Review of Literature:

Because of its low cost, easy availability and ease of fabrication, carbon steel, stainless steel and mild steel are the most widely used structural and fabrication material in industries and materials of construction. Chloride ion is a very common impurity present in water usually as sodium chloride. Carbon steel, stainless steel and mild steel are severely corroded in acidic medium due to presence of aggressive ions causing general (uniform) as well as localized (pitting, crevice, hydrogen embrittlement, water line corrosion etc.) corrosion. Concentration of acids, pH and temperature of the corroding system influence the severity of corrosion of different metallic alloys. All industries old or just established in coastal areas will require cheap systems resistant to carbon steel, stainless steel and mild steel over a wide range of environmental conditions combined with strength and durability which can be met with metal alloys with the use of different organic surfactants as corrosion inhibitors. For this industries require surfactants which are cheap, easily available, environment friendly and easily applicable in all types of systems.

Salts of gluconates were evaluated by immersion tests under stagnant and dynamic conditions at different temperatures for inhibition efficiency. The results indicate that zinc gluconate inhibits corrosion excellently and gives about 90-95% inhibition efficiency in concentration range 300-500 ppm. This can be, therefore, effectively used in the sea water recirculating cooling systems using carbon steel as a material of construction of heat exchangers and desalination plants. High inhibition efficiency is attributed to chemisorption of the molecule on the metallic substrate.
Several studies on the use of phosphonic acids as corrosion inhibitors have been reported in the literature\textsuperscript{8-18}. According to Sekine and Hirakawa\textsuperscript{8}, the effectiveness of 1-hydroxyethylidene-1, 1-diphosphonic acid (HEDP) as a corrosion inhibitor was shown at low concentrations and high temperatures when corrosion and its inhibition were studied for SS41 steel in 0.3\% NaCl i.e. in low chloride media. HEDP was considered to inhibit the corrosion of SS41 steel by chemical adsorption according to the Langmuir adsorption isotherm at concentrations <50 ppm of HEDP. At concentrations >50 ppm, the iron complex of HEDP was produced and the inhibition effect was inversely proportional to the concentration.

The mutual inhibition effect (synergistic effect) was found to be greatest when 60 ppm of HEDP and 40 ppm of the Zn\textsuperscript{2+} ion were used in 0.3\% NaCl solution. It was considered that the local anodic region on the steel surface was inhibited by HEDP and the local cathodic region was inhibited by the precipitation film of insulated zinc hydroxide Zn(OH)\textsubscript{2}. Moreover, since HEDP was difficult to decompose, it was recognised to have excellent stability. The efficiency of HEDP as a scale-preventive agent of industrial boilers and the stability of HEDP from its decomposition test have been reported by Good\textsuperscript{19}.

The synergistic effect of phosphonic acid with Zn\textsuperscript{2+} ion as corrosion inhibitor for carbon steel in low chloride media have been reported in literature by several authors\textsuperscript{20-24}. These authors have discussed the use of aminotrimethylene phosphonic acid (ATMP)\textsuperscript{15}, 2-carboxy ethyl phosphonic acid (2-CEPA)\textsuperscript{25}, hydroxyethylphosphonic acid (HEDP)\textsuperscript{26} and citrate ethylene diamine phosphonic acid (CEDPA)\textsuperscript{27} with Zn\textsuperscript{2+} ions as corrosion inhibitor in low chloride media. US-VIS-NIR
spectra have revealed that this synergistic effect is due to the formation of Fe$^{2+}$-phosphonic acid complex on the metal surface. The synergistic effect of HEDP and Zn$^{2+}$ ion on the inhibition of corrosion of carbon steel in neutral aqueous environment containing 60 ppm Cl$^-$ has been evaluated by Rajendran et. al$^{28}$. The mutual influence of this inhibitor system and the biocide, N-ethyl-N, N, N-trimethyl ammonium bromide (CTAB) has also been studied. Again it was observed that due to the shift of the electron cloud density from the oxygen atom to Fe$^{2+}$ there is a formation of Fe$^{2+}$-HEDP complex as it was thought that the oxygen atom of the phosphonic acid is coordinated to ferrous ions$^{29-33}$.

As chloride, sulphate and nitrate are aggressive ions from corrosion point of view, carbon steel when immersed completely in water tends to corrode due to their thermodynamic instability$^{34-36}$. Sodium nitrite has been found to be an effective anodic inhibitor for corrosion of carbon steel in aqueous solution of sodium chloride by Sanyal and Sanyal$^{37}$. The corrosion of carbon steel is reduced due to the formation of a passive film$^{38}$ and the potential of steel is ennobled as the concentration of nitrite is increased in aqueous solution of sodium chloride. Chromate$^{39}$ has been extensively used as inhibitor for carbon steel in aqueous medium. The protective effect of chromate is again due to the formation of passive film on metal surface$^{40}$. Chromate ions act as anodic inhibitor and maintain their excellent inhibitive effect over the temperature range from 30$^0$C to 80$^0$C. Its increased efficiency at higher temperature is of interest and may be attributed to increased chemisorption$^{41-43}$ of the chromate enabling the formation of a protective oxide film$^{44-46}$. However, strict water pollution rules have now banned the use of chromates as inhibitor.