

## Short Communication

# Spectrophotometric method for the estimation of water in deuterium oxide (D<sub>2</sub>O)

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### Abstract

A spectrophotometric method is described to estimate water in D<sub>2</sub>O in 0.5 to 50% concentration by employing a water absorption band with  $\lambda$  max at 1445-1398 nm.

Keywords: Spectrophotometry, water, estimation, deuterium oxide.

### Introduction

There has been a need for an analytical method for quantitative determination of water in deuterium oxide (D<sub>2</sub>O). An absorption band in near IR region at  $\sim$  1445-1398 nm present in water<sup>1-3</sup> was found entirely absent in D<sub>2</sub>O (fig. 1). This band could be suitably employed for determination of water in D<sub>2</sub>O.

### Experimental

Using a double beam Cary 17 DX spectrophotometer the absorption spectra were recorded in the region 1500-1350 nm. A quartz cell of path length 5 cm was employed for water concentration 0.5-6%, whereas a 0.5 cm path length cell was employed in the concentration range 10-50%. Concentrations between

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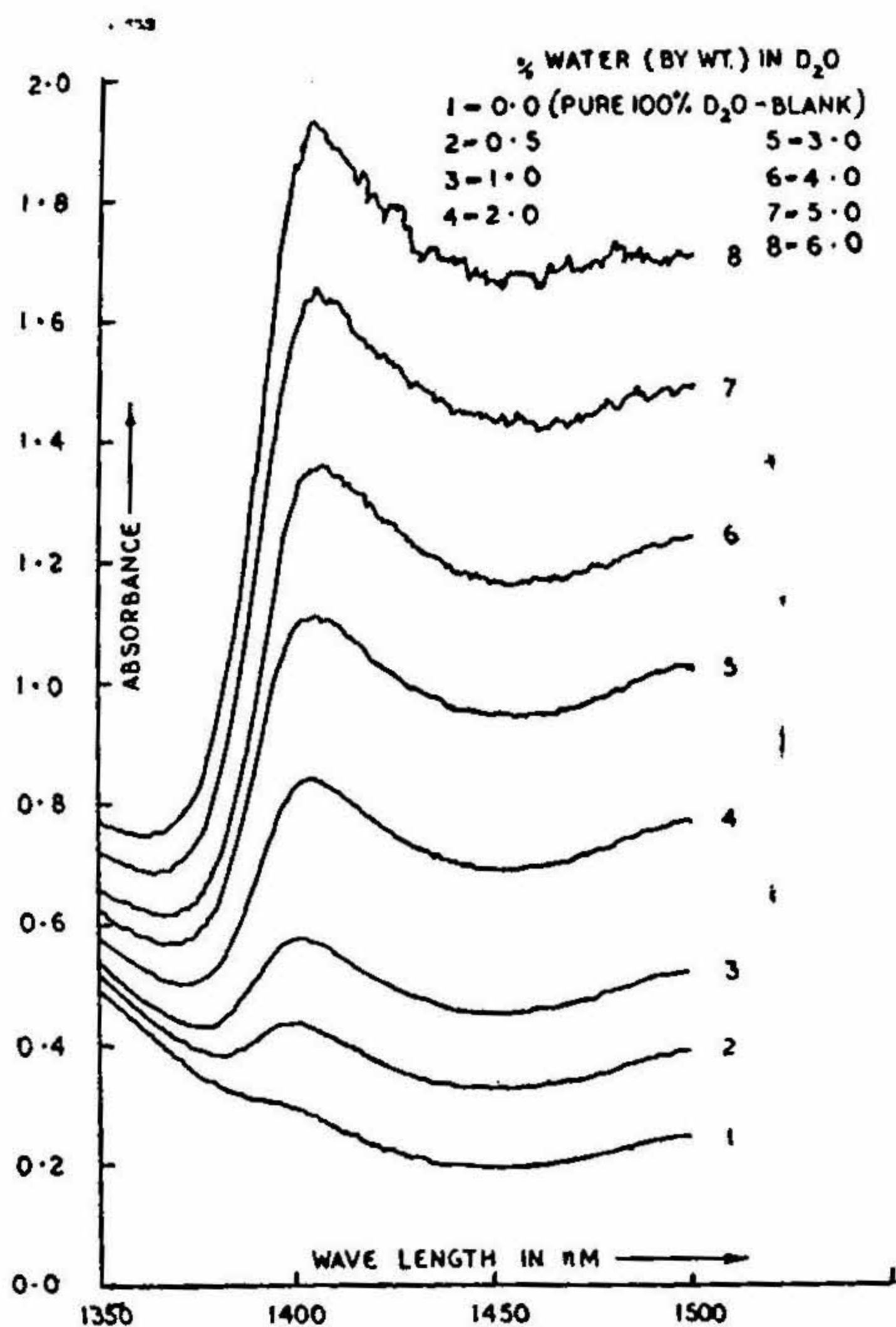


FIG. 1. Absorption spectrum of water in D<sub>2</sub>O—cell path length 5 cm.

these two values can be determined using cells of 1 and 2 cm thickness. All recordings were made at room temperature ( $30 \pm 0.1^\circ \text{C}$ ).

### 3. Results and discussion

Several recordings with varying water concentration were taken with each cell thickness. These were repeated several times and found reproducible. Spectrophotometric recordings are reproduced in fig. 1.

It was observed that the band shifted to lower wavelengths with decrease in water concentration.

The two calibration curves of water concentration vs. absorbance for water concentration 0.5–6% (cell path length 5 cm) and water concentration 10–50% (cell path length 0.5 cm) are reproduced in fig. 2.

Water in D<sub>2</sub>O can be determined in concentration range 0.5 to 50% using different cell thicknesses. The linearity of water concentration vs. absorbance curve (fig. 2) is

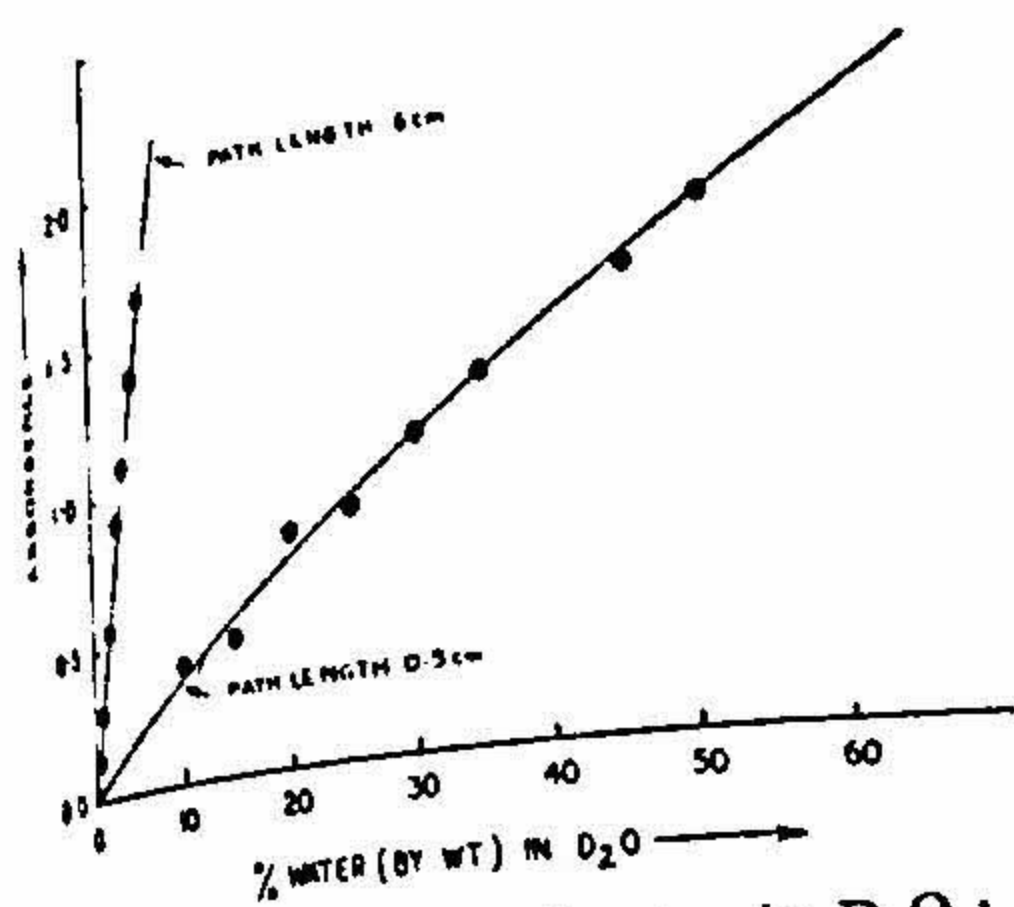


FIG. 2. Calibration curve of water in  $D_2O$  :  
water concentration (% by wt.) vs. absorbance.

Its entire concentration range was excellent. The standard deviation for analysis of samples containing 0.5 to 6% water ( $H_2O$ ) in  $D_2O$  is found to be  $\pm 0.7\%$ , while that of samples containing 10 to 50% water ( $H_2O$ ) in  $D_2O$  is  $\pm 0.4\%$ .

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#### References

- GOLDSTEIN, R. AND PENNER, S. S. *J. Quant. Spectrosc. Radiative Transfer*, 1964, 4, 441.
- BEDS, K. AND CHOPIN, G. R. *J. Chem. Phys.*, 1963, 39, 2035.
- YAMATERA, H., FRITZ, PATRICK, B. AND GORDON, G. *J. Mol. Spectrosc.*, 1964, 14, 268.