



1- Titre

EXPERIMENTAL WORK ON THE INHIBITOR EFFECT OF ZINC OXIDE NANOPARTICLES AGAINST CORROSION OF X60 STEEL IN HCL AT 1M

2 –Authors Affiliation email addresses Sarah MESSAST 1,2 , Siham.ABDERRAHMANE 1 , Nabila BOUASLA 1,3

1 Surface Engineering Laboratory (LIS); Faculty of Sciences ; Badji Mokhtar-Annaba University

2 University Chadli Bendjedid EL-TARF; Faculty of Sciences ; Department of Physics

3 Chadli Bendjedid EL-TARF University; Faculty of Sciences ; Department of Chemistry

Messastsarah@gmail.com abderrahmanesihem@yahoo.fr nbouasla@yahoo.fr

3- INTRODUCTION

THE FIELD OF NANOTECHNOLOGY HAS BEEN ONE OF THE MAJOR FOCUS OF RESEARCH FOR SCIENTISTS ACROSS THE WORLD. THIS FIELD DEALS WITH THE PRODUCTION AND USAGE OF NANOSCALE MATERIALS. THE POPULARITY OF NANOTECHNOLOGY IS DUE TO ITS UNIQUE PROPERTIES THAT CANNOT BE FOUND IN ITS LARGE COUNTERPART. IN THESE RECENT YEARS, ZINC OXIDE NANOPARTICLES (ZNO NPS) EMERGED AS AN IMPORTANT MATERIAL THAT CAN BE UTILIZED ACROSS VARIOUS FIELDS SUCH AS MEDICINE, COSMETICS, TEXTILES, WASTEWATER TREATMENT AND MANY OTHERS. THE FABRICATION OF ZNO NPS CAN PROCEED THROUGH THREE MAJOR PATHWAYS WHICH ARE PHYSICAL, CHEMICAL AND GREEN SYNTHESIS. AMONG THESE SYNTHESIS METHOD, GREEN SYNTHESIS IS PREFERABLE AS IT IS MORE ENVIRONMENTALLY IN THIS STUDY, ZINC OXIDE NANOPARTICLES WERE PREPARED USING A NATURAL EXTRACT OF PLACTUNTUS AMBONICUS PLANET BY A GREEN METHOD THE CORROSION INHIBITION OF CARBON STEEL X60 IN 1 M HCL USING A GREEN SYNTHESIZED ZNO-NPS WAS INVESTIGATED AT VARIOUS CONCENTRATIONS USING ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY (EIS) MEASUREMENTS, POTENTIODYNAMIQUE POLARIZATION (PDP) AND LINEAR POLARISATION RESISTANCE (PR). THE RESULTS REVEALED THAT THE CORROSION INHIBITION PROCESS IS EXPONENTIALLY INCREASED WITH THE INHIBITOR CONCENTRATIONS, AND AN INHIBITION EFFECTIVENESS OF 78% COULD BE ACQUIRED. POLARIZATION CURVES SHOWED THAT THE ECO-FRIENDLY CONSEQUENTLY, THE OBTAINED INHIBITION EFFICIENCY VALUES DERIVED FROM ALL CHOSEN ANALYSIS TECHNIQUES WERE IN REASONABLY GOOD AGREEMENT E SYNTHESIS METHOD [1-9].

4- RÉSULTATS and DISCUSSION

The efficacy of ZnO-NPs as an inhibitor of corrosion in carbon steel X60 when immersed in 1 M HCL was proved through electrochemical measurements (Electrochemical Impedance Spectroscopy (EIS) and Potentiodynamique Polarization (PDP) [10-11].



fig .1. Preparation of *PLACTUNTUS AMBONICUS* leaves extract (P.a)



fig .2. Synthesis of ZnO NPs

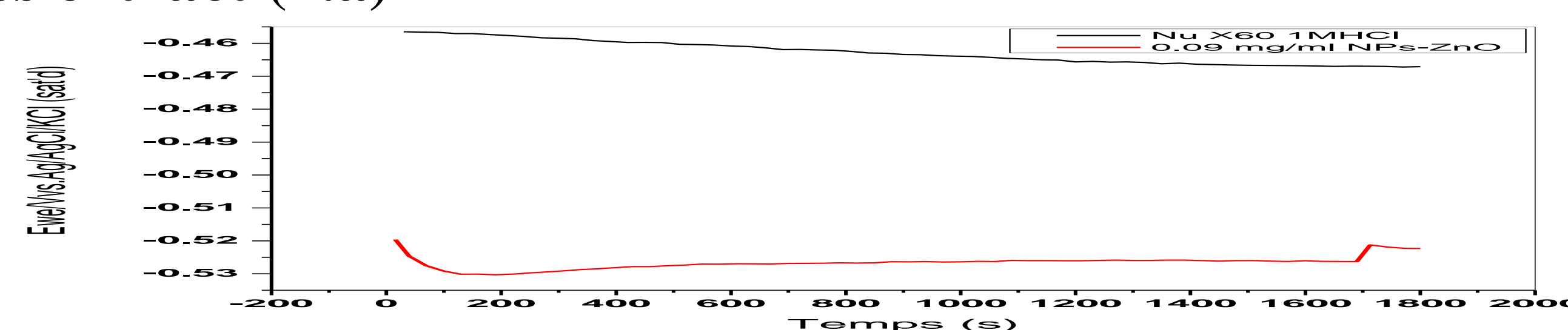


Fig.3. Diagram of the open circuit potential of steel X60 as a function of time in 1M HCL in absence and presence of NPs-ZnO at different concentrations, after 30 min of immersion, at 25°C

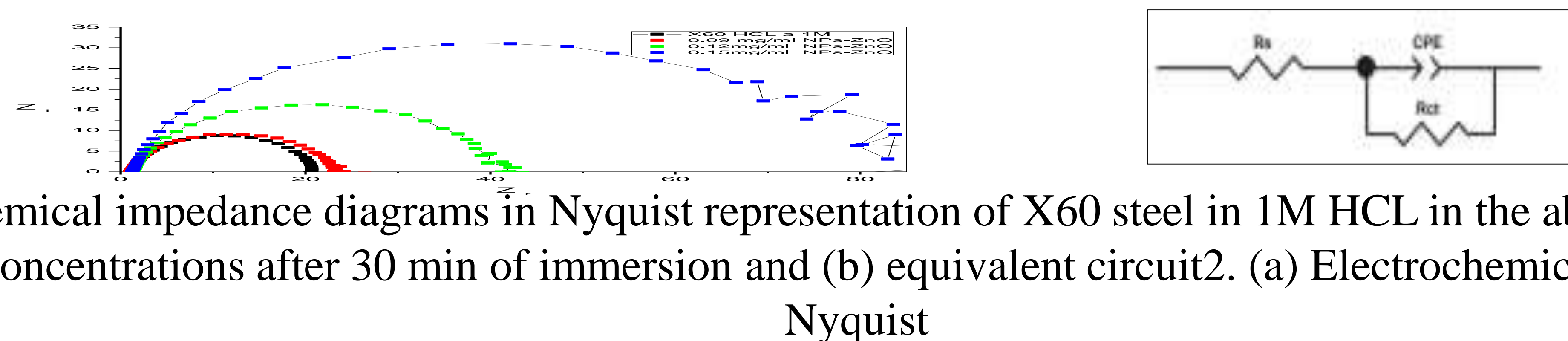


Fig.4. (a) Electrochemical impedance diagrams in Nyquist representation of X60 steel in 1M HCL in the absence and presence of NPs-ZnO at different concentrations after 30 min of immersion and (b) equivalent circuit2. (a) Electrochemical impedance diagrams in Nyquist

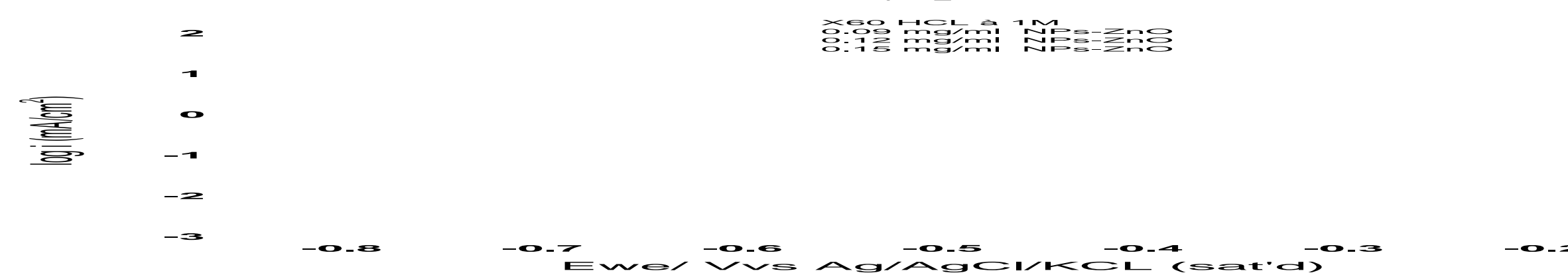


Fig.5. Courbes de polarisation potentiodynamique de l'acier X60 dans HCL 1M en présence et en présence de NPs-ZnO à différentes concentrations, après 30 min d'immersion, à 25°C.

5- CONCLUSION:

The following primary conclusions are derived from the present investigation of this research:

1. A green synthesis of ZnO NPs could be obtained by using a natural (*P.a*) extract as an inexpensive.
2. ZnO NPs inhibited the corrosion properties of X60 steel in 1 M HCL.
3. There was a significant increase in the corrosion inhibition efficiencies ZnO NPs that was in line with their concentrations, and there was good agreement of the obtained values from polarization and EIS measurements.
4. Most importantly, green ZnO NPs can be used as an eco-friendly corrosion inhibitor for carbon steel X 60 in 1M HCL acid solution.

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