TABLE II

*The effect of tannic acid and caffeine on the infectivity titres of enteroviruses*

| Virus species | Infectivity titre of virus ($TCID_{50}$/ml) | | | Per cent inhibition by | |
|---|---|---|---|---|---|
| | Control | Virus-tannic acid mixture | Virus-caffeine mixture | Tannic acid | Caffeine |
| Poliovirus type 2 | $10^{7\cdot33}$ | $10^{5\cdot66}$ | $10^{6\cdot5}$ | 97·9 | 85 |
| Poliovirus type 3 | $10^{5\cdot33}$ | $10^{4\cdot66}$ | $<10^{2}$ | 78 | >99·95 |
| Coxsackievirus B, type 1 | $10^{5\cdot66}$ | $10^{4\cdot33}$ | $10^{3\cdot33}$ | 95·4 | 99·54 |
| Coxsackievirus B, type 2 | $10^{5\cdot5}$ | $10^{3}$ | $10^{2}$ | 99·69 | 99·96 |
| Echovirus type 11 | $10^{6}$ | $10^{3\cdot5}$ | $10^{5}$ | 99·69 | 90 |

Seven species of viruses were tested and over 99·75% inhibition was observed with 5 of them. Two agents, namely poliovirus type 1 and echovirus type 7 were not inhibited to a similar extent. These results have been further confirmed in that the same dilution of tea extract completely inhibited 100 $TCID_{50}$ of each of the 5 sentitive virus species, but not poliovirus type 1 or echovirus type 7.

Commercial tea is manufactured from the tender leaves of *Camellia theifera* The main constituents of its infusion are caffeine, theophylline, theobromin, xanthine, tannic acid, gallic acid and certain fats and oils[3]. Therefore we examined if some of these compounds have antiviral property. Theophylline and theobromin did not inhibit the growth of viruses, but both tannic acid and caffeine were found to be antiviral. The results of experiments along the same lines as described before, but using tannic acid (0·1%, w/v) and caffeine (2%, w/v) instead of tea, are summarised in Table II. All the species of viruses inhibited by tea were found to be also inhibited to varying degrees by tannic acid and/or caffeine. Although tannic acid is known to have antiviral properties[4], we are not aware of any earlier reports of such property attributed to caffeine. Further studies are in progress.

This investigation was supported by a grant from the Research Funds of the Christian Medical College, Vellore.

The Enterovirus Laboratory, Christian Medical College Hospital, Vellore,
*December* 23, 1977.

T. JACOB JOHN.
P. MUKUNDAN.

1. John, T. J., Christopher, S. and Fernandez, E., *Indian J. Med. Res.*, 1974, 62, 699.
2. Reed, L. J. and Muench, H. A., *Amer. J. Hyg.*, 1938, 27, 493.
3. Nadkarni, A. K., *Dr. K. M. Nadkarni's Indian Materia Medica*, Popular Book Dept., Bombay, 1954.
4. Herrman, Jr., E. C. and Kucera, L. S., *Proc. Soc. Exp. Biol. Med.*, 1967, 125, 874.

## AN INDIGENOUS UV PHOTOELECTRON SPECTROMETER

IN this communication we would like to briefly report the successful design and fabrication of an indigenous UV Photoelectron Spectrometer for the study of electronic structures of atoms and molecules in gas or vapour phase. The spectrometer consists of a helium lamp, a 127° cylindrical secoor analyser and an electron detector. The helium discharge tube comprises of two water-coolel aluminium electrodes connected through 1·5 mm dia, 40 mm long quartz capillary[1]. Helum gas is introduced with a fine needle valve and pumped at the end of the discharge capillary. The lamp is operated by a 1·5 kV DC supply at 75 mA current to give HeI (584 Å, 21·22 eV) resonance radiation. HeI radiation is collimated to the photoionization chamber through a 1 mm dia., 30 mm lang Pyrex glass capillary. By reducing the gas pressure in the discharge tube, HeII (304Å, 40·8 eV) radiation could be obtained. The reaction chamber itself is a 6 mm diameter stainless steel tube connected to the reaction gas inlet and pumping system to maintain a gas pressure of about 1 mm.

The energy analyser system consists of 127° cylindrical sectors[2] (60·3 mm mean diameter, 60 mm long) separated by 12 mm. Slits of 1 mm × 10 mm

are used for both the inlet and the outlet for electrons and the analyser is used in the dispersion mode. The entire analyser assembly with a copper Faraday cup electron collector and the helium lamp are mounted on a 8½" dia aluminium flange fitted on to the spectrometer chamber. The spectrometer chamber can be pumped to a base vacuum of $10^{-6}$ torr. The spectrometer chamber region has been shielded from Earth's magnetic field using a set of Helmholtz coils.

The gas under investigation is introduced into the photoionization chamber through a fine needle valve. By slowly increasing the dispersion voltage applied between the analyser plates, the photoelectron signal obtained can be read off a ECIL electrometer amplifier. The signal can be maximised with respect to variation of the helium gas pressure, reaction gas pressure and also rotation of the inlet slit provided on the reaction chamber. We have obtained the photoelectron spectrum of argon using this spectrometer. The resolution obtained is about 0·1 eV with a count rate of $10^7$ electron/sec. By reducing the slit with and employing a charge sensitive amplifier both the sensitivity and resolution can be improved. A double 127° sector analyser system can also be mounted in the same chamber to improve the resolution. A 180° spherical sector analyser[3] has been fabricated and the performance of this is now being tested. In order to satisfactorily record the UV photoelectron spectrum of a gas or vapour, we are using a channeltron electron multiplier and a locally fabricated rate meter. Details of the design of the spectrometer will be published elsewhere in the near future.

The authors are thankful to Professor C. N. R. Rao for constant encouragement and guidance. The financial support of this project by the Department of Science & Technology, Government of India, is gratefully acknowledged.

Solid State & Structural Chemistry Unit,
Indian Institute of Science,
Bangalore 560 012.
*February* 3, 1978.

M. S. Hegde.
P. K. Basu.

1. Poole, R. T., Liesegang, J., Lackey R. C. G. and Jenkin, J. G., *J. Electron. Spectrose. and Rel. Phenomenon*, 1974, 5, 773.
2. Leventhal, J. J. and North, G. R., *Rev. Sci. Instr.*, 1972, 42, 120.
3. Browne, C. P., Craig, D. C. and Williamson, R. M., *Ibid.*, 1951, 22, 952.

## PRODUCTION OF PECTIC ENZYMES BY *CORYNESPORA CASSIICOLA* CAUSING FRUIT ROT OF PAPAYA

The importance of pectic enzymes produced by pathogenic microorganisms has received special emphasis in studies on physiology of parasitism in plants. Pectic enzymes are implicated almost routinely as a feature of host-pathogen interaction and it is more or less accepted that pectic enzymes are responsible for both maceration and killing effects during disease development. The principle involved in maceration was at an early stage equated with protopectinase (PP) complex. But now it has been resolved into several enzymes like PME (Pectin methylesterase), PG (Polygalacturonase), PMG (Polymethylgalacturonase), PMTE (Pectin methyl transeliminase) and PGTE (Polygalacturonase transeliminase). Studies on the production of pectolytic enzymes *in vitro* have largely been done by the investigators because such studies provide information on the capacity of a pathogen to produce these enzymes. Hence pectic enzymes of *Corynespora cassiicola*, a pathogen observed to be quite virulent on papaya fruits at Jabalpur, have been investigated *in vitro* as well as *in vivo*.

The pathogen was grown on three different media at 28° C (Table I). The mycelial mats were harvested after the incubation period of 3, 6, 9, 12 and 15 days. The filtrates obtained were centrifuged at 4000 r.p.m. for 20 minutes. The clear supernatant was used as the crude enzyme. The *in vivo* studies were carried out with extracts of healthy and inoculated fruits. The crude enzyme sample was prepared by grinding 5 g of rotted/healthy fruit tissue in pestle and mortar in distilled water (15 ml) with 0·5 N NaCl (15 ml). The ground tissue extract was strained through several layers of muslin cloth and squeezed. The filtrate was centrifuged at 4000 r.p.m. for 20 minutes. The supernatant was taken as the enzyme sample.

The enzyme preparations were assayed for the presence and activity of pectic enzymes (PME, PG, PMG, PMTE and PGTE). The activity of PME was measured in terms of increase in the activity of hydrolysis of pectin which has been expressed as microequivalent of methoxyl group removed by the enzyme sample (Hancock *et al.*[1]; Agarwal *et al.*[2]). The activity of other enzyme samples was assayed by determining the loss in viscosity of the reaction mixture immediately and after 2 hrs. at 30° C following the method of Bell *et al.*[3].

The per cent enzyme actively was calculated as $V_1 - V_2/V_1 - V_w \times 100$ where $V_w$ is the viscosity of distilled water. The composition of the reaction mixtures for 2 ml of enzyme sample for the different