



Ain Shams University
Faculty of Science
Chemistry Department

IMPACT OF THE AIR POLLUTANTS ON METALS CORROSION

BY

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A Thesis

*Submitted for the Degree of Doctor of philosophy in Chemistry
(Physical Chemistry)*

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﴿ قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا

عَلَّمْتَنَا إِنَّكَ ^صأَنْتَ الْعَلِيمُ الْحَكِيمُ ﴿٣٢﴾

صدق الله العظيم

(سورة البقرة ، الآية ٣٢)

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ARABIC SUMMARY

ABSTRACT

The present study was conducted in different sites with different activities in El-Mansoura city to examine the impact of air pollutants on metals corrosion and the role of paints in prevention of the atmospheric corrosion.

The first part of this thesis dealt with the air quality of the sites under investigation during the period from Dec. 2005 to Nov. 2007.

Results clearly indicate that the highest rate of dust deposition was recorded at a rural residential area by an average annual mean value of $26.77 \text{ g/m}^2\cdot\text{month}$. The rate of dust deposition over all the tested sites exceeds the Egyptian standard set for both residential and industrial areas.

The maximum concentration of suspended particulate matter was recorded at the rural residential area and the urban residential area located near the El-Mansoura city center, by annual mean value of $204.64 \text{ }\mu\text{g/m}^3$ and $152.46 \text{ }\mu\text{g/m}^3$. These values are twice the maximum allowable concentration that is given by the Egyptian Law No.4, 1994 ($90 \text{ }\mu\text{g/m}^3$). Both of the deposited dust and the suspended particulate matter were analyzed for their water-soluble sulfates, chlorides, nitrates and ammonium salts.

On the other hand, the concentrations of some gaseous air pollutants like SO_2 , NO_2 , NH_3 , H_2S and total oxidant were also monitored at the sites under investigation. SO_2 and NO_2 concentrations were found to be less than the Egyptian air quality limit ($150 \text{ }\mu\text{g/m}^3$). NH_3 and H_2S gases are mainly detected in the atmosphere close to their natural or industrial sources. Total oxidant mainly ozone is considered a major constituent gas.

The rain water samples were also collected from the tested sites and analyzed for their chemical compositions.

The second part of this study dealt with the atmospheric corrosion of some ferrous and non-ferrous metals exposed to the outdoor atmosphere at the tested sites. The chemical composition of the corrosion products, the changes in the mechanical properties of tested metals and the changes in morphology of the corroded surfaces were determined.

Finally, the last part of this study was concerned with applying paints to the tested ferrous and non-ferrous metals and examining their ability to protect the tested metals against the atmospheric corrosion.

Key words:

Air pollution, gaseous pollutants, deposited particulate matter, suspended particulate matter, smoke, rainwater, atmospheric corrosion carbon steel, reinforcement steel, copper, α -brass, aluminium, Al-Si-Mg alloy, galvanized steel, organic coating.

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