EXPERIMENTAL INVESTIGATION FOR THE INFLUENCE OF NANOPARTICLES ON DIESEL ENGINE PERFORMANCE AND EMISSIONS

By

Omar Ahmed Mohamed AbdelLatif Mazen

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Chemical Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

EXPERIMENTAL INVESTIGATION FOR THE INFLUENCE OF NANOPARTICLES ON DIESEL ENGINE PERFORMANCE AND EMISSIONS

Key Words:
Nanoparticles additives; Diesel Engine; Emissions; TiO_2; CuO
Summary:

TiO_2 and CuO nanoparticles are investigated as potential additives to diesel fuel to reduce emissions and enhance engine performance. Various concentrations of nanofuels are examined under different loads to accurately determine their influence in combustion process. The measured emissions are CO, CO_2, NO, O_2, unburned HC meanwhile the mechanical parameters are BSFC, brake power, RPM, thermal efficiency and exhaust temperature. It is worth mentioning that the experimental work was conducted on two conditions; cold start and hot start.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources and have cited them in the reference section.

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In the Name of Allah, the Most Merciful, the Most Compassionate all praise be to Allah, the Lord of the worlds; and prayers and peace be upon Mohamed His servant and messenger. First and foremost, I must acknowledge my limitless thanks to Allah, the Ever-Magnificent; the Ever-Thankful, for His help and bless. I am grateful to some people, who worked hard with me from the beginning till the completion of the present research particularly my mother for her continuous support, guidance and inspiration. Second my supervisors Prof.Fatma, Prof.Mamdouh and Dr.Tarek who have been always generous during all phases of the research, and I highly appreciate their efforts. Morever I would like to express my gratitude to Chemical and Mechanical Engineering departments in BUE as they helped me a lot during the experimental work in addition to chemist Dr.Ahmed Azazy working in scientific and technology centre of excellence. I would like to take this opportunity to say warm thanks to all my beloved friends, who have been so supportive along the way of doing my thesis. . I also would like to express my wholehearted thanks to my family for their generous support they provided me throughout my entire life and particularly through the process of pursuing the master degree. Because of their unconditional love and prayers, I have the chance to complete this thesis.

Dedication

I dedicate this thesis to my parents; Ahmed Mohamed Abdelatif Mazen and Azza Zaki Zaki and my finace Aya Alaaeldein whose love, unselfish and continuous support laid the foundations for discipline and application necessary to complete this work. Also I would like to dedicate this work to my supervisors Prof.Fatma Ashour and Prof.Mamdouh Ayad and Dr. Tarek Mohamed for their contributions and care.

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Nomenclature

API: American Petroleum Institute

BSFC: Brake Specific Fuel Consumption

BP: Brake Power

CFR: Cooperative Research Committee

CI: Cetane Index

CN: Cetane Number

CIE: Compression Ignition Engine

DFPs: Direct Fuel Particulate Filters

EPA: Environmental Protection Agency

FBP: Final Boiling Point

IBP: Initial Boiling Point

NEDC: New European Driving Cycle

PM: Particulate Matters

RPM: Revolution per Minute

SCR: Selective Catalytic Reduction

TEM: Transmission Electron Microscope

THC: Total Hydrocarbon