

## Composition and Stability of Lead-Alizarin Red S Chelate

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With 2 Figures

### Abstract

The composition and stability of the red coloured complex of lead-Alizarin Red S chelate ( $\lambda_{\max}$  490m $\mu$ ) have been determined using the mole ratio method and the slope ratio method. The ratio of lead to Alizarin Red S has been determined to be 1:1. The chelate is stable between pH 5.4 and 8.2. The value of formation constant is  $6.0 \cdot 10^4$  at pH 4.0 at 25°.

MUKHERJI and DEY<sup>1)</sup> in an earlier publication from these laboratories reported the formation of a 1:1 (metal:chelating agent) red coloured chelate ( $\lambda_{\max}$  490 m $\mu$ ) of lead with Alizarin Red S. They employed only one method, i. e., method of continuous variations<sup>2)</sup> for determining the composition of the chelate by absorption spectra studies. It is, however, useful to investigate a system using different methods. Hence a further study on the system was made and the composition was studied using the mole ratio and the slope ratio methods, the results are reported in this communication.

### Experimental

Reagents: Stock solutions of lead nitrate (B. D. H.) and Alizarin Red S (B. D. H.) were prepared in double distilled water.

Instruments: For the measurements of absorbance a Unicam SP 500 spectrophotometer employing 10 mm glass cells was used. Hydrogen ion concentration was adjusted with a L&N direct reading pH indicator.

### Results and discussion

Conditions of study: All experiments were done in an air conditioned room maintained at 25°. The pH of all the solutions was fixed to 4.0 by adding hydrochloric acid or sodium hydroxide. The total volume kept in every case

<sup>1)</sup> A. K. MUKHERJI and A. K. DEY, Proc. Nat. Acad. Sci., **26**, 20 (1957).

<sup>2)</sup> P. JOB, Comp. Rend. **180** (1928); Ann. Chim., **9** (10), 113 (1928); Ibid **11** (6), 97 (1936).

was 25 ml and solutions were kept for 30 minutes before taking the observations.

$\lambda_{\text{maz}}$  of the chelate: MUKHERJI and DEY by employing the method of VOSBURGH and COOPER<sup>3)</sup> found that only one complex was formed under the conditions of study having  $\lambda_{\text{max}}$  at 490  $m\mu$ .

Molar ratio of the chelate: Mole ratio method<sup>4)</sup> and the slope ratio method<sup>5)</sup> were employed for determining the ratio of lead to Alizarin Red S.

Table 1  
Composition of the Lead-Alizarin Red S Chelate

Method employed	pH	Composition Pb:ARS*	Wavelength $m\mu$	
Continuous variations	3.7-4.2	1:1	490	DEY et al <sup>1)</sup>
Mole ratio	4.0	1:1	490	Author
Slope ratio	4.0	1:1	490	Author

\* Alizarin Red S

The results of the earlier workers and the present work are given in table 1 (Fig. 1 and 2).

The results of the present work are in agreement with the work of the earlier workers, hence the composition of the chelate Pb(ARS) is confirmed.

Effect of pH on the stability of the chelate: The  $\lambda_{\text{max}}$  of the chelate i.e., 490  $m\mu$

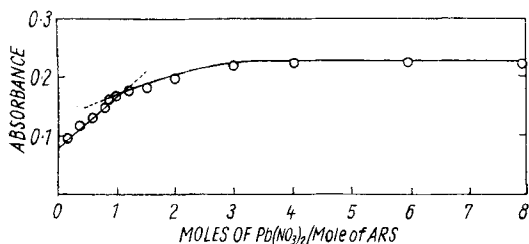


Fig. 1. Composition of the chelate by the absorption spectra studies, using mole ratio method at 490  $m\mu$ , pH 4.0

Curve Final concentration of ARS  $2.0 \cdot 10^{-4}$  M

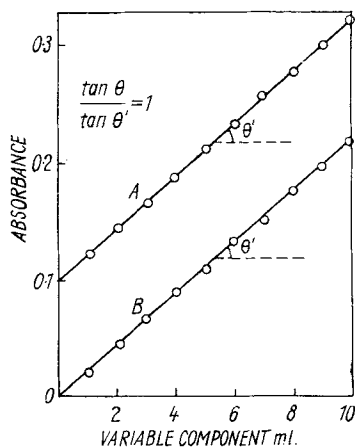


Fig. 2. Composition of the chelate by absorption spectra studies using slope ratio method at 490  $m\mu$ , pH 4.0. 10 ml ( $5.0 \cdot 10^{-4}$  M) excess component x ml ( $1.66 \cdot 10^{-4}$  M) variable component (15 - x) ml  $H_2O$ . Curve A. Lead nitrate varying, Curve B. Alizarin Red S varying

<sup>3)</sup> W. C. VOSBURGH, and G. R. COOPER, J. Amer. Chem. Soc., **63**, 437 (1941).

<sup>4)</sup> J. H. YOE and A. L. JONES, Ind. Engng. Chem. Analyt. Ed., **16**, 111 (1944).

<sup>5)</sup> A. F. HARVEY and D. L. MANNING, J. Amer. Chem. Soc., **72**, 4488 (1950).

holds good between pH 5.4 and 8.2 which shows that the chelate is stable within this range of pH.

Evaluation of the stability constant (K). Mole ratio method has been employed for the determination of stability constant. Table 2 shows the results along with the results of the earlier workers.

Table 2  
Stability constant

Method employed	pH	Stability constant
DEY et al	3.7—4.2	$5.0 \cdot 10^4$ previous work
Mole ratio	4.0	$6.0 \cdot 10^4$ present work

The above values shows the reliability of the stability constant values.

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