Summary and conclusions

Cationic surfactants are very important due to their incorporation in several applications including: emulsification, detergency, solubilization and biocides.

In this thesis, new types of cationic surfactants were synthesized based on complexation reaction between Fe III and amide products.

Amidation reaction was carried out between morpholine and fatty acids (lauric acid, myristic acid, palmitic acid and stearic acid) to get Morpholin -4-yl-dodecan-1-one (II a), Morpholin -4-yl-tetradecan-1-one (II b), Morpholin -4-yl-hexadecan-1-one (II c) And Morpholin -4-yl-octadecan-1-one (II d).

The products of amidation were reacted with Fe III to get Tri[morpholin-4-yl-dodecan-1-one]- di[chlorium ferriate] complex (III a), Tri[morpholin-4-yl-tetradecan-1-one]- di[chlorium ferriate] complex (III b) , Tri[morpholin-4-yl-hexadecan-1-one]- di[chlorium ferriate] complex(III c) and Tri[morpholin-4-yl-dodecan-1-one]- di[chlorium ferriate] complex (III d) 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 through measuring their surface properties including surface tension at different temperatures (25, 35 and 45ºC).

The surface parameters including critical micelle concentration (CMC), effectiveness (π_{cmc}), efficiency (PC20), maximum surface excess (Γ_{max}) and minimum surface area (A_{min}) were studied.

The thermodynamic parameters of micellization and adsorption of the synthesized cationic surfactants were calculated according to Gibb's adsorption equations. The ΔG^{o}_{mic}, ΔG^{o}_{ads}, ΔS_{mic}, ΔS_{ads}, ΔH_{mic} and ΔH_{ads} of the prepared ferrosurfactants were calculated at different temperatures as 25, 35 and 45 °C.

The synthesized metallocationic surfactants were evaluated as biocides for different microorganisms including: gram-positive bacteria, gram-negative bacteria, yeast and mold.

<u>The summary of work was as following:</u>

- The elemental analysis showed that the synthesized metallocationic surfactants are pure compounds.

- The FTIR spectra showed disappearance of the starting material function groups.

- ^{1}H-NMR showed that the distribution of the protons on the chemical structure is as expected.

- The surface tension measurements showed the good surface activity of these complexes.

- The efficiency (PC20) 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 adsoption (ΔG^{o}_{mic}, ΔG^{o}_{ads}) are always negative indicating that the two processes are spontaneous.

- The synthesized metallocationic surfactants showed good biocidal activity towards gm + ve and gm –ve bacteria also yeast and mold.