SUMMARY AND CONCLUSION

Cationic surface active agents are important type of surfactants due to their incorporation in several applications including: emulsification, detergency, solubilization and biocides.

In this thesis, new types of cationic surface active agents were synthesized based on quaternization of tertiary amine and alkyl halide named dodecyl bromide.

The used tertiary amines were synthesized from chloromethylation and chlorosulphonation of naphthalene to get chloromethyl naphthalene (I_a), 1,5 bis dichloromethyl naphthalene (II_a) and 1,5-disulphonyl dichloride naphthalene (III_a), respectively. Then reaction of (I_a) and (II_a) with piperidine to get piperidine-1-yl methyl naphthalene (I_b) and dipiperidine-1-yl dimethyl naphthalene (II_b), respectively. And reaction of (III_a) with 4-amino pyridine to get dipyridine-4,4'-yl-1,5bis disulphonamide naphthalene (III_b). Then make the quaternization reactions between (I_b), (II_b),(III_b) and dodecyl bromide (R) to get N-methyl naphthalene –N-dodecyl pipyridinium bromide (I_c), N,N'-1,5 bis dimethyl naphthalene –N, N'– didodecyl dipipyridinium bromide (II_c) and 4,4'-1,5 bis disulfonamide naphthalene – N,N'– didodecyl dipyridinium bromide (III_c), respectively.

The cationic surfactants (I_c), (II_c) and (III_c) was complexed by stannous chloride ($Sn\ Cl_2\ 2\ H_2O$) and cobalt chloride ($Co\ Cl_2\ 6\ H_2O$) to give the corresponding metallocationic surfactants M, N, X, Y, Z, A and B.

The chemical structures of the synthesized metallocationic surfactants were confirmed using several analytical tools including:

- Micro elemental analysis to determine the percentage of each element in the structure.
- FTIR spectroscopic analysis.
- ^{1}H-NMR spectroscopic analysis.

The synthesized metallocationic surfactants were evaluated as surface active agents throughout measuring their surface properties including: surface tension at different temperatures (25, 35 and 45 °C), interfacial tension at 25 °C and emulsification power at 25 °C.

The surface parameters including: critical micelle concentration (CMC), effectiveness (π_{CMC}), efficiency (PC_{20}), maximum surface excess (Γ_{max}) and minimum surface area (A_{min}) were studied.

The thermodynamic parameters including: free energy of micellization (ΔG^{o}_{mic}) and adsorption (ΔG^{o}_{ads}) were calculated based on the surface parameters.

The synthesized metallocationic surfactants were evaluated as biocides for different microorganisms including: three different types of Gram- positive bacteria, one type of Gram- negative bacteria, one type of yeast and one type of fungi.

The antimicrobial activity of some of the prepared metallocationic surfactants against sulfate reducing bacteria (SRB) was determined.

The summary of the above work was as the following:

- The elemental analysis showed that the synthesized metallocationic surfactants are pure compounds.
- The FTIR spectra showed disappearance of the starting material function groups and appearance of the products function groups.
- ^{1}HNMR showed that the distribution of the protons on the chemical structure is as expected.
- The surface tension and interfacial tension measurements showed the good surface activity of these complexes.
- Emulsification power of the synthesized surfactants showed the low emulsion stability of these complexes as a function of time, so that these surfactants can not be used as long term emulsion stabilizers.
- The efficiency (Pc_{20}) and effectiveness (Π_{CMC}) of the synthesized metallosurfactants showed their good surface activity while the maximum surface excess (Γ_{max}) showed the ability of these compounds to accumulate at the interface.
- The standard free energies of micellization and adsorption ($\Delta G^{o}_{mic,}$ ΔG^{o}_{ads}) are always negative indicating that the two processes are spontaneous.
- The synthesized metallocationic surfactants showed good biocidal activity towards Gram-positve and Gram-negative bacteria also yeast and fungi.

- The synthesized metallocationic surfactants (X, Y and Z) showed biocidal activity towards sulfate reducing bacteria (SRB).