CHAPTER - VI
CONCLUSIONS AND SCOPE FOR FURTHER STUDY

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A.CONCLUSIONS

1. Electrochemical evaluation techniques were successfully applied to understand the corrosion phenomenon and its inhibition in Giammarco Vetrocoke solutions. Thus higher corrosivity of GV solutions, especially semilean in character, was established with techniques like OCP measurement, polarization studies and AC impedance study. Microsctucture evaluation for pearlite leaching also was carried out. The higher corrosivity of GV semi lean solution substantiated the relatively more corrosive effects observed in the semi lean section in the process vessel's internal surface of the plant.

2. Antimony trioxide and ferric ions, when added to the GV solution, effectively controls the corrosion problems like general corrosion and localised corrosion (SCC). This is achieved by a shift of corrosion potential towards more noble values and supported by lowering of current values, thereby achieving passivation.

3. Antimony trioxide in the range of 0.14% to 0.15% and ferric ions at 0.02% to 0.03% was found to be the critical range of concentration which gives good compatibility and highest effeciency. Thus, synergistic effect of antimony trioxide and ferric ions was established with potential measurements, polarization studies confirmed by AC impedance, pearlite leaching studies.

4. Application of diversified techniques for inhibitor evaluation like AC impedance technique and pearlite leaching studies confirmed the compatibility and effeciency of these critical concentration of antimony trioxide and ferric ions.

5. Addition of antimony trioxide and ferric ions in the real system and assessment of the inhibitor performance afterwards, substantiated the fact that antimony trioxide and ferric ions, in combination, are capable of combating corrosion problems in CO_2 removal system.

6. Antimony trioxide at more than 0.15% concentrations creates dissolution problems in the GV solution. It was also found that ferric ion concentration of more than 0.03% has an accelerating effect on the corrosive characteristics of the solution. This combined factors may create fouling problems in the system which consequently may effect the effeciency of the plant.

7. It was established with the help of theoretical understanding that the inhibitor combination of antimony trioxide and ferric ions function as anodic inhibitors.

8. The importance of free energy in the oxidation and reduction of antimony ions is stressed and a postulation is derived based on these, for oxidation of ferrous to ferric ions.

9. The formation of Fe_2O_3 layer on the CS surface which effectively reduces corrosion problems was proved theoretically using Pourbaix diagrams and current potential diagrams.

10. Easy availability, safety in handling, economically and operationally viable and low concentration required, considering large volume to be handled, substantiates the use of antimony trioxide in CO_2 removal system using potassium carbonate-arsenic oxide solution.

B. SCOPE FOR FURTHER STUDY

1. The use of organic inhibitors in the CO_2 removal system using GV solutions. Ethylene diamine tetraacetic acid (EDTA), which is a known chelating agent with transition metals, is one candidate.

2. Electrochemical evaluation of various strong oxidizing agents in GV solution which would convert ferrous to ferric ions, but which should not alter the physical characteristics of the solution and keeping in mind the presence of hydrogen gas in the system.

3. The trace elements present in the GV solution (e.g. mercury, which comes from potassium hydroxide used in preparing GV solution) may have varied effects on the potential characteristics, if present at a critical level. Study on the effect of trace elements in GV solutions should be interesting.

4. Application of antimony trioxide/ ferric ions, inhibitor combination, in other CO_2 removal systems where glycine, diethanolamine, vanadium pentoxide are used in combination with potassium carbonate. Electrochemical evaluation of inhibitors in such systems, where SCC is a predominant phenomena.

5. CO_2 removal systems using monoethanol amine, where SCC phenomena is serious, antimony trioxide with lesser concentration of ferric ions could be evaluated. Potassium dichromate and vanadium pentoxide may also be studied in this system.

6. Surface analytical methods like XRD, EDX, STM etc., could be extensively used to study the surface phenomena on the CS material and thus the effective role of inhibitors can be established.

7. Application of established on-line monitoring techniques like Electrical Resistance (ER), Linear Polarization Resistance (LPR) and Zero Resistance Ammetry (ZRA) to evaluate extent of aeration in real life conditions in the plant. This will not only give the suitability and effeciency of inhibitors present in the system, but also would indicate the corrosive characteristics of the system. Electrochemical noise and Impedance studies, may also be applied in-situ to monitor the health of the system.

8. Effect of various inhibitors added in the CO_2 removal system for corrosion control on the CO_2 absorption capacity of the solution used.