Ion exchange chromatography is a method of great significance when it concerns the separation of ions of similar properties i.e. systems which are troublesome or impossible to analyze by the other methods. The reported examples of applications of the ion exchange phenomenon dates back to the time of Moses but these are historical events. The credit of adoption of chromatographic process for analytical and preparative purpose goes to the person use the term chromatography was Swett (1872-1919) the Russian chemist. A revolutionary development in chemistry took place with separation of coloured plant pigments into bands on a column of chalk. In 1906 Swett stated that 'chromatography is a method in which the components of the mixture are separated on an adsorbent column in a flowing system'. But it was amazing that this great discovery remained unnoticed for nearly 30 years. The 1960's saw a rapid rise in the routine use of chromatography as a universal technique. Hence Swett's column chromatography exhibit wide applicability in chemistry, biology and medicine.
So, chromatography demand a change in definition. According to IUPAC, chromatography is a method used primarily for the separation of the components of a sample, in which the components are distributed between two phases, one of which was stationary while the other moves. The stationary phase may be packed in a column, sprayed as a layer or distributed as a film etc., in these definitions 'chromatographic bed' is used as a general term to denote any of the different forms in which the stationary phase may be used. The mobile phase may be gaseous or liquid.

Although the ancient literature showed many references of ion exchange, the studies of such phenomenon on a scientific basis started only in the middle of the last century with the discoveries of some types of soils which could exchange for similarly charged ions. Taylor and Urey (1938) separated alkali metals using ion exchange chromatography. At first ion exchangers were mostly used for water softening but they become played an important role in the separation of rare earth. An important guarded project i.e. 'Manhattan Project' was based on the developing the separation of fission products and also the discovery of new elements like promethium and some of the transuranium elements. Furthermore ion exchangers in any form have been widely used in various field.
To increase the selectivity of the ion exchangers a new type of resin was developed by Skogesid (1947). This development and the use of the synthetic resin got momentum during second world war i.e. in the Manhattan project in U.S.A. Skogesid observed through the introduction of dipicrylamine in the resin as a functional group that the incorporation of chelate forming groups in the organic resin opens a new dimension in the separation of ions by exchange process on chemically modified resin. These new types of resins, called chelating ion exchangers are very selective for a particular metal ion or a group of ions at definite pH range and have been utilized in various fields ranging from separation and concentration of a particular from sea water to environmental analysis.

Once the importance was noted the development of new chelating resins advanced in rapid pace since the 1960's through the introduction of common organic chelating groups used in analytical chemistry.

N-Benzoyl-N-phenylhydroxylamine (N-BPHA) is a well established versatile reagent, used for the gravimetric and spectrophotometric determination of various metal ions such as Al(III), Be(II), Cu(II), Co(II), Ni(II), Zn(II) etc. But most important factor is that it can form complexes with Nb(V) and Ta(V) at different pH and also with the Zr(IV) and Hf(IV).
The present investigation mainly deals with the introduction of N-BPHA group into the resin matrix study the adsorption pattern of different metal ions and develop some method for the separation and concentration of the more important metals and also some important pairs.

This dissertation has been divided into three parts. The first two chapters describes the general review of the ion exchange phenomenon with special reference to chelating ion exchangers separated from the experimental part.

Chapter 1 of this dissertation is an introductory one containing a brief history of the development of ion exchangers with a special reference to chelating ion exchangers and a review of the work reported so far on the latter. The content of the Chapter 2 of introductory part is the aim of the present investigation. The rest part of this dissertation deals with the experimental work.

Chapter 3 describes the new method adopted for the synthesis of resin containing N-benzoyl-N-phenylhydroxylamine as the functional group. The new resin has been characterised by determine its water regain value, stability towards acids, alkali, heat and γ-radiation and i.r. spectra.

Chapter 4 describes the method of determination of sorption capacity by batch operation, as the function of pH. The metal ion studied were Na(I), K(I), Be(II), Co(II), Cu(II),
Ni(II), Cd(II), Zn(II), Hg(II), Al(III), Fe(III), Ce(III), Ce(IV), Ti(IV), Th(IV), Zr(IV), Hf(IV), Nb(V), Ta(V), V(V), U(VI). The sorption capacities of the resin for Al(III), Be(II), Zr(IV) and V(V) were high, Cu(II), Co(II), Nb(V) and Ta(V) were appreciable. Therefore, this resin can easily be used for the separation and preconcentration of Al(III), Be(II), Co(II), Cu(II), V(V) and Zr(IV), Hf(IV) and separation from other metal ions.

Chapter 5 contains the studies on the separation of aluminium(III) from binary, ternary and more complexing mixture. Aluminium(III) was separated from a synthetic mixture of Na(I), K(I), Ca(II), Mg(II), again it was also separated from another synthetic mixture containing Fe(III) and Ti(IV). This resin therefore applied for the preconcentration and separation of Al(III) from bauxite and other clay samples.

Chapter 6 describes the separation of beryllium(II) from binary, ternary and other complexing mixture. Be(II) was mainly separated from Al(III). It also describes the separation of Be(II) from other synthetic mixture containing Cu(II), Co(II), Zn(II), Mg(II). Be(II) can also be separated from a ternary mixtures containing Be(II), Fe(III) and Al(III). The results of this experiment have been applied for the separation of Be(II) from Al(III) in beryl and also in Cu-beryl alloy.
Chapter 7 describes the separation of uranium(VI) from vanadium(V). U(VI) and V(V) also separated from Na(I), K(I), Ca(II) and Mg(II). The synthetic mixture containing U(VI) and V(V) used for the separation of these two elements. The main importance of this chapter is the recovery of vanadium from the resin containing N-BPHA as a functional group.

Chapter 8 is the main important chapter of this dissertation. This chapter deals with the separation of Zr(IV) from Hf(IV). This resin has been applied for the separation of Zr(IV) from a complexing mixture containing Ti(IV), V(V), Nb(V) etc. Separation of Zr(IV) from Hf(IV) in different proportion was affected by controlling the flow rate of elution.

Chapter 9 describes the separation of Nb(V) from Ta(V) using tracer technique. This chapter also deals with the separation in micro quantities.

Chapter 10 describes the application of those separation in various ores and minerals described in other chapters.

Chapter 11 describes summary of the results obtained from experiments on investigation of different metal ions by the resin and also the inference which could be drawn.
The closing pages of the dissertation have been devoted to the analysis of the result from which it could be concluded that the new resin synthesised and the methods developed can be adopted in analytical separations and preconcentrations.