliwell, G. & Riaz, M. (1971) *Arch. Mikrobiol.* **78**, 295
 Reese, E. T., Siu, R. G. H. & Levinson, H. L. (1950) *J. Bacteriol.* **59**, 485
 Selby, K. (1968) in *Biodeterioration of Materials* (Walters, A. H. & Elphick, J. L., eds.), p. 62, Elsevier, Amsterdam
 Whitaker, D. R. (1953) *Arch. Biochem. Biophys.* **43**, 253

The Kinetics of Respiratory Degeneration and Regeneration During Drug Treatment of Two *petite*-Negative Yeasts

By A. A. LUHA and P. A. WHITTAKER (*School of Biological Sciences, University of Sussex, Falmer, Brighton BN1 9QG, U.K.*)

We have studied the respiration rates of the *petite*-negative yeasts (Bulder, 1963) *Kluyveromyces (Saccharomyces) lactis* and *Saccharomyces fragilis* during treatment with drugs known to interfere selectively with mitochondrial macromolecular synthesis (Kellerman *et al.*, 1969), and similarly during respiratory adaptation after pre-growth of the cells in a drug-containing medium. Methods for the measurement of respiration rates and selection of suitable drug concentrations have been described (Luha *et al.*, 1971). The mitochondrial protein-synthesis inhibitors chloramphenicol and erythromycin and the mitochondrial nucleic acid-synthesis inhibitors acriflavine and ethidium bromide appear to have similar effects on the respiration rates of *K. lactis*. No significant inhibition of respiration rate occurs until between 60 and 90 min after addition of the drug. Thereafter the respiration rate falls off exponentially while the cells continue to grow in exponential phase.

Regeneration of respiratory activity has been studied in *K. lactis* after growth in the presence of chloramphenicol at 2 and 4 mg/ml and of ethidium bromide at 5 and 10 µg/ml. In contrast with the repression experiments there is a significant difference. De-repression from chloramphenicol proceeds much more rapidly, the Q_{O_2} (µl of O₂ taken up/h per mg dry wt.) rising from 10 to about 150 in 2½ h. A similar rise after ethidium bromide treatment takes between 6 and 7 h. Ethidium bromide exerts a similar effect on repression of the respiratory system of *S. fragilis*. De-repression from this drug is also observed in this system. In this case, however, a distinct lag