Energy Conversion and Management 150 (2017) 242–258

Contents lists available at ScienceDirect

Energy Conversion and Management

journal homepage: www.elsevier.com/locate/enconman

Characterization of n-butanol diesel blends on a small size variable compression ratio diesel engine: Modeling and experimental investigation

Ashish Nayyar[a,b,*], Dilip Sharma[b], Shyam Lal Soni[b], Alok Mathur[a]

[a] Department of Mechanical Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India
[b] Department of Mechanical Engineering, Malaviya National Institute of Technology Jaipur, India

ARTICLE INFO

Keywords:
n-Butanol-diesel blend
VCR diesel engine
Performance
Emission
Smoke
NO_x

ABSTRACT

The continuous rise in environmental pollution has attracted the attention of researchers in clean alternative fuels for internal combustion engines. In the present study, experimental investigations were carried out on a small size, modified, variable compression ratio diesel engine with n-butanol-diesel blends (10–25% by volume) as fuel to determine the optimum blending ratio and operating parameters for reduced emissions. Full Factorial design approach was employed for modeling and analysis of experimental data. The experiments were planned and performed in three distinct phases at a constant speed of 1500 rpm and at varying engine load (12, 16, 20 and 24 Nm). The engine loads, blending ratio, compression ratio, injection timing and injection pressure were taken as input parameters and their effects on engine performance and emissions were investigated experimentally and analytically. In the modeling work, reduced quadratic and cubic prediction models were developed, checked for normality and homogeneity and parameters were optimized for desired responses. The optimum results were observed with twenty percent n-butanol-diesel blend (B20) at a higher compression ratio of 19.5 as compared to 18.5 for diesel under similar operating conditions. Brake thermal efficiency improved by 5.54% and smoke & nitrogen oxides decreased by 59.56% & 15.96% respectively for B20 in comparison to diesel at full load condition. Results of the study show that n-butanol-diesel blend is a potential fuel to reduce emissions from diesel engines with improved performance. A close match between experimental results and prediction results reveals that the developed models can be used with adequacy to optimize similar type of diesel engines using n-butanol-diesel blends.

1. Introduction

Development of clean and alternative fuels for IC engines has attracted substantial research in recent years. Diesel engines are more efficient than SI engines but suffer from high smoke emission. Smoke emission can be controlled by improving fuel, improving the combustion process or by suitable after-treatment. Out of these options, use of improved fuels would be an easy solution as it would be applicable for new as well as old engines without structural modifications [1,2].

A variety of alternative fuels and additives such as alcohols [3–9], biodiesels [10–12] and vegetable oils [13–16] can be used in compression ignition (CI) engines with adequate performance and reduced emissions. Improved fuels can also be obtained by adding suitable percentages of these alternatives to diesel. Among these, oxygenated additives have drawn more attention because of their capability to reduce emissions without much affecting the engine performance [17–19]. Oxygenated additives are renewable in nature and support the local agriculture industry [20,21]. Alcohols are bio-oxygenated compounds. The presence of oxygen; low viscosity and high volatility of alcohols make them suitable fuels for diesel engines. Among alcohols, n-butanol has a higher heating value and lower latent heat of vaporization. Its Cetane number is higher as compared to methanol and ethanol, and it is completely miscible with diesel. The calorific value of n-butanol is also higher than methanol and ethanol. This implies that same amount of n-butanol produces higher power from the same engine running on ethanol/methanol-diesel blends [22–26]. n-Butanol can be produced by fossil matter as well as by waste biomass (namely biobutanol), however, the properties of n-butanol produced from both sources are same [27,28].

In an experimental study, it was reported that smoke and NO_x can

Abbreviations: BTE, brake thermal efficiency; BSFC, brake specific fuel consumption; CA btdc, crank angle before top dead centre; CI, compression ignition; CN, cetane number; CO, carbon monoxide; CR, compression ratio; DI, direct injection; HC, unburned hydrocarbon; IC, internal combustion; Inj. Pr., injection pressure; Inj. T., injection timing; max, maximum; NO_x, nitrogen oxides; PM, particulate matter; TC, turbocharged

* Corresponding author at: Department of Mechanical Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India.
E-mail addresses: ashishnayyar@skit.ac.in (A. Nayyar), dsharma.mech@mnit.ac.in (D. Sharma), slsoni.mech@mnit.ac.in (S.L. Soni), ashoom@gmail.com (A. Mathur).

http://dx.doi.org/10.1016/j.enconman.2017.08.031
Received 30 May 2017; Received in revised form 1 August 2017; Accepted 11 August 2017
0196-8904/

Environ Sci Pollut Res
DOI 10.1007/s11356-017-9599-8

RESEARCH ARTICLE

Experimental investigation of performance and emissions of a VCR diesel engine fuelled with *n*-butanol diesel blends under varying engine parameters

Ashish Nayyar[1,2] · **Dilip Sharma**[2] · **Shyam Lal Soni**[2] · **Alok Mathur**[1]

Received: 6 January 2017 / Accepted: 20 June 2017

Abstract The continuous rise in the cost of fossil fuels as well as in environmental pollution has attracted research in the area of clean alternative fuels for improving the performance and emissions of internal combustion (IC) engines. In the present work, *n*-butanol is treated as a bio-fuel and investigations have been made to evaluate the feasibility of replacing diesel with a suitable *n*-butanol-diesel blend. In the current research, an experimental investigation was carried out on a variable compression ratio CI engine with *n*-butanol-diesel blends (10–25% by volume) to determine the optimum blending ratio and optimum operating parameters of the engine for reduced emissions. The best results of performance and emissions were observed for 20% *n*-butanol-diesel blend (B20) at a higher compression ratio as compared to diesel while keeping the other parameters unchanged. The observed deterioration in engine performance was within tolerable limits. The reductions in smoke, nitrogen oxides (NO_x), and carbon monoxide (CO) were observed up to 56.52, 17.19, and 30.43%, respectively, for B20 in comparison to diesel at rated power. However, carbon dioxide (CO_2) and hydrocarbons (HC) were found to be higher by 17.58 and 15.78%, respectively, for B20. It is concluded that *n*-butanol-diesel blend would be a potential fuel to control emissions from diesel engines.

Keywords Additive · *n*-Butanol-diesel blend · Emission · NO_x · Performance · Smoke

Responsible editor: Philippe Garrigues

✉ Ashish Nayyar
ashishnayyar@skit.ac.in

Dilip Sharma
dsharma.mech@mnit.ac.in

Shyam Lal Soni
slsoni.mech@mnit.ac.in

Alok Mathur
ashoom@gmail.com

1 Department of Mechanical Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India

2 Department of Mechanical Engineering, Malaviya National Institute of Technology Jaipur, Jaipur, India

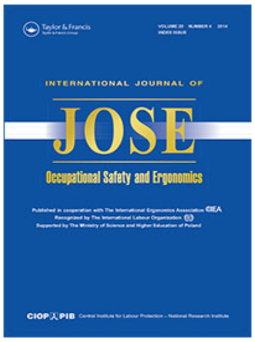
Nomenclature

BSEC	Brake specific energy consumption
BSFC	Brake specific fuel consumption
BTE	Brake thermal efficiency
CA btdc	Crank angle before top dead centre
CI	Compression ignition
CO	Carbon monoxide
CN	Cetane number
CO_2	Carbon dioxide
HC	Hydrocarbons
IC	Internal combustion
NO_x	Nitrogen oxides
PM	Particulate matter

Introduction

Development of alternative and green fuels for IC engines has attracted substantial research in recent years. Diesel engines are more efficient than SI engines but suffer from high smoke emission. Smoke emission can be controlled by improving fuel, by improving the combustion process, or by suitable after-treatment. Out of these options, use of improved fuels would be an easy solution as it would be applicable for new as

Published online: 13 July 2017



Taylor & Francis
Taylor & Francis Group

International Journal of Occupational Safety and Ergonomics

ISSN: 1080-3548 (Print) 2376-9130 (Online) Journal homepage: http://www.tandfonline.com/loi/tose20

Non–powered hand tools improvement researches for prevention of work–related problems: A review

Rahul Jain, M. K. Sain, M L Meena, G S Dangayach & A. Bhardwaj

To cite this article: Rahul Jain, M. K. Sain, M L Meena, G S Dangayach & A. Bhardwaj (2017): Non–powered hand tools improvement researches for prevention of work–related problems: A review, International Journal of Occupational Safety and Ergonomics, DOI: 10.1080/10803548.2017.1296214

To link to this article: http://dx.doi.org/10.1080/10803548.2017.1296214

Accepted author version posted online: 20 Feb 2017.

Publisher: Taylor & Francis & Central Institute for Labour Protection – National Research Institute (CIOP-PIB)

Journal: *International Journal of Occupational Safety and Ergnomics*

DOI: 10.1080/10803548.2017.1296214

Non–powered hand tools improvement researches for prevention of work–related problems: A review

Rahul Jain*[1], M. K. Sain[1, 2], M L Meena[1], G S Dangayach[1], A. Bhardwaj[1]

[1]*Department of Mechanical Engineering, Malaviya National Institute of Technology, Jaipur*

[2]*Department of Mechanical Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jagatpura, Jaipur*

SHORT TITLE: "Non–powered hand tools improvement researches"

KEYWORDS: Design, Ergonomics, Hand Tool, Low–middle–income Countries, Work–related Health problems.

***CORRESPONDING AUTHOR: Rahul Jain**, Department of Mechanical Engineering, Malaviya National Institute of Technology, JLN Marg, Malaviya Nagar, Jaipur, Rajasthan, India – (302017), Telephone: +91-9460568520

[1]E- Mail: rjmahesh207@gmail.com

WORD COUNT (Excluding references, tables and figures): 3212

First Principle Study of (Ga, Al) co-doped ZnO for Optoelectronic Devices Application

First Principle Study of (Ga, Al) co-doped ZnO for Optoelectronic Devices Application

Praveen K. Jain[a,b], Mohammad Salim[a]

[a] Department of Electronics & Communication Engineering, Malaviya National Institute of Technology, Jaipur, India

[b] Department of Electronics & Communication Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India

*corresponding author: ***praveenjain.spsl@gmail.com***

Abstract:

The relative stability, electronic structure and optical properties of (Ga-Al) codoped ZnO was investigated by the first-principle calculations based on DFT. To study the doping effects, ZnO supercells with 32 atoms was built. The results are obtained by using the Material Studios 8.0 provided by Accelrys. Ab initio spin-polarized all-electron density functional theory computations have been performed for substitution. The results indicate that the energy band shifts towards lower energy region for Al and/or Ga doped ZnO, which endorsed the doping of Al and/or Ga. It has been observed that the preparation of (Ga-Al) codoped ZnO is difficult compared to Al/Ga doped ZnO due to the requirement of considerably larger formation energy. The imaginary part of the dielectric function ε_2 (ω), reflectivity R (ω), absorption coefficient α (ω), and refractivity index n (ω) were calculated. The contribution of different density of states in the formation of conduction and valence band has been analyzed for different configuration of ZnO.

1. INTRODUCTION

ZnO is wide direct band gap (3.44 eV) semiconductor material and have high exciton binding energy (60 meV). ZnO is a suitable material for the application in the field of photonics, electronics, acoustics and sensing due to its compatible optical, electronic, and piezoelectric properties. Several research groups have been paying attention on ZnO for its potential applications in the field of spintronics and optoelectronics [1-6].

Switching characteristics in TiO_2/ZnO double layer resistive switching memory device

Switching Characteristics in TiO_2/ZnO Double Layer Resistive Switching Memory Device

Praveen K. Jain[a,b], Mohammad Salim[a], UmeshChand[c], , C. Periasami[a]

[a]Department of Electronics & Communication Engineering, Malaviya National Institute of Technology, Jaipur, India

[b] Department of Electronics & Communication Engineering, Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India

[c]Department of Electronics Engineering and Institute of Electronics, National Chiao Tung University, Taiwan

*corresponding author: ***praveenjain.spsl@gmail.com***

Abstract- The uniform and reliable resistive switching characteristics of the ZnO based RRAM device with thin TiO_2 layer are successfully investigated. In this study, the effect of thickness of TiO_2 layer on switching characteristics has been investigated. Compared with different thicknesses of thin TiO_2 layer, the remarkable improved resistive switching parameters such as lower forming voltage and the narrower variation of endurance are achieved for TiO_2 layer of thickness 2 nm. The forming voltages are dependent on the TiO_2 thickness which supports the idea that forming process is governed by dielectric breakdown like phenomenon. The Ti/TiO_2/ZnO/Pt device with the 2 nm TiO_2 layer exhibits good DC endurance up to 10^3 cycles. The non-volatility of data storage is further confirmed by retention test measured at room temperature. It has been observed that both low resistance state (LRS) and high resistance state (HRS) do not exhibit any degradation for more than 10^4 s.

Keywords: Resistive Switching, ZnO thin film, TiO_2, double layer, RRAM, memory device