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Analytical Chemistry

POTENTIOMETRIC DETERMINATION OF HYDROGEN PEROXIDE AND SODIUM PERBORATE WITH POTASSIUM DICHROMATE

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The potentiometric determination of hydrogen peroxide or sodium perborate with potassium dichromate in 8–11 M phosphoric acid medium is described. The reverse titrations proceed smoothly in 6–11 M phosphoric acid. Organic substances such as acetate, tartrate, and citrate do not interfere in the determination.

Keywords: Potassium Dichromate; Potentiometry; Hydrogen Peroxide; Sodium Perborate

INTRODUCTION

SEVERAL reagents have been proposed for the determination of hydrogen peroxide by redoxtitrimetry (Berka *et al.*, 1965; De Whalley, 1962; Kolthoff *et al.*, 1957; and Riechert *et al.*, 1939). Chatterjee and Gyani (1958) found that dichromate oxidises hydrogen peroxide to water and oxygen quantitatively in fifteen minutes in the presence of manganese (II). In the absence of manganese (II) and at low acidities, excess of hydrogen peroxide was consumed, which they attributed to the formation of chromium (V). Schiller and Horvath (1961) also found the formation of chromium (V). Potassium dichromate in phosphoric acid medium functions as a strong oxidising agent (cf. Rao & Rao, 1963), and this paper describes its use for the titration of hydrogen peroxide and sodium perborate with potassium dichromate in phosphoric acid medium.

EXPERIMENTAL

Materials and Method

Potassium dichromate solution 0.1 N. Hydrogen peroxide solution 0.05 M, standardised by permanganate titration (Kolthoff *et al.*, 1957) Sodium perborate solution 0.05 M was standardised by permanganate titration (*loc. cit.*).

Apparatus

The potentiometric assembly used consists of an OSAW Crompton potentiometer and galvonometer (Ambala, India). A saturated calomel reference electrode, a bright platinum rod as indicator electrode and two porous-plate salt bridges (Rao & Rao, 1963) filled with saturated solutions of sodium nitrate and sodium perchlorate. A chloride bridge, caused interference.

Method

About 1–10 ml of hydrogen peroxide or sodium perborate solution was treated with enough syrupy phosphoric acid to give an overall acid concentration of 8–11 M in a final volume of 40 ml. The mixture was titrated potentiometrically with potassium dichromate. Potentials could be recorded immediately after addition of each portion of titrant until near the equivalence point, where a wait of 1–2 minutes was necessary.

Results and Discussion

The effect of varying the overall phosphoric acid concentration over the range 2–12 M was studied. Though a potential break was observed at acidities greater than 4 M, quantitative results were obtained only with 8–11 M over all phosphoric acid concentration, the potential break being 200–240 mv per 0.04 ml of 0.10 N dichromate. Typical results are presented in Table I. The reverse titration also proceeded smoothly in 6–10 M phosphoric acid medium.

Table I

Potentiometric titration of hydrogen peroxide and sodium perborate

Substance	Taken mg.	Found mg.	Error (%)
Hydrogen Peroxide	3.31	3.30	0.30
	4.14	4.15	0.24
	9.94	9.94	—
	13.25	13.23	0.15
	17.39	17.36	0.17
			Av. 0.17
Sodium Perborate	29.45	29.42	0.11
	39.29	39.22	0.20
	46.99	47.07	0.17
	66.07	66.15	0.12
	73.40	73.40	—
			Av. 0.10

Interferences

Aluminium (III), cerium (III), manganese (II), cobalt (II), nickel (II), barium (II), lead (II), zinc (II) chromium (III), mercury (II), molybdenum (VI), uranium (VI), sodium, potassium, acetate, borate, tartrate, citrate and acetate do not interfere when present in five fold ratio to the titrand. Iron (II), arsenic (III), uranium (IV), antimony (III), molybdenum (V), nitrate, chloride, thiourea, thiocyanate, thioglycollic acid and L-cystine interfere in all concentrations.

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REFERENCES

Berka, A., Vulterin, J., and Zyka, J. (1965) *Newer Redox Titrants.* Pergamon Press, pp. 6, 43, 70, 89, 103, 114, 157, 190, 194.

Chatterjee, K., and Gyani, B. P. (1958) Potentiometric study of the reaction between dichromate and hydrogen peroxide. *J. Indian chem. Soc.*, **35**, 784.

De Whalley, C. H. (1962) Hydrogen peroxide as analytical reagent. *Anal. Chem. Proc. Intern. Symp. Birmingham, Engl.*, 397.

Kolthoff, I. M., Belcher, R., Stenget, V. A., and Matsuana, G. (1957) *Volumetric Analysis*, Vol. III. Inter Science Publishers Inc., New York, pp. 75, 80, 143, 282, 465, 509, 528.

Rao, G. C., and Rao, P. K. (1963) Potassium dichromate in strong phosphoric acid medium as a new oxidimetric reagent. *Talanta*, **10**, 1257.

Reichert, J. S., Mcneight, S. A., and Rudel, H. W. (1939) Determination of hydrogen peroxide and some related peroxygen compounds. *Ind. Engng. Chem. Anal. Ed.*, **11**, 194.

Schiller, R., and Horvath, L. (1961) The *p*H dependence of the reduction of dichromate ions by hydrogen peroxide. *Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlment*, **9**, 161.