BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

SaPM-A15

SIMULTANEOUS VISCOSITY-DENSITY DETERMINATIONS ON SMALL VOLUMES OF PROTEIN SOLUTION. D. W. Kupke, M. G. Hodgins* and J. W. Beams*, Depts. of Biochemistry and Physics, Univ. of Virginia, Charlottesville, Virginia.

The magnetic densimeter designed for rapid determination of the density of biopolymer solutions (~0.2 ml) has been adapted to give the viscosity simultaneously. The apparatus was modified to allow the magnetically suspended buoy to rotate slowly (~1 rev/min) by remote drive coils. Results with standard solutions show a linear correlation between sec/rev and the relative viscosity; precisions of 2 parts in 10^4 have been obtained on replicate samples. With this technique, the corrections and problems associated with capillary-flow methods are essentially eliminated, provided that a sufficiently constant torque (which serves in place of the force of gravity) is applied. The intrinsic viscosity $[\eta]$ has been determined on a number of protein-solvent systems and compared with literature values; good agreement was obtained in nondenaturing solvents when reasonable allowances are made for differences in estimating protein concentrations. Myosin could be measured with precision to ~0.1 mg/ml; in the dilute region, curvature of the reduced viscosity versus concentration was indicated. In 6 M guanidinium chloride ± mercaptoethanol somewhat higher values of $[\eta]$ were obtained for ribonuclease than those reported with the use of capillary methods. Kinetic experiments following the addition of mercaptoethanol were feasible in some cases because the buoy is in continuous rotation throughout a reaction. The values of the specific volumes derived from the concurrent density determinations were in excellent agreement with those from independent determinations on the same preparations.

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IN VIVO CHARACTERIZATION OF PHYCOMYCES RESPONSES USING PRECISION AUTOMATED TRACKING MACHINE. Kenneth W. Foster (intr. by Max Delbrück), Division of Biology, California Institute of Technology, Pasadena, California.

Our laboratory studies the photoresponse and the "avoidance" response of the sporangiophore of the fungus Phycomyces. Its growth rate is about 50 μm/min. Light stimulation causes phototropism and a transient growth response. The "avoidance" stimulus causes the fungus to grow away from a physical barrier. In order to improve our measurements we have developed equipment which incorporates accurate and versatile control of the stimuli with precision measurement of its growth velocity. The sporangium at the top of the sporangiophore is servoed to a constant position in three dimensions, thus also fixing in space the responding zone below the sporangium. Continuous highly magnified observation and either uniform or local light stimulation is possible. Measurement every second of the three coordinates of the servoed stage supporting the sporangiophore provides a growth velocity over 10 sec. with about 5% error. With this equipment the detailed shape of each response can be measured without averaging over many experiments. Reproducible fine structure is apparent. Response shape as a function of stimulus, the relationship of the tropic response to the growth response, the number of photosystems used and photoresponse mutants will be discussed.