Zinc plating occupies a unique position in plating industry as it offers sacrificial protection to steel. Since 1800 the use of zinc coating on steel was foreseen and applied. Attempts are being continued to develop non-cyanide zinc plating baths with good complexing agents.

As long as steel retains its pre-eminence as a material of construction, the need to protect it against corrosion will not only continue, but also increase progressively. Zinc is a favourite of design engineers over several decades and used as protective coating for steel. The protection effected by zinc to steel is based on its position in the electrochemical series, with the results that zinc behaves anodically towards the underlying steel, and protects it sacrificially. No other commonly electrodeposited metal offers so much corrosion protection at a low cost when compared with zinc and hence this is a popular industrial finish.
About 35-40% of the world zinc output is used for the coating of steel using a large variety of techniques: hot dip galvanizing, spraying, zinc or zinc chromate containing paints and electroplating. The use of electroplated zinc for the protection of steel has been growing faster than all other zinc coating methods.

Moreover, although zinc is mainly used for protection, the recent developments in bright zinc plating and in the various passivation treatments enable finishes of attractive appearance for decorative purposes. Zinc coatings not only prevent articles from corroding in service, but also play a useful part in preventing corrosion during handling, transport and storage, thus ensuring that the products reach the consumer in good condition.

Zinc is electroplated on a very large number of steel components and fittings for products such as automobiles, domestic appliances, office furniture, electrical equipment, etc. Zinc is also plated on steel sheet and strip in continuous plants. Some of the essential requirements for the plating bath solution and coating properties are briefly as follows:

i) The plating bath solution must exhibit a good macro dispersing power to ensure uniform deposit in case of work pieces having complicated (odd) shapes.

ii) It must produce bright, lustrous, ductile and cohesive deposit.

iii) Ingredients of the plating bath solution must be cheap, non-toxic, easily soluble in water and readily available in the market.

iv) Operation and maintenance of the bath must be easy.

v) The bath must not involve efficient treatment after plating.

vi) The plating bath solution must have universal application to the plating of frame parts and small parts.

vii) The plating bath solution is to be environmentally acceptable and controllable from the point of view of discharge technology.

viii) The plating bath solution should not be corrosive for base metal and anode under idle period.
ix) Only minimum number of ingredients must be present to give good deposit.

x) The bath must be insensitive to impurities.

xi) The coating must display over a wide range of current density, a uniform appearance and high degree of brightness and smoothness.

xii) The deposited coatings must allow chromating.

xiii) The durability of the deposit must be high.

xiv) Requirements peculiar to the particular branch of industry must be taken into account.

To obtain all these properties from any one process is difficult and hence several plating baths are in vogue.

Zinc has traditionally been plated from solutions containing sodium cyanide. Cyanide is very toxic and it inevitably occurs in wastewater by drag out from plating baths or being rinsed off the plated parts. Today legislation is becoming severe and the local authorities are demanding less metallic impurities in the effluent as well as almost zero cyanide concentration. Only in the large-scale industries some efforts are being made in the effluent treatment of cyanide by alkaline-chlorination method. However, this is too much expectation financially by the small and medium scale industries.

The bright acid chloride zinc plating system is one of the plating baths developed around 60's in Germany and Europe. This bath consists of zinc chloride and ammonia and faced some difficulties in the effluent treatments of ammonia and corrosion of the plating equipments. Acid and alkaline non-cyanide baths are emerging as important zinc plating baths because of low cost effluent treatment and ease of operation.

A new class of acid zinc electroplating baths allows one to obtain remarkable performances in the technique, owing to new additives of a strongly complexing nature.
Bright zinc electrodeposits can be obtained by the addition of brighteners into the plating bath. Bright deposits improve the appearance of the article and offer corrosion resistance. Good quality bright deposit is always obtained from plating baths containing addition agents. A brightener generally possesses the following characteristics:

i) shifts the cathodic potential in more negative direction

ii) forms complex with zinc ion

iii) brings down the surface tension at the interface of electrode surface and solution

iv) increases the viscosity of bath solution

v) controls the rate of growth of fresh nuclei and hence rate of deposition

vi) increases the throwing power of the bath solution.

The existing cyanide baths pose severe pollution problems due to the toxic nature of cyanide. Because of this handling and storage of cyanide baths require special attention. Further, the effluent of cyanide baths has to be treated as per the pollution control board regulations. All these make the operation of cyanide baths more expensive. Also it is evident from the available literature that single addition agent generally does not produce good deposit over a wide current density range. To overcome this, combination of two or more addition agents are used. These addition agents are usually of organic nature and their solubility in aqueous zinc plating solution is limited. Also, presence of many addition agents in the bath creates problems in determining the brightener requirement. Some addition agents also cause pollution and health hazard.

Due to the above said problems associated with the existing baths, the other electroplating solutions such as sulphate, chloride, sulphate-chloride and non-cyanide
alkaline are in great demand. In the present work efforts have been made to develop bath solutions containing minimum number of addition agents. Also it is aimed to get bright defect free deposit over wide current density range using single, water-soluble and non-toxic brightener. Attention has been given to optimize the bath with improved current efficiency and throwing power as well as the deposit with improved brightness, corrosion resistance, wear resistance, adherence, ductility, etc. Emphasis has also been given to develop industrial baths possessing no effluent treatment.

In the present thesis results obtained during detailed investigations on the development of acid zinc sulphate, zinc chloride, zinc sulphate-chloride and alkaline zinc baths containing suitable organic compounds as primary and secondary brighteners are presented.