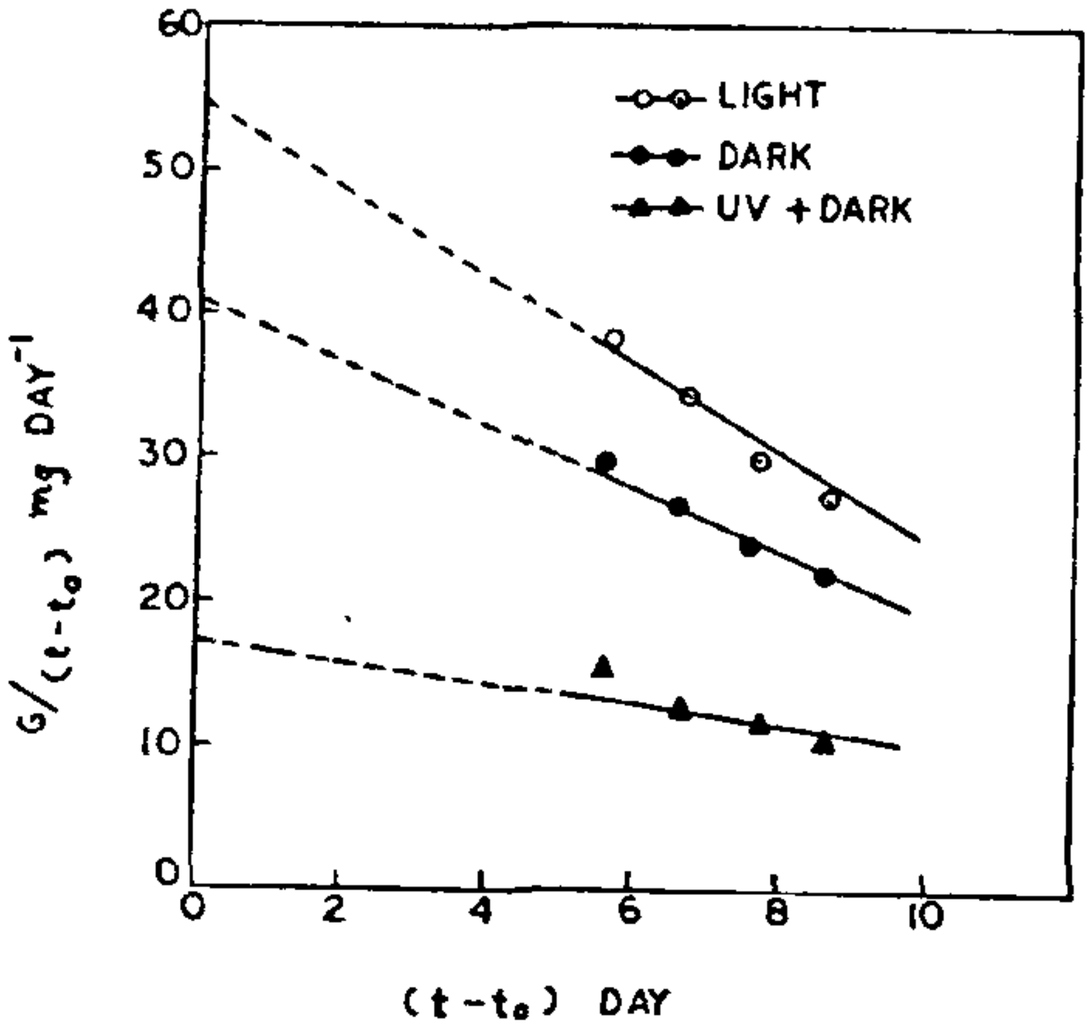

Figure 2. Test of equation (4).

the one proposed earlier[3] for microbial growth,

$$G = L[t - t_0\{1 - \exp(-t/t_0)\}] + L_1(t - t_0)^2. \quad (5)$$

The fact that (5) does represent the growth data in the present case was confirmed in the usual manner[3]. Using the values of t_0 and the values of coefficients L and L_1 the curve predicted by (5) has been traced by giving hypothetical values to t and calculating the corresponding values of G. Since the theoretical points fall on the experimental curves (figure 1), it can be concluded that the growth data of *S. luxurians* are adequately represented by (5) in the present case.

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COMPLEXES OF DITHIOCARBAZIC ACID WITH SOME OXOCATIONS

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SOME new complexes of dithiocarbazic acid $H_2N.NH.CSSH$ with VO(IV), ZrO(IV) and UO_2(VI) of the general composition $MO_n(dtcz)_2.2H_2O$ ($n = 1$ with V and Zr and $n = 2$ with U) have been synthesised and characterised by analytical, magnetic, electronic and infrared spectral studies. The ligand and the complexes have been prepared according to literature methods[1,2]. The magnetic moments at 293°K indicate that the UO_2(VI) and ZrO(IV) complexes are diamagnetic, whereas the magnetic moment of VO(IV) complex is 1.44 B.M., which is much lower than the spin-only moment for a d^1 system (1.73 B.M.). It is likely that the present VO(IV) complex has polynuclear structure[3].

The IR spectra of the free ligand and the corresponding complexes clearly indicate that the $\nu(NH_2)$ bands in ligand occurring at 3310, 3260 and 3200 cm^{-1} are shifted to lower frequencies in all the complexes. The bands in the 1050–940 cm^{-1} region in the spectra of dithiocarbazate can be assigned to the asymmetric and symmetric modes of the CSS– group[4]. The low values of these bands reveal the linkage of metal ions via thiocarboxylate sulphur.

In conclusion, it can be said that the ligand is bidentate ligand, coordination taking place through amino nitrogen and thiocarboxylate sulphur.

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THE INTERACTION OF NICKEL, COBALT, PALLADIUM AND BERYLLIUM WITH OVALBUMIN BY pH METRIC METHOD

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METAL-PROTEIN interactions play a vital role from several points of view such as protein fractionation[1], the elucidation of protein structure[2] and in establishing the mechanism of metabolic processes[3-6]. Among several techniques for studying metal-protein complexes, pH-metry is a rapid technique for this purpose[7-14]. In the present communication results on the binding of several metal ions with ovalbumin using pH-metric method are reported.

A solution of ovalbumin (OA) (Sigma Chemicals Co. USA) was prepared in distilled water, centrifuged and the concentration of the filtrate determined by drying a known aliquot in an air oven at 105°C. Solutions of chlorides of Co(II), Ni(II), Pd(II) and Be(II) (A.R.) in distilled water were analysed by standard methods. pH measurements were carried out with systronic pH-meter at 25°C. Total ionic strength of the mixtures was adjusted to 0.15 by the addition of the requisite amounts of 1.0 M potassium chloride solution.

From pH measurements the values of the total number of hydrogen ions dissociated per mole of ovalbumin (γ) were calculated in the presence and absence of metal ions using the Tanford equation[7, 8]. Here the titration curve of the protein with and without metal ions were quite different (figure 1). In fact, the hydrogen ions dissociated per mole of protein were slightly greater in the presence of metal ions than with the protein alone. This is equal to $n_{M'}$ (the number of metal ions bound per mole of protein (Mol. wt. 45,000) based on Gurd and Murray[15] concept of one to one binding (one $n_{H'}$ ion from one metal ion). All the metals showed characteristic binding with the carboxyl groups from aspartyl and glutamyl amino acid residues in the pH range 3.00 to 5.50[16]. It was further observed that the extent of binding ($n_{M'}$) increased with increasing pH (figure 2). It was, there-

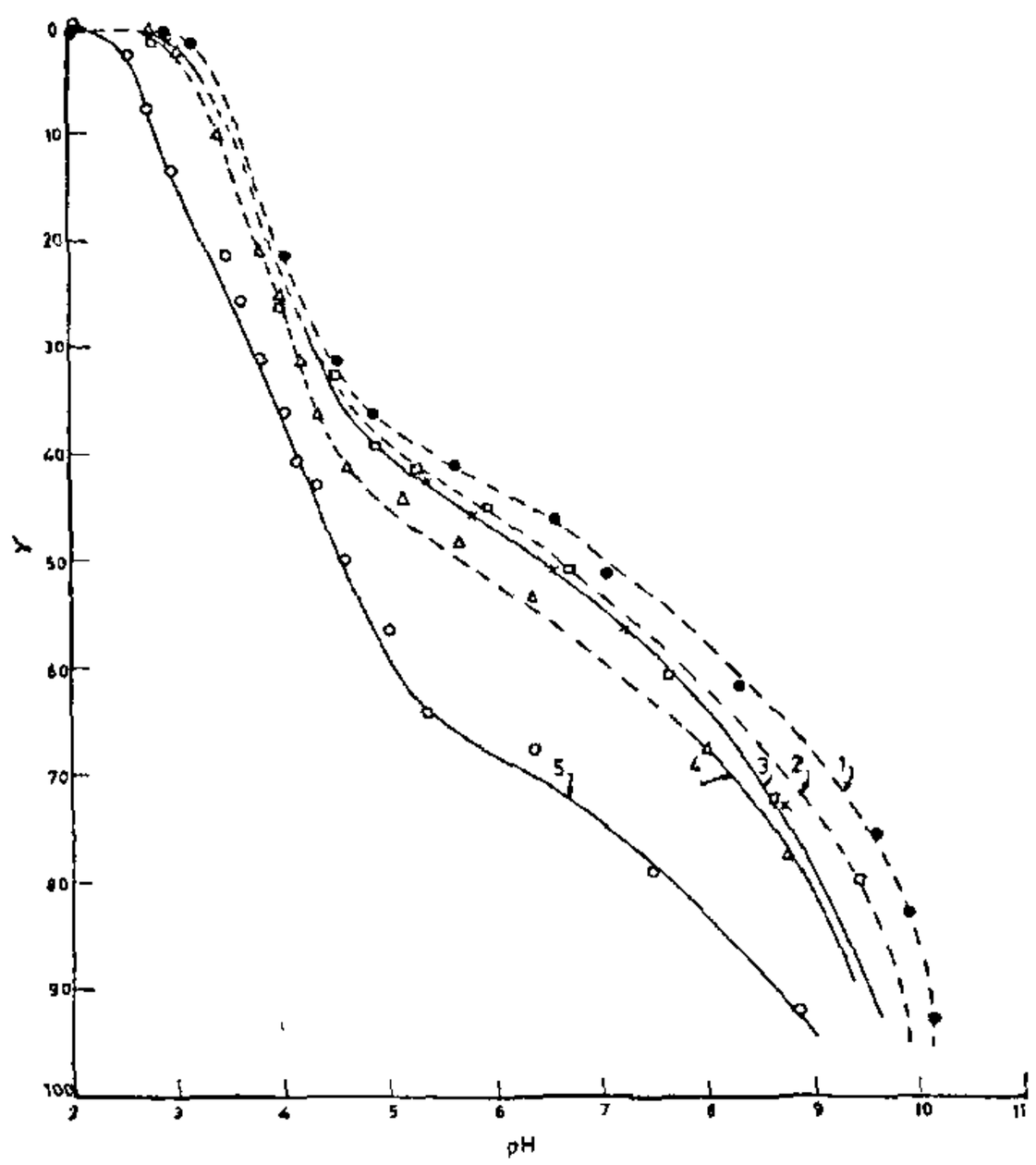

Figure 1. Titrations of ovalbumin in the presence and the absence of metal ions, at 25°C, u = 0.15, ●—● (OA), □—□ (Co + OA) ×–× (Ni + OA), Δ—Δ (Be + OA) and ○—○ (Pd + OA).

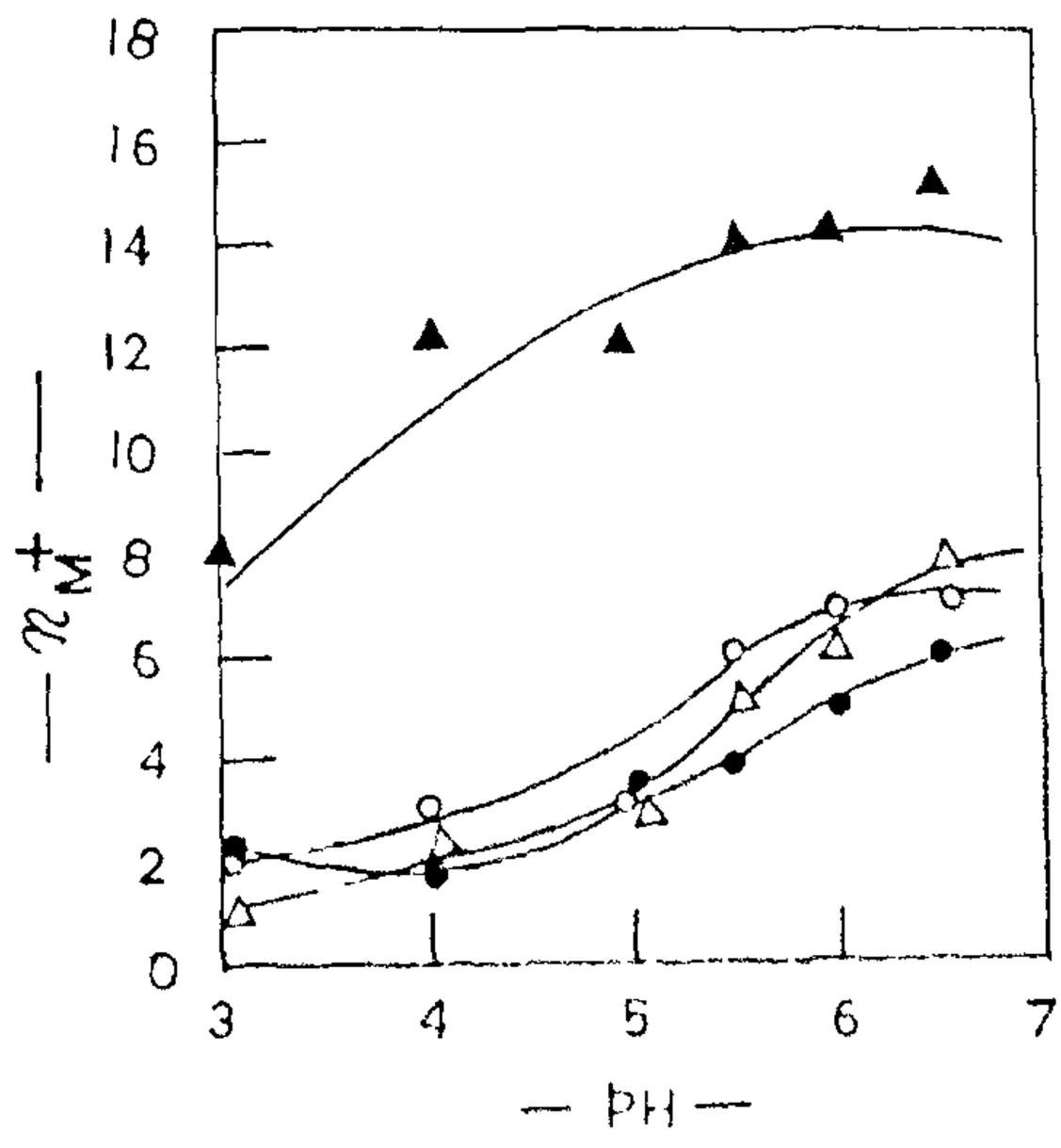

Figure 2. Mole of metal ion bound per mole of OA ($n_{M'}$) plotted against pH ▲ - ▲ (Pd), Δ - Δ (Be), ● - ● (Co) and O - O (Ni).