CHAPTER IV

RESULTS

Potassium

A. In the fuel lean flame.

The concentration of 2 ppm of potassium was determined in the presence of other alkali metals does effect the K-absorbance a considerable amount with the order Cs Rb Li Na. In the case of caesium and rubidium, the trend is similar the K-absorbance is gradually increased from 0.175 to 0.300 and 0.27 for Cs and Rb added respectively in amounts up to 400 ppm. The effect levels off when the concentration of interfering atoms exceeds 400 ppm.

When lithium and sodium were used the K-absorbance was increased also but to a lesser extent than in the case of caesium and rubidium. For lithium added the increase in K-absorbance is somewhat similar to that of caesium and rubidium.

For sodium added the K-absorbance quickly reached the maximum value when 100 ppm added but the magnitude of the increase is not as great as those for caesium and rubidium.

For higher concentration of up to 10,000 ppm of caesium, rubidium and sodium added, the absorbance reaches a maximum in the range of 1,000 - 4,000 ppm and then decreases again.

B. In the fuel rich flame.

The results of the fuel rich flame are much the same as for fuel lean flame except that the increase in K-absorbance is not as great. The absorbance increases with increasing concentration of interfering atom from 0.130 to 0.250 for caesium added, 0.225 for rubidium added, 0.200 for lithium added and 0.155 for sodium added at 700 ppm for caesium and rubidium, 900 ppm for lithium and 500 ppm for sodium respectively. With higher concentrations of interfering atom there is also the trend of absorbance to level off to a maximum and then decrease.

Sodium

A. In the fuel lean flame

The study with 1 ppm sodium chloride solution and varying concentration of interfering atoms caesium, rubidium, potassium and lithium is shown in Fig. 6. The presence of other alkali metals with the exception of lithium does increase the Na absorbance in the order Cs > K > Rb. Upon the addition of interfering atoms up to 100 ppm. Na-absorbance is increased from 0.255 to 0.270,0.270,0.265 and 0.260 for caesium,potassium and rubidium added respectively but decreased to 0.244 when lithium was added. Generally the effect tends to level off when the concentrations of interfering atoms exceeded 100 ppm.

B. In the fuel rich flame

Using this rich flame in which most sodium analysis are done also improve the absorbance of sodium and the effect is more pronounced than using the lean one. The order of increment in Na-absorbance is Cs > Rb > K. For the system with lithium added up to 100 ppm the sodium absorbance does increase from 0.235 to 0.240 and remain at the value when lithium was added up to 700 ppm. In amounts greater than 700 ppm the presence of lithium depresses the Na-absorbance a great deal. Na-absorbances decrease from 0.240 when 700 ppm lithium added to 0.195 when 7500 ppm lithium added. This trend shows that with lithium added greater than 7500 ppm the Na-absorbance will decrease even more.

Lithium

A In the fuel lean flame.

The study was also done with 3 ppm LiCl solution. After the addition of the four interfering species Li-absorbance was increased in the order Rb > Cs > K > Na. The absorbance curves of Rb and Cs are very close together in magnitide similarly for K and Na. The addition of Rb and Cs shows that the Li-absorbance was increased from 0.2700 to the maximum value of 0.300 for 300 ppm added. When the concentration of interfering atoms is greater than 300 ppm the effect tends to level off. For K and Na the maximum is smaller than Cs. Li-absorbance increased from 0.2700 to 0.2800 only when 100 ppm of K added but to 0.2750 when the same concentration of Na added.

Another duplicate samples were done using Li_2SO_4 solution and the result seems very similar for those of chloride except the order is Rb > Na > K > Cs. The blank value for Li-absorbance is higher than the chloride. The addition of Rb shows that the Li-absorbance was increased from 0.325 to the maximum value of 0.400 for 1,000 ppm added but decreased to 0.295 when the concentration reached 7,000 ppm. For K,Na and Cs the effect reached maximum at 100 ppm amount added and leveled off when the concentrations of interfering atoms were increased.

B. In the fuel rich flame.

Using a fuel rich flame with 3 ppm LiCl solution showed that the effect of adding Na,K,Rb,Cs as the interfering atoms was increased in the order Rb $\approx$ K $>$ Cs $\approx$ Na. The enhancement effect in this case is small in magnitude. Li-absorbance is increased from 0.1800 to 0.2200 for Na and Cs added 100 ppm and level off but for K and Rb added the absorbance is increased to 0.2300 for 100 ppm added and level off again.

For Li_2SO_4, the order is Rb $>$ K $>$ Na $>$ Cs for concentration up to 1,000 ppm added but for higher concentration the order seems to change a little K seems to be the only atom which has a constant effect at high concentrations that the Li-absorbance is increased to a maximum as the concentration of K increased. For Rb,Cs and Na the effect tends to suppress Li-absorbance as the concentration is increased.

The addition of La^{+3} to the K-Cs system.

It was decided to study the effect of a releasing agent on an alkali metal system in order to determine whether there was an additional effect. Accordingly, lanthanum was added to the K-Cs system and the results show similar behaviour when lanthanum is added in both fuel rich and fuel lean flames. The study was done using two differences concentration of La^{+3}, 10^3 and 5×10^3 ppm. Figure shows that in fuel lean flame, K 2 ppm with varying Cs concentrations up to 4oo ppm, K-absorbance is increased from 0.175 to the maximum of 0.300 and with increasing Cs concentration the increment seems to remain at 0.300. When La^{+3} 10^3 ppm was added to this system, K-absorbance again increased but the maximum K-absorbance shifted to 0.325 at 500 ppm Cs added. With La^{+3} increased to $5x10^3$ ppm, K-absorbance even increased more. For the fuel rich flame the effect is less. For 10^3 and $5x10^3$ ppm of La^{+3} added the increase in K-absorbance is very close together.

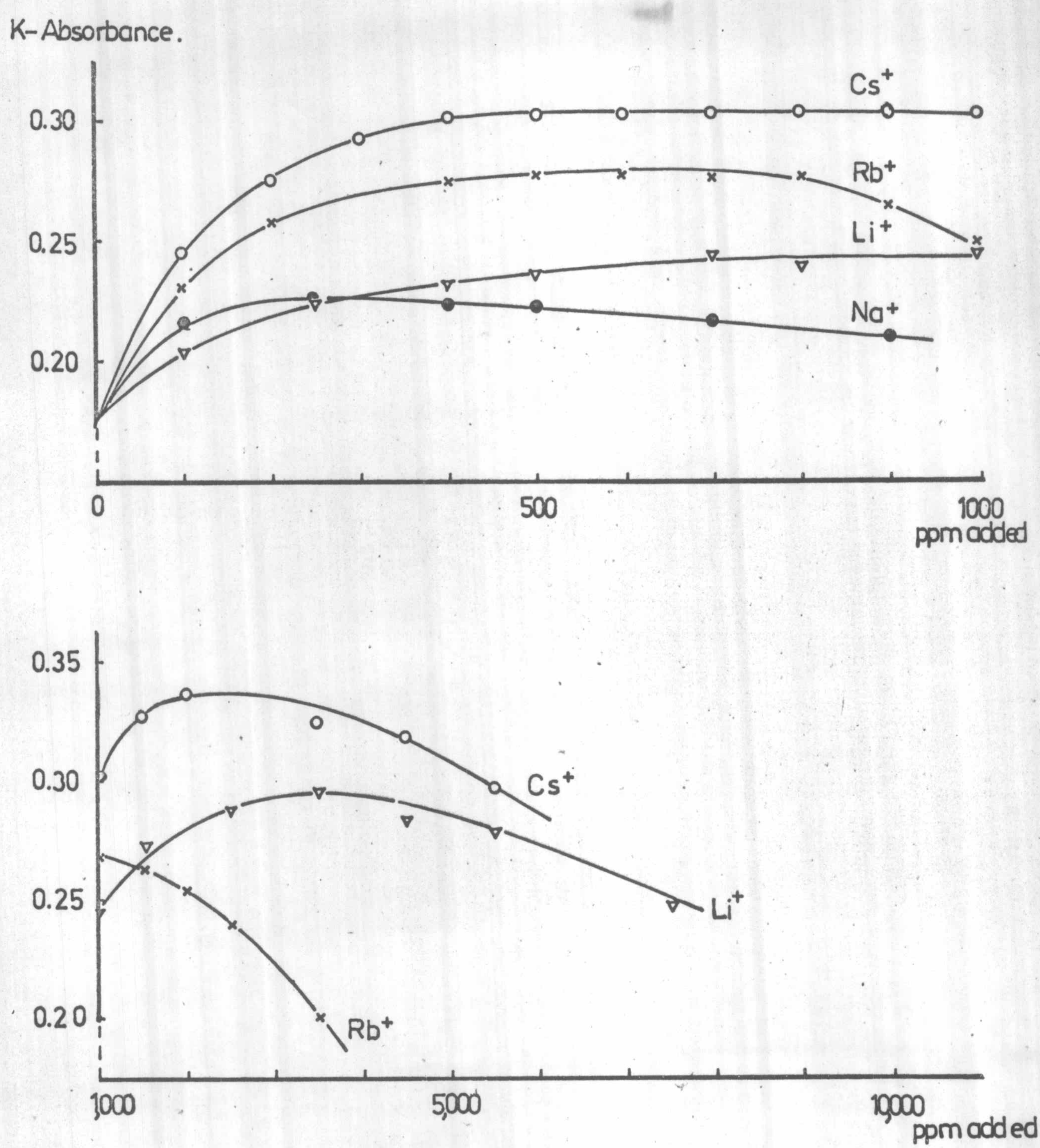

Fig. 5-a Effect of the addition of other alkali metals on the determination of 2 ppm K in fuel lean flame

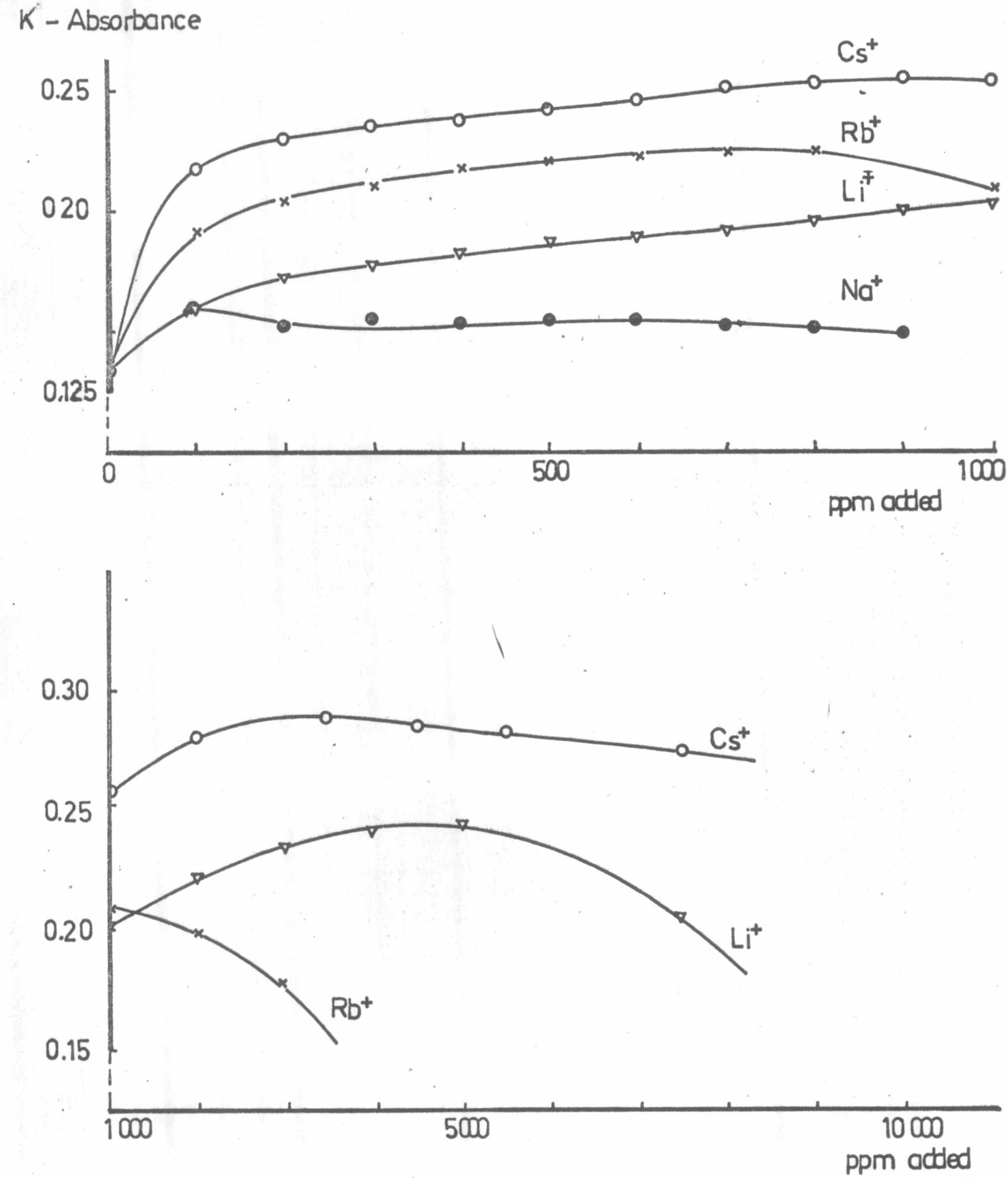

Fig. 5-b Effect of the addition of the other alkali metal on the determination of 2 ppm K in fuel rich flame

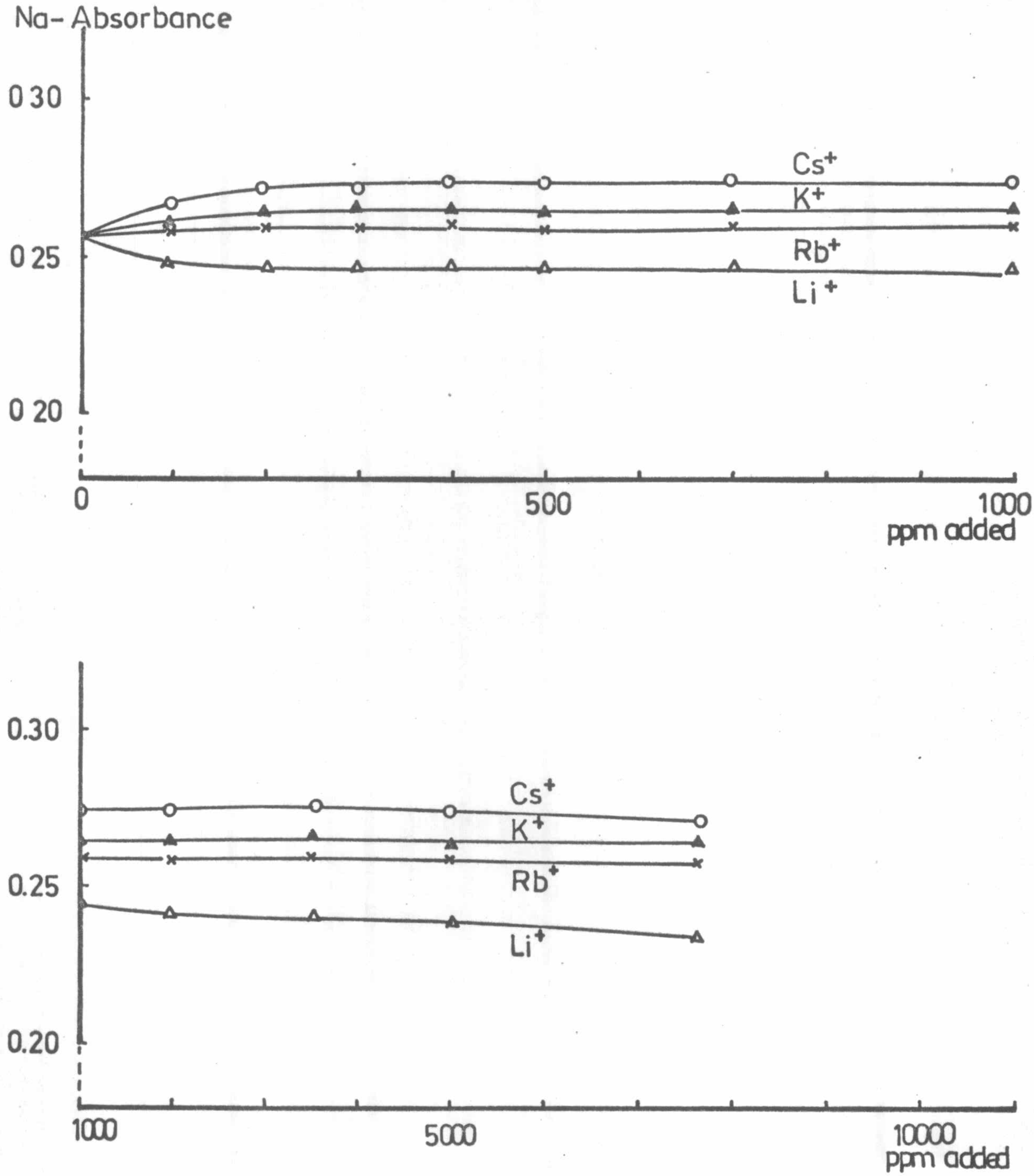

Fig. 6 a Effect of the addition of other alkali metals on the determination of 1 ppm Na in fuel lean flame.

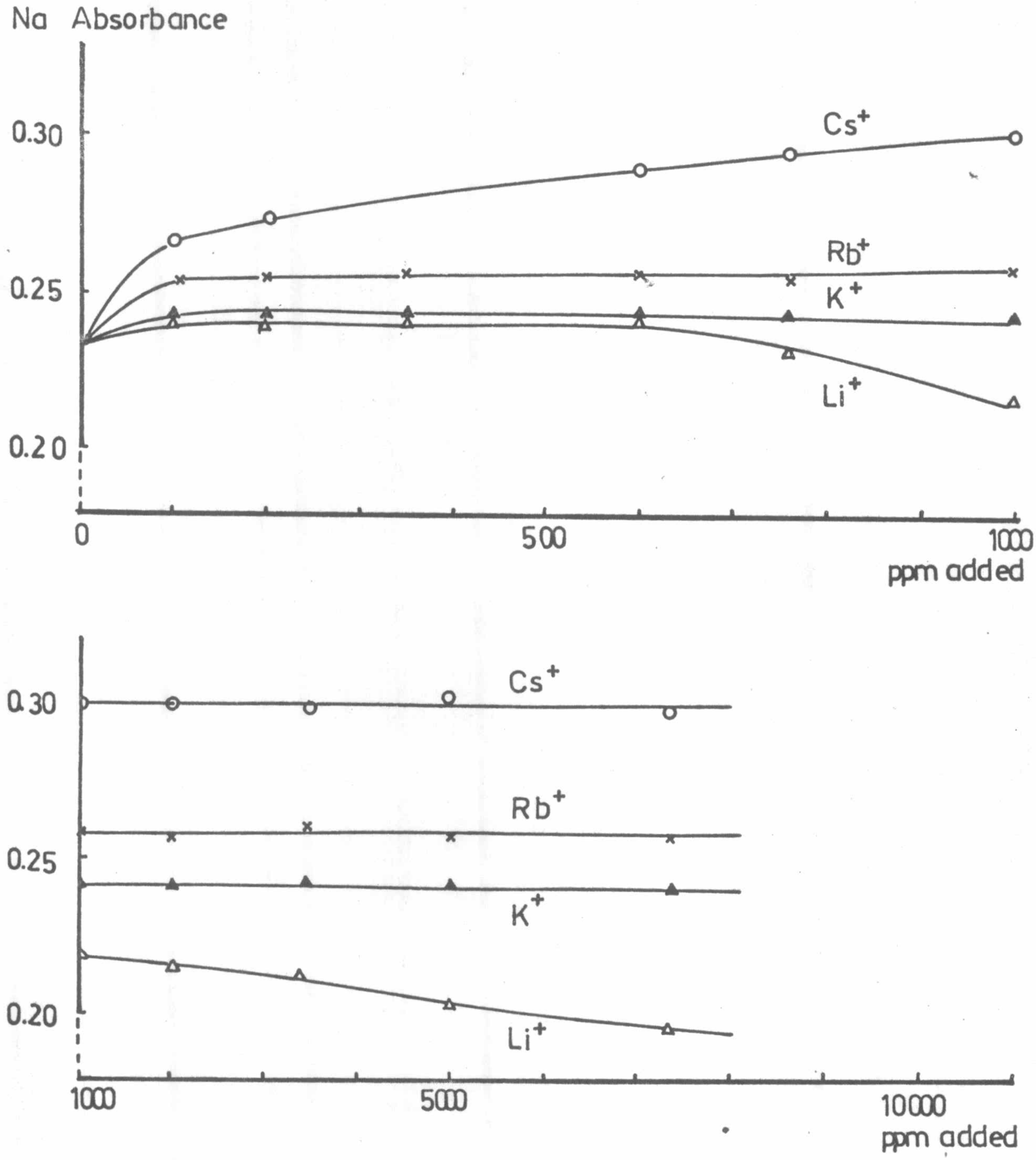

Fig. 6 b Effect of the addition of other alkali metals on the determination of 1 ppm Na in fuel rich flame.

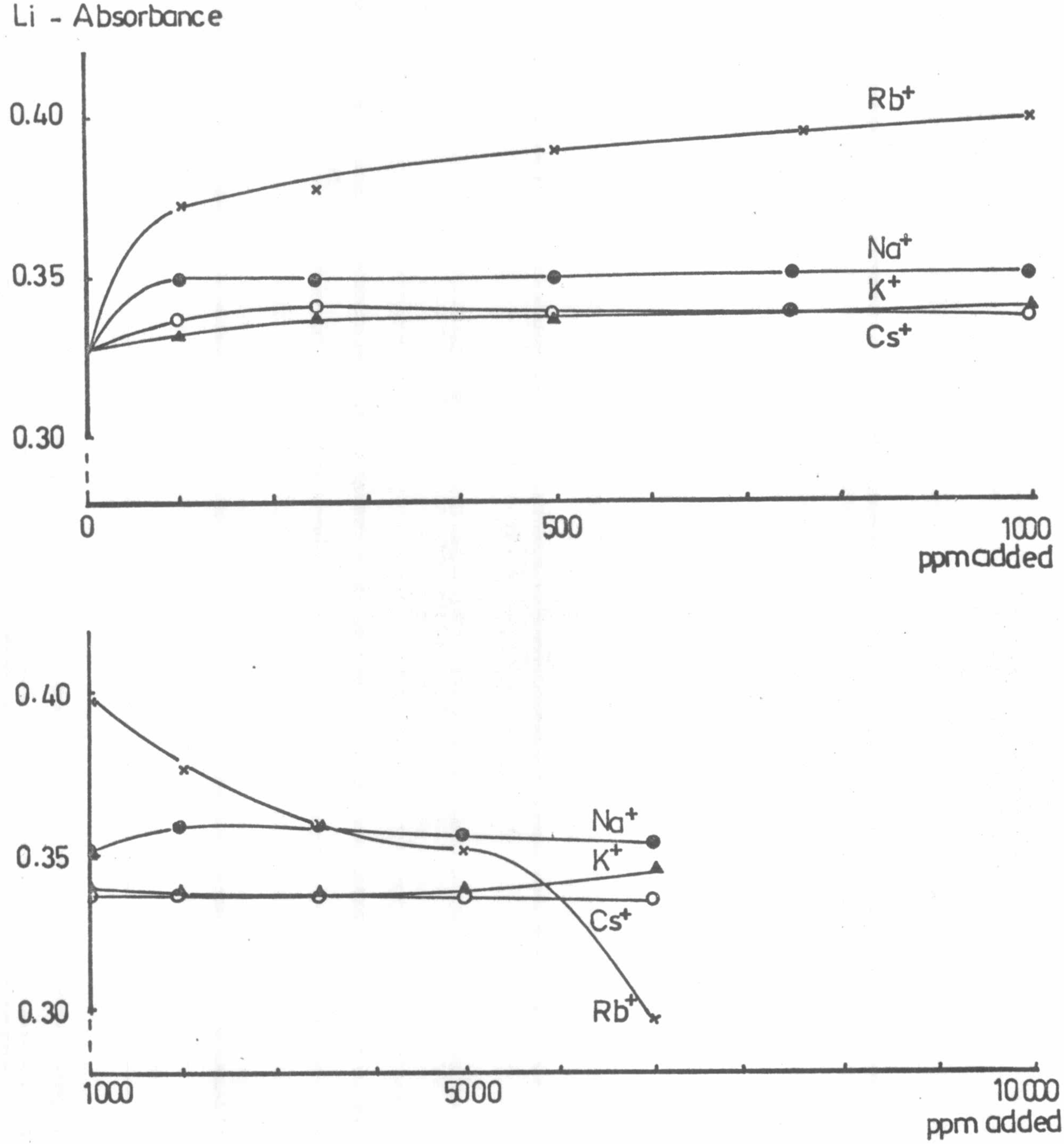

Fig. 7 a Effect of the addition of other alkali metals in the determination of 3 ppm Li_2SO_4 in fuel lean flame

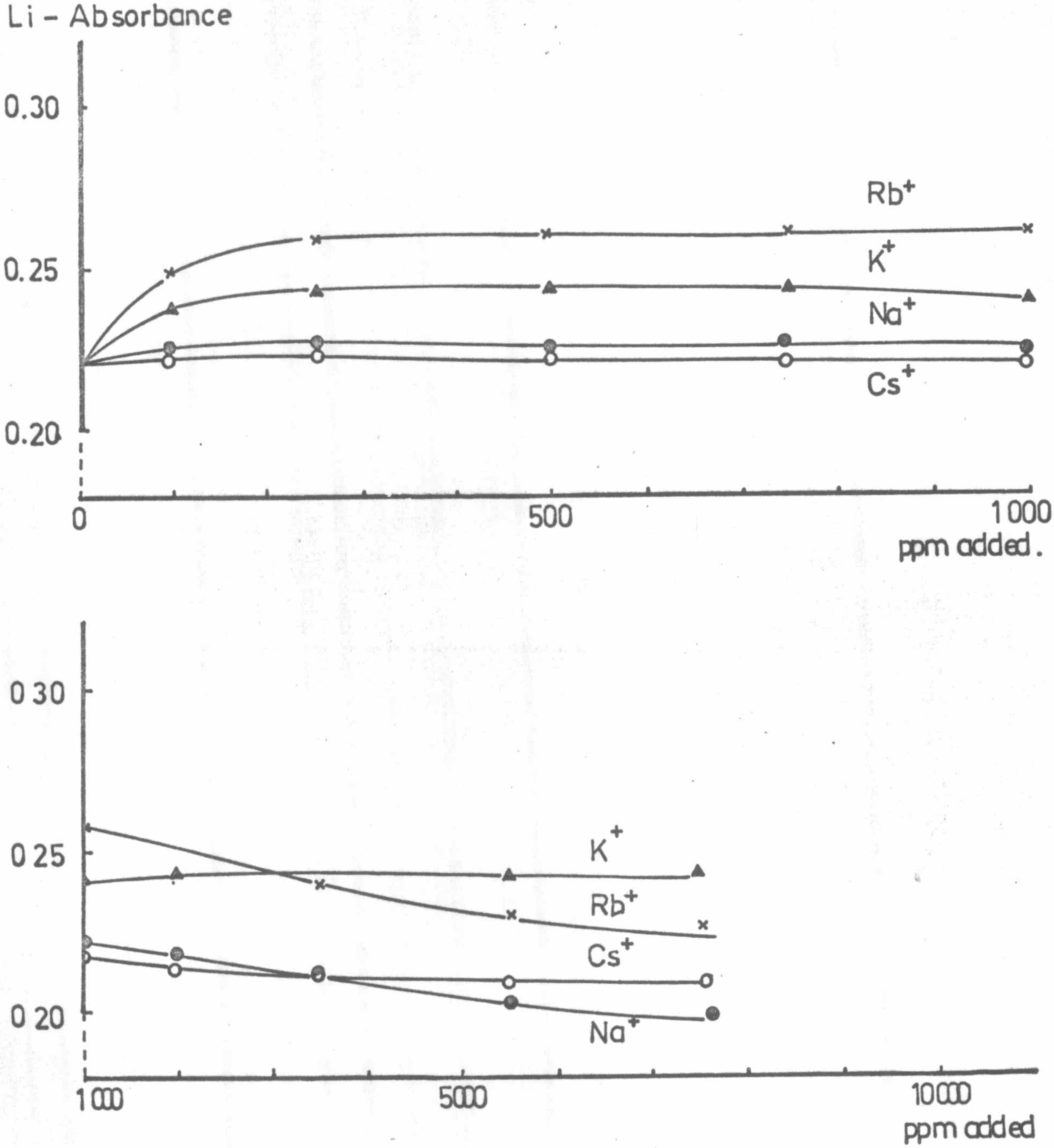

Fig. 7b ·Effect of the addition of other alkali metals in the determination of 3 ppm Li_2SO_4 in fuel rich flame

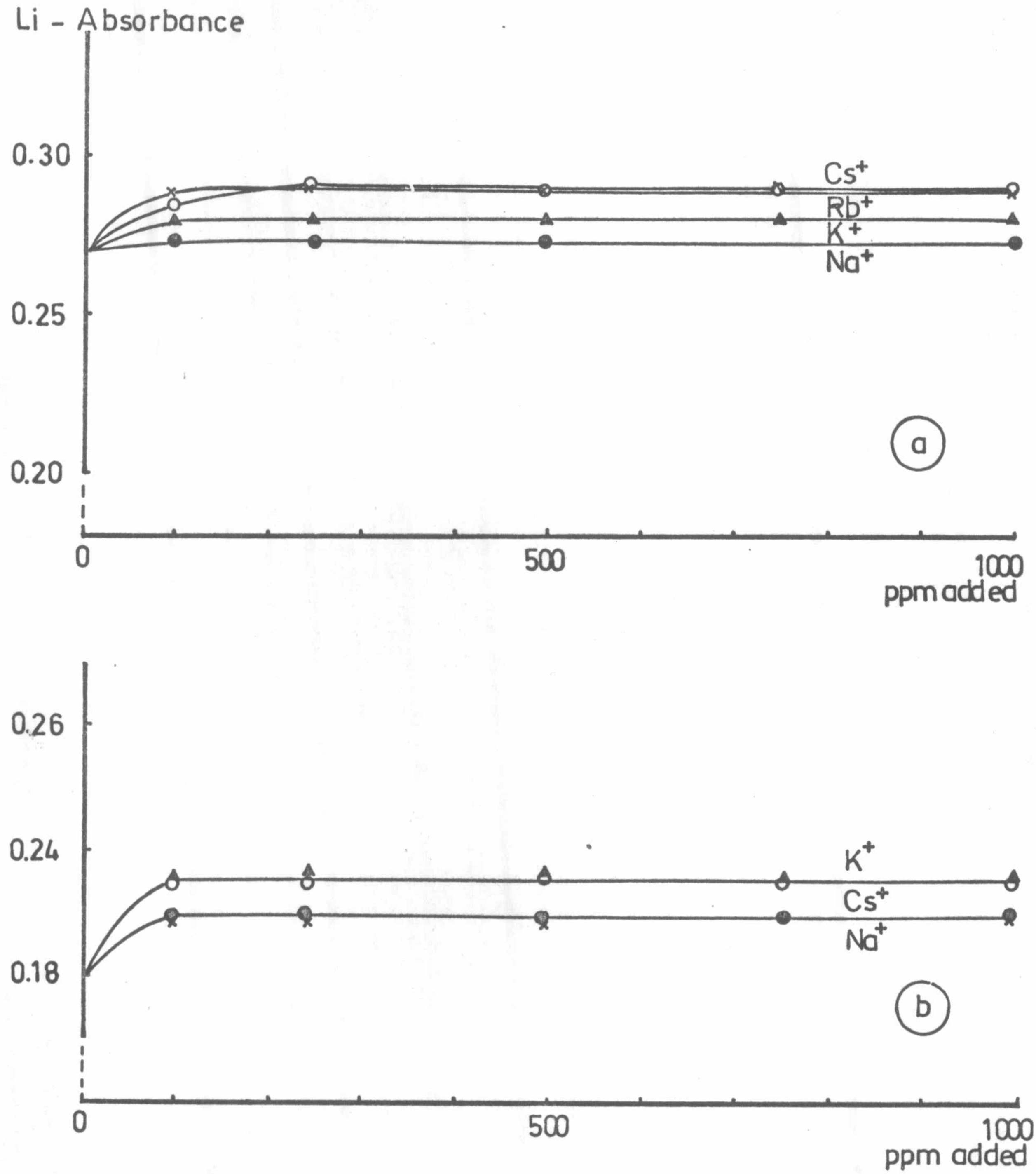

Fig. 7 c Effect of the addition of other alkali metals on the determination of 3 ppm LiCl in

ⓐ fuel lean flame

ⓑ fuel rich flame

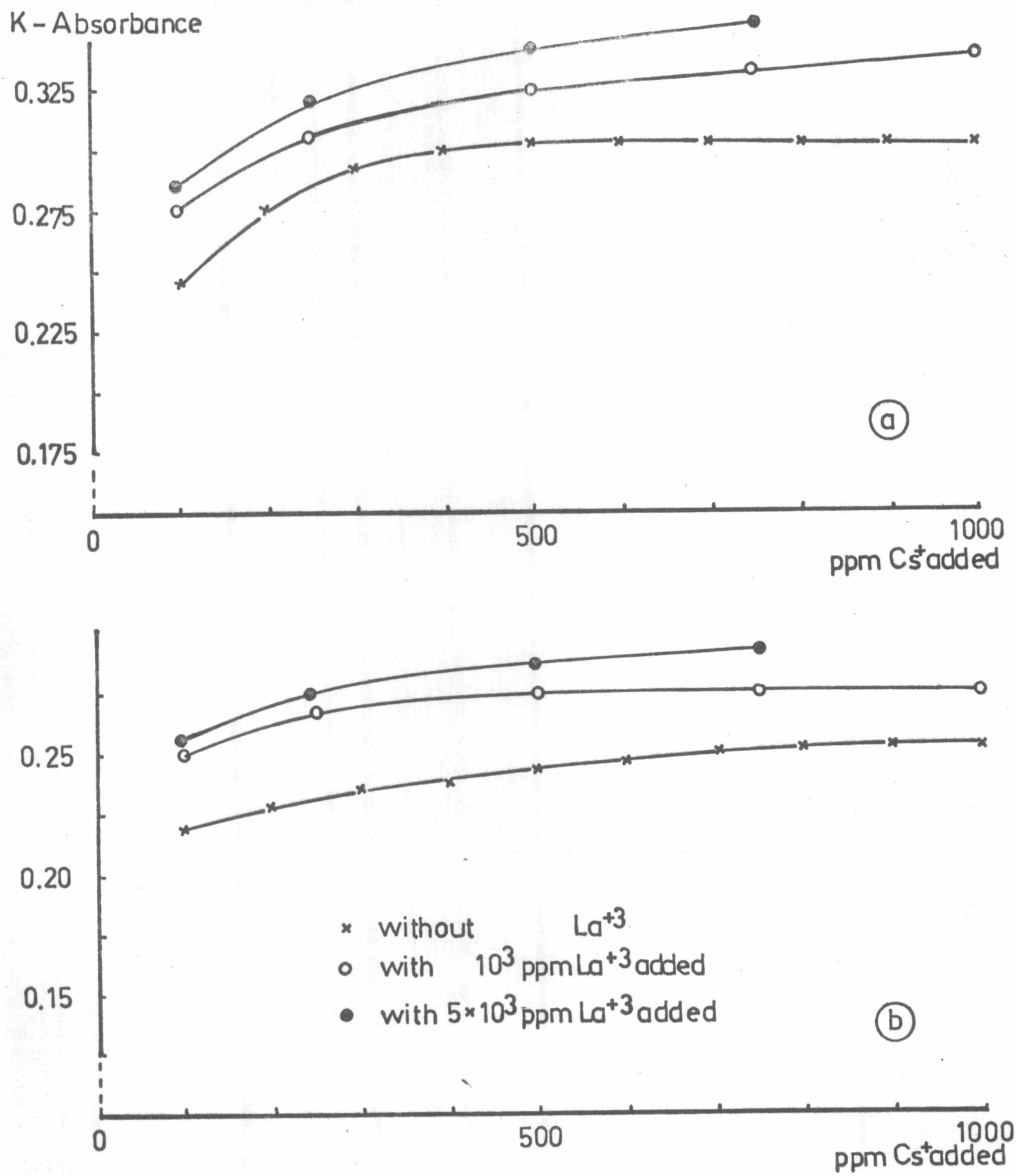

Fig. 9: Effect of La^{+3} to the K- Cs system

(a) in fuel lean flame

(b) in fuel rich flame

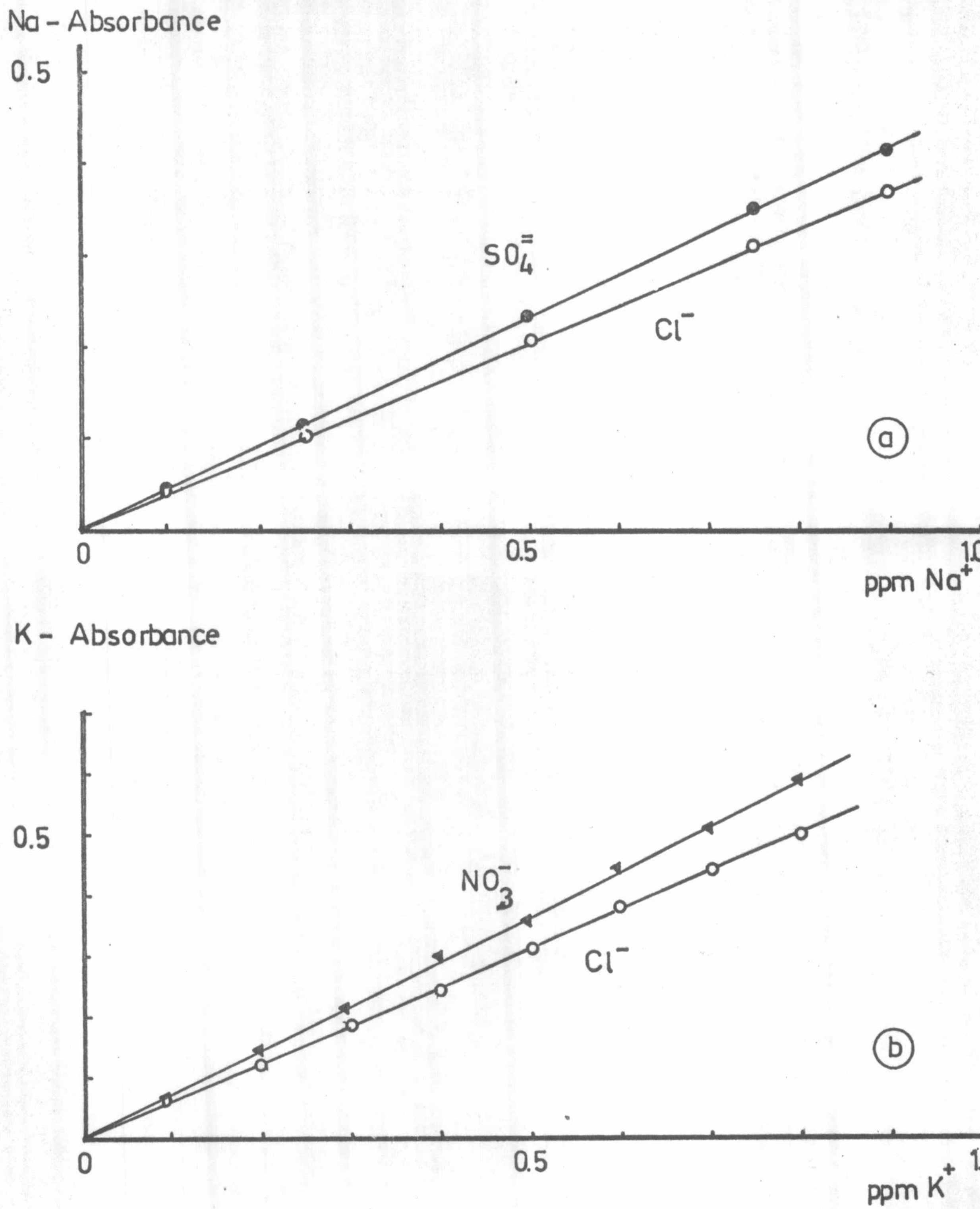

Fig. 8 Effect of anion in the determination of

(a) Na
(b) K