

# A NOTE ON THE DETERMINATION OF SODIUM PHOSPHATE

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THE British Pharmacopœia assay for Sodium Phosphate has the requirement that 6 g., dissolved in 100 ml. of water, should be titrated with 0.5 N hydrochloric acid, using a mixture of equal parts of solution of bromocresol green and solution of methyl red as indicator. The end-point is a grey colour indicating pH 4.5. In practice, a neutral grey colour was not found with this indicator, the colour change being from pink to blue, through a series of 'shaded' greys. We have examined the reaction between hydrochloric acid and sodium phosphate to determine the end-point, so as to indicate it precisely.

## METHOD

The experimental work fell into three parts.

1. The colour change of various mixtures of bromocresol green and methyl orange was examined. Phthalate buffers of the British Pharmacopœia, ranging from pH 3.6 to pH 5.6 were prepared, and to 5 ml. of each buffer solution was added 0.1 ml. of the mixed indicator. The composition of the indicator varied from bromocresol green 1:methyl red 1 to bromocresol green 6:methyl red 1. The resulting solutions were examined both in daylight and in artificial light. The colour changes, recorded in Table I, show a 3:1 or a 4:1 mixture to cover the range about pH 4.5.

TABLE I

THE COLOUR CHANGE OF MIXTURES OF BROMOCRESOL GREEN AND METHYL RED

Composition of Indicator Bromocresol green : Methyl red	pH Range over which Indicator changes colour		Colour at pH 4.5
	Daylight	Artificial light	
1:1	4.2-5.4	4.5-5.6	pink
2:1	4.2-5.0	4.2-5.4	purple/grey
3:1	4.2-5.0	4.0-5.2	grey
4:1	4.2-5.0	4.0-5.0	grey
5:1	3.6-5.0	3.8-5.0	blue/grey
6:1	3.6-5.0	3.6-5.0	blue/grey

TABLE II

TITRATION OF 100 ML. PORTIONS OF 0.1 N SODIUM PHOSPHATE SOLUTIONS WITH 0.5 N HYDROCHLORIC ACID. (CONSOLIDATED RESULTS)

Volume of added 0.5 N hydrochloric acid (ml.)	Glass-electrode pH	Colour (artificial light) Indicator		
		1:1	3:1	4:1
0	9.12	blue	blue	blue
18.0	5.90	"	"	"
19.0	5.60	grey/blue	"	"
19.5	5.25	blue/grey	"	"
19.6	5.17	purple/grey	grey/blue	"
19.7	5.03	"	"	"
19.8	4.91	pink/purple	purple/grey	grey/blue
19.9	4.70	purple/pink	grey	"
20.0	4.48	pink	pink/grey	grey
20.1	4.30	"	orange/pink	pink/orange
20.2	4.13	"	"	orange/pink

## DETERMINATION OF SODIUM PHOSPHATE

2. Sodium phosphate solutions were titrated with hydrochloric acid. pH changes were recorded potentiometrically using a glass electrode, and at the same time the colour of the added indicator was noted. The results are shown in Table II.

3. Accurately weighed amounts of pure anhydrous sodium phosphate were determined by titration against 0.5 N hydrochloric acid using 1 ml. of the mixed indicator:—(a) 1 part bromocresol green : 1 part methyl red ; (b) 3 parts bromocresol green : 1 part methyl red ; (c) 4 parts bromocresol green : 1 part methyl red.

Finally, the determination was carried out using the 4:1 indicator, with buffer solutions of pH 4.4, 4.5 and 4.6 (120 ml.) each containing 1 ml. of the mixed indicator.

The results are shown in Table III.

TABLE III  
THE DETERMINATION OF PURE ANHYDROUS SODIUM PHOSPHATE

	Percentage of Na <sub>2</sub> HPO <sub>4</sub> found	
	Operator A	Operator B
Indicator 1:1 titrated to the closest approach to a grey colour	97.6	98.3
	97.8	98.2
	98.3	97.8
Indicator 3:1, titrated as above	100.6	98.8
	100.6	99.8
	100.3	100.1
Indicator 4:1 titrated as above	100.3	99.1
	100.2	99.2
	100.3	99.0
Indicator 4:1, using pH 4.5 buffer containing indicator for comparison	100.0	99.7
	100.1	100.1
	100.1	100.1
	100.0	100.1
	100.2	99.7
	99.8	99.7

### CONCLUSION

It is suggested that the following method of assay for Sodium Phosphate is more suitable than the present official method:

“Dissolve about 6 g., accurately weighed, in 100 ml. of water and titrate with 0.5 N hydrochloric acid using 1 ml. of a mixture of four parts of solution of bromocresol green and one part of solution of methyl red as indicator, and titrating until the colour of the solution matches that obtained by adding 1 ml. of the above indicator to 120 ml. of buffer solution of pH 4.5.”

### SUMMARY

1. The end-point of the B.P. 1953 assay of Sodium Phosphate is unsatisfactory.
2. A new indicator system employing four parts of solution of bromocresol green and one part of solution of methyl red is recommended.
3. Readings should be matched with a standard prepared by adding 1 ml. of the new indicator mixture to 120 ml. of buffer solution of pH 4.5.