Atomic absorption spectrometry (AAS) is an efficient method from the viewpoint of chemical analysis. Most of the elements of the Periodic Table can be determined by this technique. But a wide variety of non-metals and anions cannot be determined by direct AAS, because they possess their principal resonance line in the vacuum UV region. A group of metals show low sensitivity by their direct AAS determination due to formation of refractory oxide which is very difficult to dissociate in the flame. **Indirect** AAS technique solves this problem and has been applied to the determination of non-metals, anions, organic compounds and metals which have low sensitivity by their direct AAS determination. In this technique, the analyte is reacted with a metal with suitable reagent and the metal reacted or unreacted is determined by AAS. The indirect AAS technique is highly selective and shows higher sensitivity in comparison to the direct AAS technique. Since 1965 there is an increasing interest in the use of this technique in the field of analytical chemistry.
The present work involves new methods for the estimation of traces of four anions and three metals by AAS in environmental, biological, geochemical and inorganic samples. The dissertation consists of 9 chapters of which first two chapters are devoted to introductory discussions while the other chapters describe the experimental part.

In Chapter 1 a brief discussion on atomic absorption spectrometric technique has been included.

Chapter 2 presents an excellent review work on the indirect AAS technique including its application in various fields of our interest.

Chapter 3 describes an indirect method for the determination of vanadium as vanadate in alkaline sludges by AAS. Vanadate forms a stable ion-association complex with copper(II) and biguanide (BigH), \([\text{Cu}(\text{BigH})_2]^{2+}(\text{VO}_3^-)_2\) which can be extracted into n-butanol in the pH range 6.4 - 7.6 with an efficiency higher than 99%. The copper content in the extract (and hence indirectly \(\text{VO}_3^-\)) is determined by aspirating it directly into air-C\(_2\)H\(_2\) flame of an atomic absorption spectrometer.

The determination of tungsten as tungstate in rat tissue samples by AAS has been discussed in Chapter 4. Tungstate forms a stable ion association complex with iron(II) and
2,2'-dipyridyl (dipy), $[\text{Fe(dipy)}_2]^{2+}$ ($\text{WO}_4^{2-}$) which can be extracted into chloroform in the pH range 0.7 to 1.5 with an efficiency higher than 98%. The extract can be analysed for iron (and hence indirectly for $\text{WO}_4^{2-}$) by flame atomic absorption after stripping back into 60% perchloric acid. The calibration curve is linear up to 19 μg/ml of $\text{WO}_4^{2-}$ with sensitivity 0.25 μg/ml.

Chapter 5 describes an indirect method for determination of trace I⁻ in seaweeds by AAS. Iodide forms a stable ion-association complex, $[\text{Hg(dipy)}_2]\text{I}_2$ with mercury(II) and 2,2'-dipyridyl which is extractable into ethyl acetate in the pH range 7.2 - 7.5 with an efficiency higher than 99%. The extract can be analysed for Hg (and hence indirectly for I⁻) by cold vapor AAS after stripping back into aqueous phase with dilute HNO₃.

The indirect determination of thiosulfate in photographic waste effluents by AAS has been presented in Chapter 6. Thiosulfate forms stable ion-association complex with lead(II) and thiourea, $[\text{Pb(thiourea)}_6]^{2+}(\text{S}_2\text{O}_3^{2-})$ which can be extracted into n-butyl acetate : n-butanol mixture (2:1) with an efficiency higher than 99%. The extract can be analysed directly for lead (and hence indirectly for thiosulfate) by flame AAS.
Chapter 7 describes an indirect method for the determination of thiocyanate in blood serum. The method is based on the complex formation between molybdenum and thiocyanate, $\text{Mo(SCN)}_5^-$ in presence of $\text{SnCl}_2$ and extraction of Mo-complex into 1:1 methyl isobutyl ketone - isoamyl alcohol mixture in the acidity range 0.83 - 0.87 M HCl with an efficiency higher than 98%. The extract may be analysed directly for Mo (and hence indirectly for SCN$^-$).

An indirect method for the determination of zirconium in microgranite rock samples by AAS is depicted in Chapter 8. Zirconium forms a stable ion-association complex $\text{Zn}^{2+}[\text{ZrF}_6]^{2-}$ with Zn(II) and fluoride, which can be extracted into chloroform in the pH range 4.2 - 4.9 with an efficiency higher than 99.5%. The extract can be analysed for zinc (and hence indirectly for zirconium) by AAS after stripping back into aqueous phase containing 4 N HCl.

In Chapter 9 an indirect method for determination of trace IO$_3^-$ in different samples of high purity by atomic absorption spectrometry is described. Iodate forms a stable ion-association complex $[\text{Hg(dipy)}_2]^{2+}(\text{IO}_3^-)_2$ in neutral medium which has been extracted into MIBK with an efficiency higher than 99%. The extract can be analysed for mercury (and hence indirectly for IO$_3^-$) by flameless AAS.