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ABSORPTION SPECTRUM OF URANYL SULFATE SOLUTION

BY

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ABSORPTION SPECTRUM OF URANYL SULFATE SOLUTION

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ABSTRACT

The absorption spectrum of pure uranyl sulfate solution in the visible and ultraviolet regions has been studied, and plots of absorbancy measurements and of molecular extinction coefficient are presented.

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ABSORPTION SPECTRUM OF URANYL SULFATE SOLUTION

O. Menis and R. Rowan, Jr.

Introduction

The absorption spectrum of uranyl sulfate solution is of interest both from the theoretical standpoint and because of its importance in the analytical chemistry of uranium and of this compound. The information in the literature dealing with this subject is limited in scope, however, and an investigation of the absorption spectrum in the visible and ultraviolet regions has been made.

There are few reports in the literature dealing with the absorption spectrum of uranyl sulfate solution. Some of the early work involved the photography of the absorption spectrum using a quartz spectrograph with a carbon arc as the radiation source.[1][2] These early data, however, are incomplete and are not readily interpreted for use in spectrophotometric determinations. In a more recent investigation by Betts and Michaels,[3] which was carried out in connection with a study of ionic association in aqueous solution, the absorption spectrum was determined in the range of 340 to 500 mμ for a solution which was 0.1 M in uranyl ions and 0.082 M with respect to bisulfate.

[redacted]

Experimental Procedure

Absorbancy measurements for the present study were made by means of a Beckman DU Spectrophotometer equipped with a tungsten lamp for measurements in the visible region and with a hydrogen discharge lamp for those in the ultraviolet region of the spectrum. The solutions were maintained at a constant temperature ($25.2 \pm 0.1^{\circ}C$) in matched quartz cuvettes by means of an attachment ("thermospacer"). The sensitivity of the instrument remained constant throughout the series of measurements, while adjustments were made by varying the slit width. The wavelength calibration of the spectrophotometer was checked with the lines of a mercury arc source.

Standard solutions containing 2.168, 5.42, and 10.84 mg of uranium per ml were prepared from a stock solution which had been found to be free of impurities and excess sulfuric acid by analysis, and absorbancy measurements were made on these solutions.

Plots of the absorbancy measurements at the various concentrations of uranyl sulfate are shown in Figure 1. The calculated molecular extinction coefficients at the maximum (418 mμ) are 13.50, 13.48, and 13.44, respectively, for the solutions containing 2.168, 5.42, and 10.84 mg of uranium per ml. This indicates that Beer's absorption law is adhered to at this wavelength.

In Figures 2 and 3 the molecular extinction coefficient of uranyl sulfate is plotted as a function of the wavelength in both the visible and ultra-violet regions of the spectrum. The measurements were made on solutions whose uranium concentration allowed optimum accuracy of absorbancy measurements in the region of the maximum. The wavelength of the maximum and the fine structure

of the spectrum conforms closely to that reported by Betts and Michaels.(3)

Acknowledgment

The authors wish to acknowledge the assistance of Mrs. S. K. Gross.

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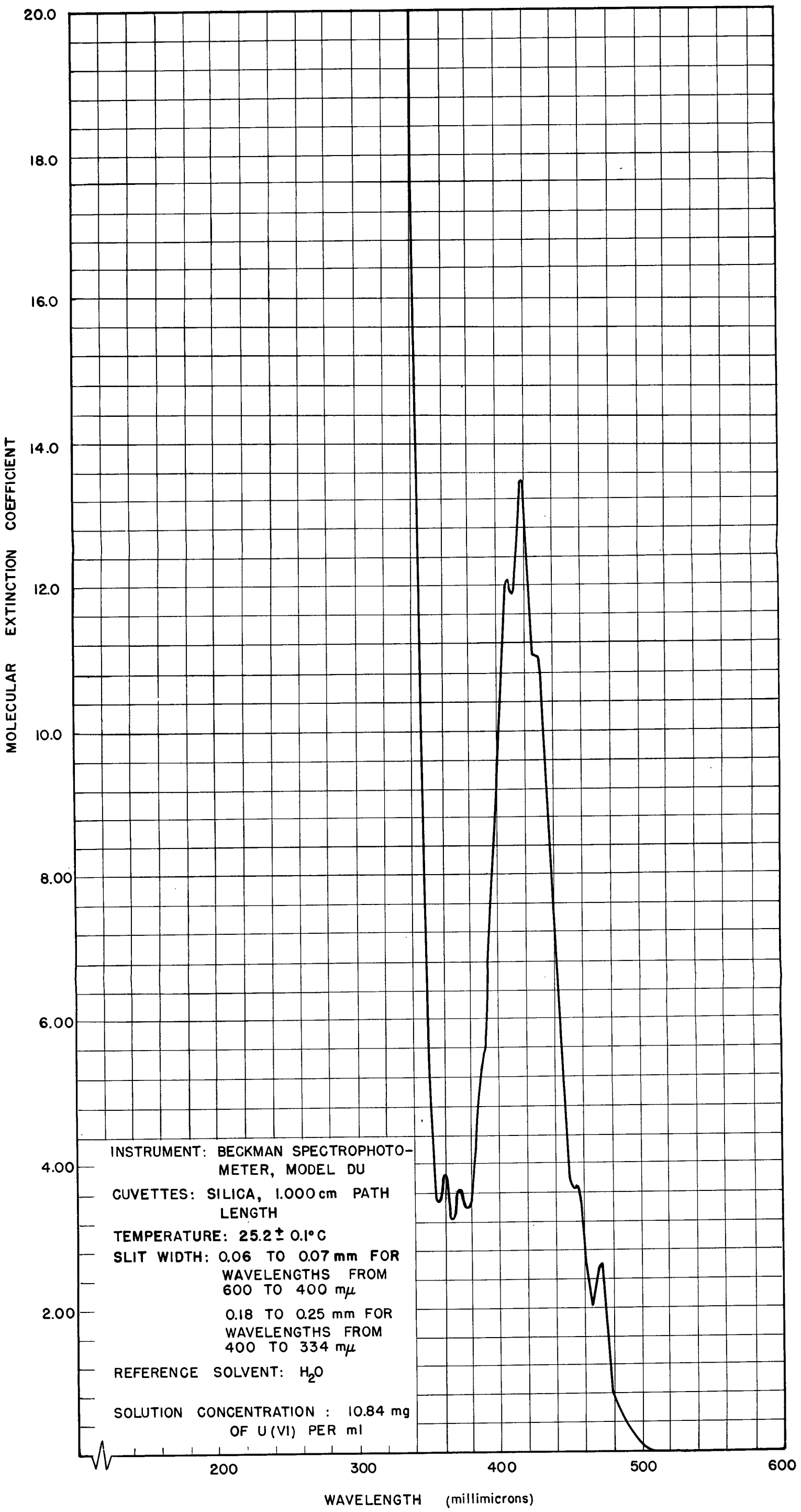

FIGURE I. VISIBLE ABSORPTION SPECTRUM OF URANYL SULFATE SOLUTION

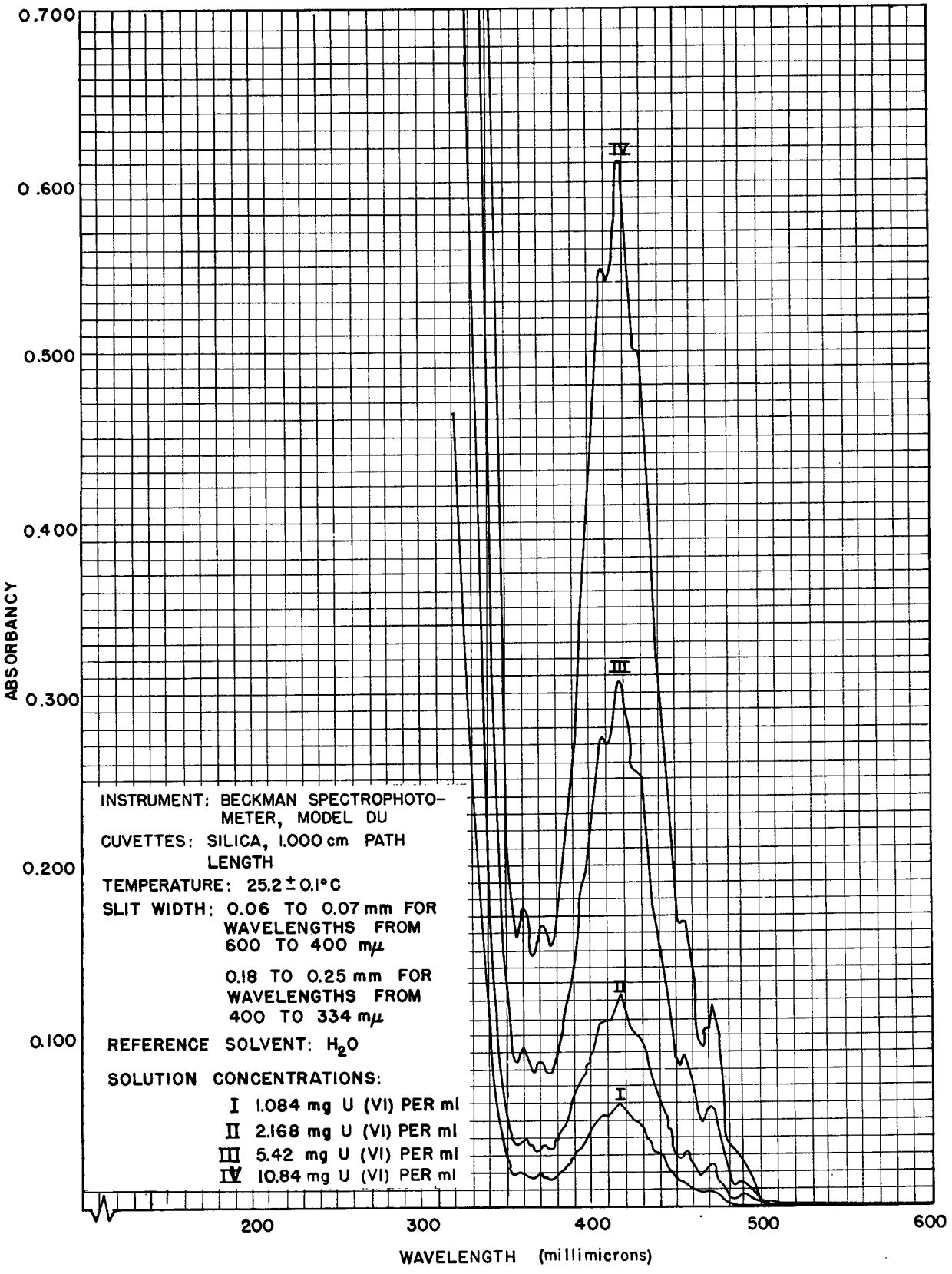

FIGURE 2. ABSORPTION SPECTRA OF URANYL SULFATE SOLUTION

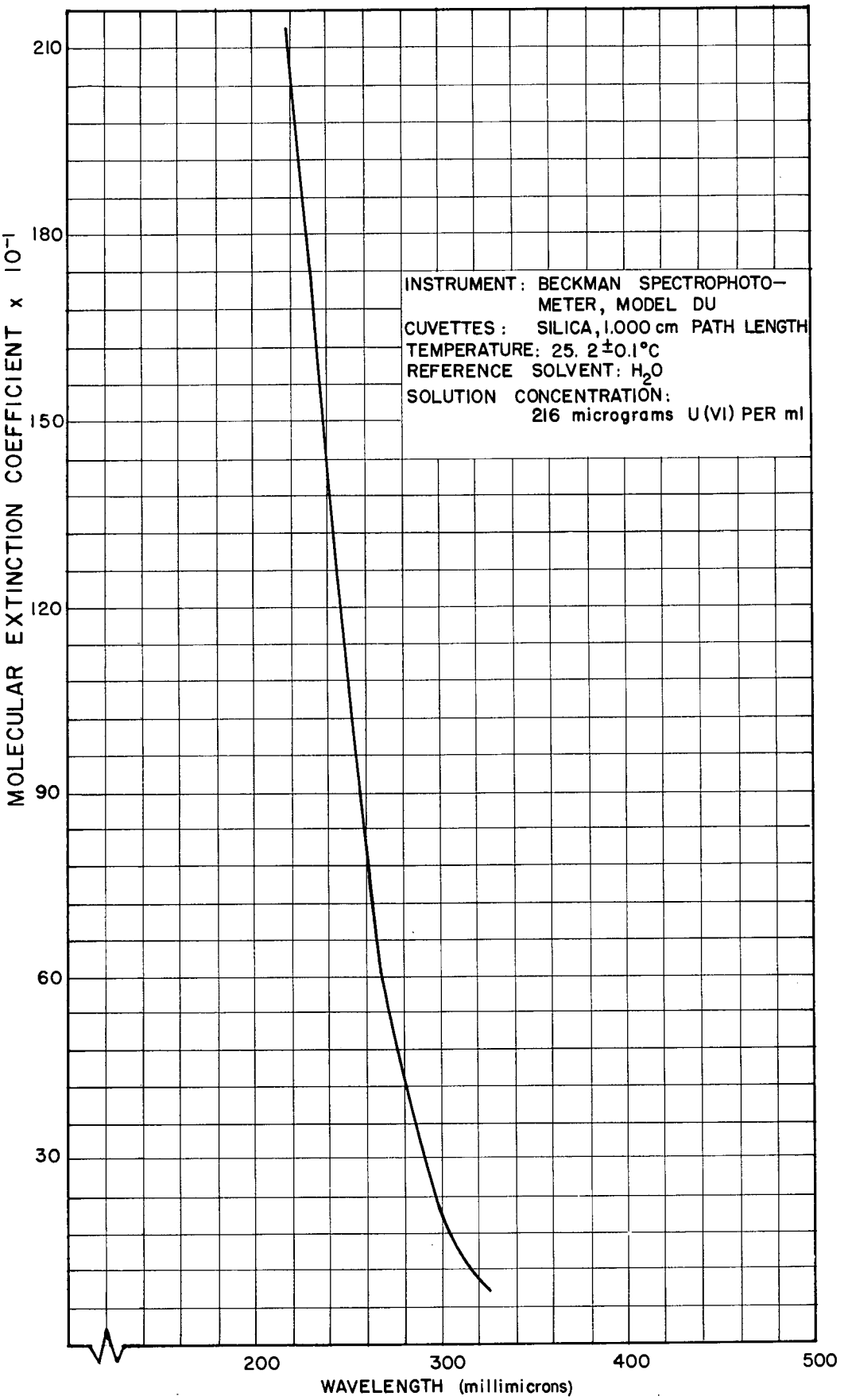

FIGURE 3 ULTRAVIOLET ABSORPTION SPECTRUM OF URANYL SULFATE SOLUTION