

able. The tolerance limits given in table I show that many cations and anions do not interfere in the determination of cobalt(II). The interference of certain metals can be reduced by using tartrate, citrate, and phosphate as masking agents.

The sensitivity of HCHMM is more than that of Bis (thiosalicylidene) ethyldiamine⁶, 5-chloro-7-iodo-8-quinolinol⁷, 1-naphthamide oxime⁸, ferrozine⁹, sulphosalicylic acid¹⁰ which have been proposed as sensitive spectrophotometric reagents for cobalt.

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OSCILLATORY REACTION UNRAVELLED BY A NOVEL DIAGNOSTIC APPROACH

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OSCILLATIONS in the acid-bromate system involving Mn(II), Ce(III) or Fe(II) ions (Belousov-Zhabotinskii or B-Z reaction) have been reported¹⁻³ with different organic substrates. The iodate-hydrogen peroxide system with Mn(II) (Briggs-Rauscher or B-R reaction)^{4,5} is known to oscillate with only a few organic substrates. Uncatalysed bromate oscillations (UBO)

have been observed in many instances; however the species causing oscillations have hitherto evaded identification^{6,7}.

The results obtained in the acid-bromate-pyrogallol system with and without the inclusion of [iron($\alpha\alpha'$ -bipyridyl)₃]²⁺ provides valuable information regarding the species responsible for the oscillations in these systems. The course of the oscillatory reaction is followed by keeping all the other constituents, except one, well-stirred and thermostated in a polythene beaker. The platinum and/or Ag/AgBr electrode immersed in the solution is coupled to a saturated calomel electrode through a salt bridge and connected to a x-t recorder for a continuous follow-up of the reaction. The addition of the thermostated last constituent triggers off the oscillation.

The uncatalysed pyrogallol system yields oscillations of large amplitude (about 400 mV) in the range 0.6 to 1V (vs SCE) (figure 1). The spectrophotometric follow up at 390 nm as well as the simultaneous recordings obtained with a platinum and Ag/AgBr electrode establish that at the peak [Br₂] = 10⁻⁴ M and

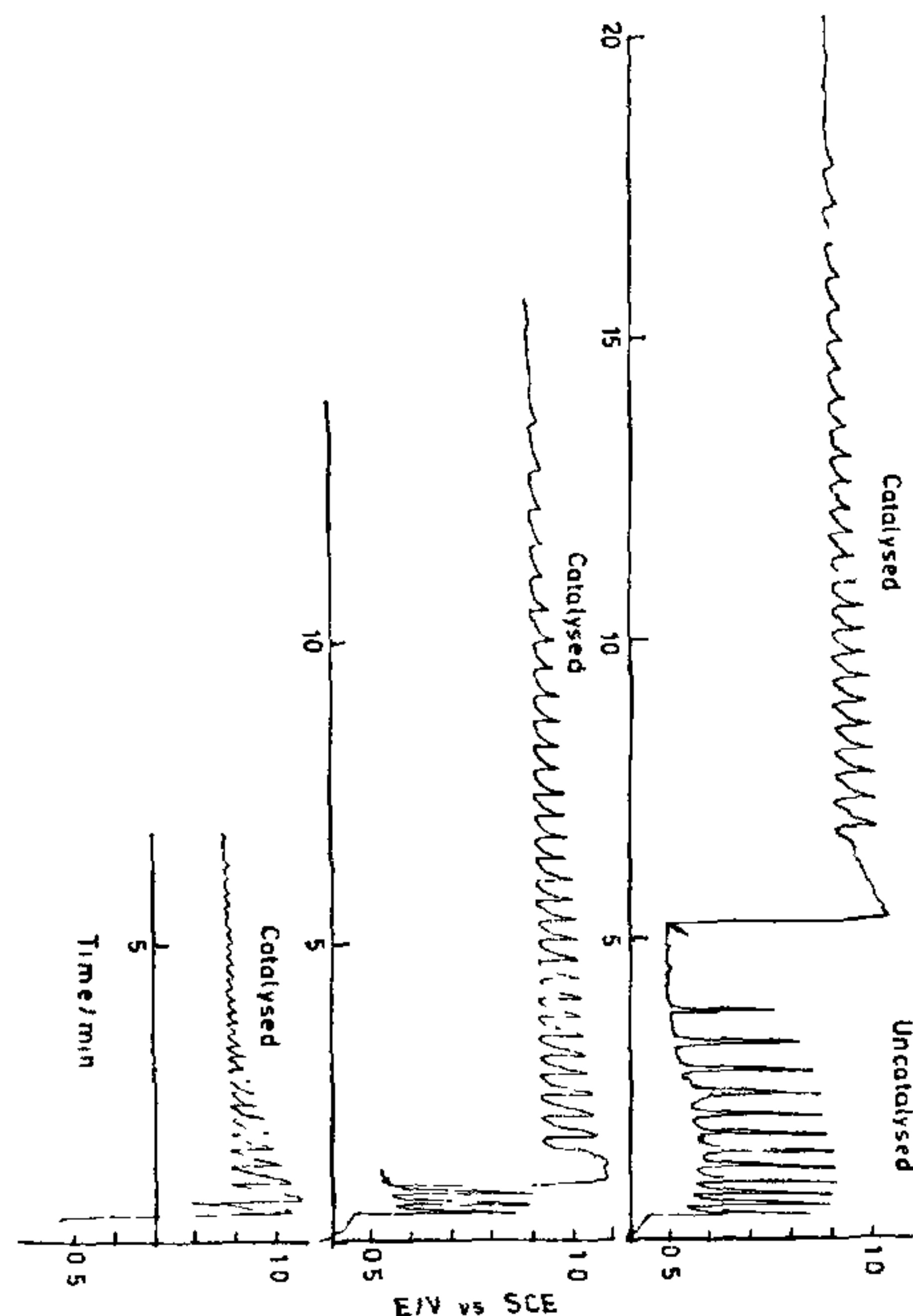


Figure 1. Oscillations in the pyrogallol-bromate system with [iron($\alpha\alpha'$ -bipyridyl)₃]²⁺ = 0.002 M PG = 0.05 M; H₂SO₄ = 2 M; KBrO₃ = 0.1 M Temperature = 30° C.

$[\text{Br}^-] = 10^{-6} \text{ M}$, whereas at the base $[\text{Br}_2] = 10^{-5} \text{ M}$ and $[\text{Br}^-] = 10^{-5} \text{ M}$ (figure 2).

The inclusion of $[\text{iron}(\alpha\alpha' \text{ bipyridyl})_3]^{2+}$ either at beginning, after the commencement of the oscillation or to the exhausted system results in a switchover to a new oscillatory phase in the voltage range 1 to 1.1 V (vs SCE) (figure 1). The oscillatory control in the B-R reaction with ethyl acetoacetate as the organic substrate has been established⁸ to be by iodine/iodide because of its large value of exchange current density. The value of the exchange current density for $\text{Pt}/\text{Fe}^{3+}/\text{Fe}^{2+}$ (10^{-3} A/cm^2) is larger compared to that of $\text{Pt}/\text{Br}_2/\text{Br}^-$ (10^{-5} A/cm^2)^{9,10}.

∴ The oscillatory control in any system is decided by the relative magnitudes of the exchange current densities of the species involved. In the present instance the switchover is due to the large magnitude of the exchange current density of $\text{Pt}/\text{Fe}^{3+}/\text{Fe}^{2+}$.

The species responsible for the oscillations in the uncatalysed system have neither been identified nor established. The oxidised/brominated product of pyrogallol registers a potential of 0.2V (vs SCE). The static potential values of a platinum electrode against SCE with a constant concentration of $[\text{Br}^-] = 10^{-3} \text{ M}$ and varying $[\text{Br}_2]$ can account for a voltage variation of 0.14 to 0.95 V (vs SCE) (table 1). The oscillations in the uncatalysed system are thus established to be due to Br_2/Br^- .

TABLE 1

Static potential values of $\text{Pt}/\text{Br}_2/\text{Br}^-$ vs SCE

$[\text{Br}_2]$	$[\text{Br}^-] = 10^{-3} \text{ M}$	Potential Volt (Vs SCE)
$1 \times 10^{-5} \text{ M}$		0.14
3×10^{-5}		0.40
5×10^{-5}		0.62
7×10^{-5}		0.75
1×10^{-4}		0.80
5×10^{-4}		0.95

A direct evidence of the above conclusion is provided by the following observations: potassium bromide (0.3 M) was added (one drop at a time) to a well-stirred and thermostated mixture of potassium bromate (0.1 M) and sulphuric acid (0.4 M). The individual triggers with a platinum and Ag/AgBr electrode coupled to a saturated calomel electrode were recorded. The downtrend is caused by an increase in the concentration of bromide and the uptrend is due to the formation of bromine from bromate and bromide. The individual shape in any oscillatory reaction

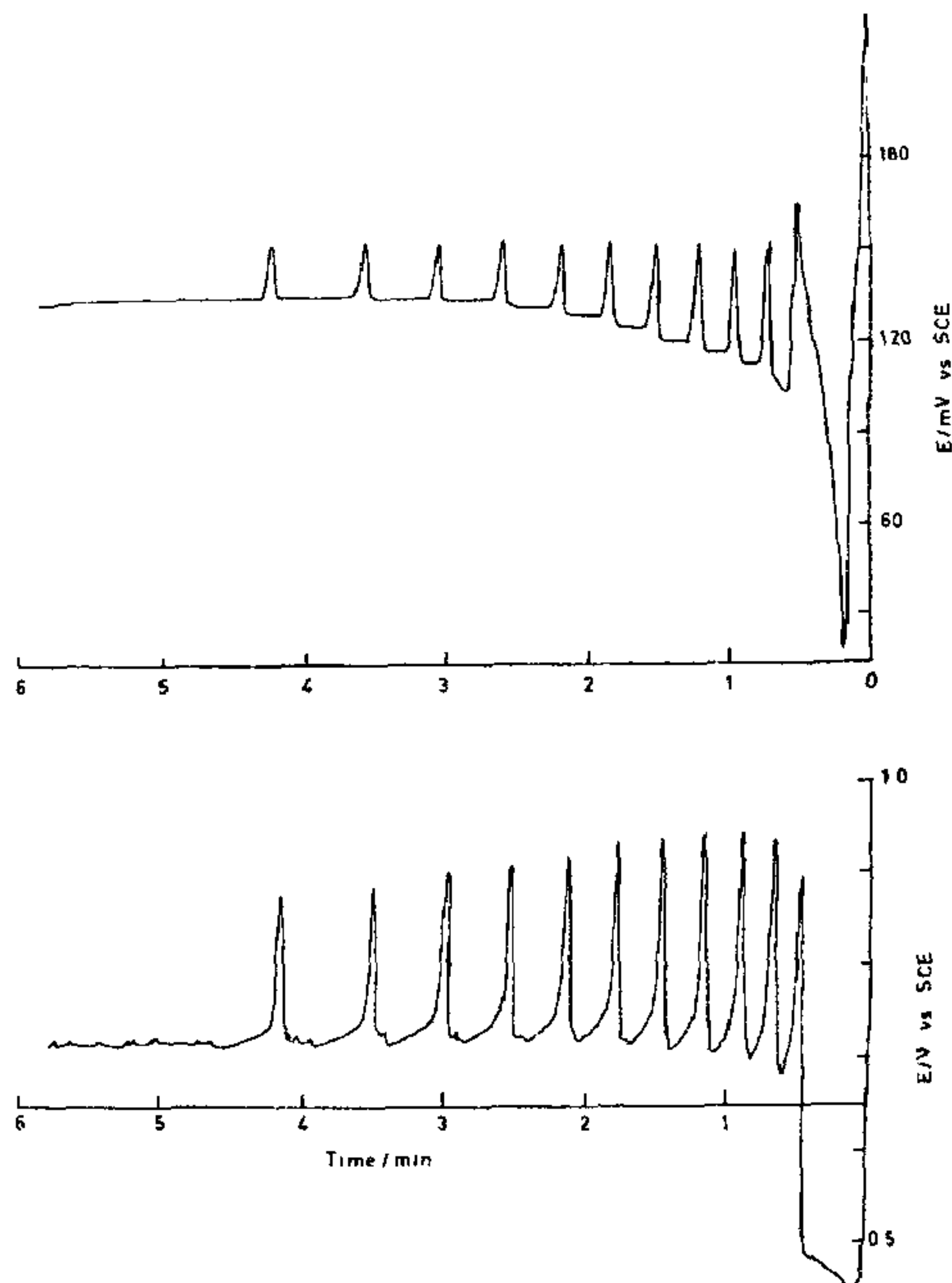


Figure 2. Oscillations in the pyrogallol-bromate system simultaneous recording E/mV with AgBr electrode E/V with Pt electrode. PG = 0.05 M; $\text{H}_2\text{SO}_4 = 2 \text{ M}$; $\text{KBrO}_3 = 0.1 \text{ M}$; Temperature = 30° C .

with a definite amplitude and frequency will depend on the rate of formation of bromine and its consumption by the organic substrate. The relative magnitudes of the exchange current densities of the systems involved will decide the oscillatory control.

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ACTION OF HALOGENS ON METHYLAMINO PARA PHENOL SULPHATE

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THE action of chlorine, bromine and iodine under alkaline conditions on methylamino para phenol sulphate (metol) gave some unexpected results. Although halogens are oxidising agents, hydroquinone was obtained as one of the reaction products.

Metol (0.5 g) was dissolved in distilled water (25 ml) in a conical flask wrapped in a black paper. Alkaline solution of bromine (50 ml, 0.1 N sodium hypobromite) was added dropwise over a period of 3 hr to the metol solution under stirring at 30°C. The reaction mixture was kept in the dark for about 20 hr. It was then acidified with H₂SO₄ (3 ml, 2 N) and evaporated on steam bath. The residue was extracted with hot toluene (50 ml, 90–100°C). The toluene extract on cooling gave white needle-shaped crystals. The compound was identified as *p*-dihydroxy benzene (hydroquinone (I)). The yield was about 7%, m.p. 171°C. The elemental analysis showed 65% C, 5% H (expected for (I) is 65.45% C and 5.45% H). The diacetyl derivative of (I) was prepared, m.p. 123°C (lit. value 123°C). The identity of compound (I) was proved by its UV spectrum (absorption maxima at 221 nm and 289 nm as recorded on Perkin Elmer 550).

Hydroquinone was obtained even when 0.1 N sodium hypochlorite or hypiodite solutions were used. It was interesting to note that the yield of hydroquinone decreased in the decreasing electronegativity of halogens. The yield was 10%, 7%, 3% with chlorine bromine and iodine respectively. Looking at the comparatively poor yield of hydroquinone, a blank experiment was carried out by adding only NaOH solution (25 ml, 0.1 N) to the metol solution, other experimental conditions remaining the same. Hydroquinone was not obtained.

The action of bromine on *p*-AcNHC₆H₄OH has been studied earlier¹. In addition to bromo derivative of the starting compound, tetrabromoquinone and also tetrabromohydroquinone were isolated from the reaction mixture. The formation of hydroquinone however was not reported earlier.

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RECORD OF A NEW DISEASE OF LEMONGRASS (*CYMBOPOGON FLEXUOSUS* STAFF) CAUSED BY *CURVULARIA VERRUCIFORMIS* AGARWAL AND SAHNI

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A NEW leaf spot disease was observed on the plants during September 1978 in the experimental field of this laboratory. The disease appeared again in September 1979 and subsequent years causing extensive damage to the crop. The field observations indicated that the disease was recognised initially as small pink-coloured circular spots on the leaf surface. As the disease advanced, the pink-coloured spot turned brown, enlarged, elongated and spread to form brown patches. Gradually, the colour of the leaves changed to brown resulting in dry leaves. Small black fruiting bodies were also observed under the surface of the leaves in the later stage of infection.

The fungus was isolated from the infected lesions on potato-dextrose-agar (PDA) medium and purified by hyphal tip culture. The fungus was grown at 20°C (±1°C) and the colony was initially white but turned black after 3–4 days of incubation. The fungus grew well with sporulation upto 30°C after which the growth deteriorated.

Microscopic examinations of the fungus culture yielded a species of *Curvularia*. The mycelium was pale brown to black in colour, branched and septate. The conidia were brown to black in colour, 3–4 septate, ovoid and curved and thick walled. The middle cells were larger while the apical cells were conical in shape (figure 1). The size of the conidia was 16.2–18.9 μ × 8.1–9.45 μ. The pathogenicity of this fungus