

# **Performance and Optimization of Nox Reduction** by Urea Spray Formation in SI Engines

Venugopal A, Sathish Kumar. J, Satish Kumar. A

Department of Mechanical Engineering, St. Joseph's Institute of Technology, Chennai, Tamil Nadu, India

# ABSTRACT

Exhaust contains environmentally harmful pollutants such as oxides of nitrogen (NOx) and particulate photochemical reactions involving primarily NOx. matter (PM).In order to control these exhaust pollutants engine after treatment technologies are being used in diesel engines. A urea selective catalytic reduction (SCR) is one of the promising after treatment devices for the abatement of exhaust emissions, particularly for NOx pollutants. The basic principal of emission reducing systems is to reduce the NOx pollutants by ammonia formed from urea. This project aims to analyse the NOx emissions from a petrol engine equipped with a Urea catalytic convertor using canister as a catalyst

Keywords: nox reduction using urea, urea spray for nox reduction, nox controlled with urea, exhaust nox decrease with urea

#### I. **INTRODUCTION**

Petrol engines are widely used in many areas like Automobiles, locomotives marine engines power generations etc., due to its high power output and thermal efficiency. Even though the diesel engines give more benefits, the human discomfort caused by the pollutant emission of these engines have to be considered. the oxides of Nitrogen are considered as the most harmful pollutants to the human health. Emissions of nitrogen oxides (NOx) contribute seriously to air pollution, which is a major environmental problem. Emissions of NOx react with moisture in the air to form nitric acid, contributing to soil and water acidification in sensitive areas. The

formation of groundlevel ozone is caused by

#### **RELATED WORKS** II.

Mohammad Zaheruddin and Dinesh Kumar G (2014) estimated the amount of NOx emission from aircraft engines using bio-diesel manufactured from algae. They found that NOx emissions in thermally stable combustors are low compared to high temperature varying combustors. Debasis Dani (2012) developed an emulsion of water and diesel to reduce NOx, Sox and particulate matter emissions. The emulsion was using a mixed surfactant method. prepared Performance and emission tests were carried out by using the fuel in a two cylinder water cooled diesel engine. M.K. Duraisamy et al (2011) used Exhaust Gas Recirculation (EGR) method to reduce the emission of NOx from a diesel engine running on biodiesel derived from Jatropha seed oil. Tests were conducted on a fully automated single-cylinder, water-cooled, constant speed direct injection diesel engine. Mohammad Raffic (2015) controlled the emission of NOx from a diesel engine using after treatment by Urea solution. The urea solution was dipped in a steel mesh and the steel mesh was coated using Zinc Oxide. K.Sivasamiet al. (2013) estimated the emission of NOx from diesel engines running on a water - Cotton seed oil methyl ester emission. A single cylinder, direct injection diesel engine was used to perform the emission test. R.Praveenet al. (2014) reduced the emission of NOx from a diesel engine by injecting aqueous solution of Urea in the exhaust pipe.

A single cylinder diesel engine was used to carry out the estimations.

### III. PROPOSED SYSTEM

In order to reduce Nox here we equipped silencer was extracted from a Pulsar 150cc Engine. It was opened on both sides using gas cutting procedure. The insides of the silencer were cleaned to remove dust and soot. The silencer was then core coated with canister (Activated Charcoal). The silencer was re-sealed using gas welding procedure. It was fitted on a Single Cylinder, 4 – Stroke, Water cooled Pulsar 150cc engine present at outside. A small hole (6mm) was drilled on the bottom half of the exhaust pipe using drilling procedure. A copper tube was partially introduced into the hole to act as a nozzle for injecting the diesel exhaust fluid (Aqueous Urea). A petrol Testing tank was used to serve as a container for holding the Aqueous Urea solution. The aqueous urea was fed into the exhaust pipe through gravity feed mechanism. An AVL Five-Gas Analyser was used to measure the amount of NOx and Unburnt Hydro-Carbons emitted from the silencer.



Fig. 1 Architecture of FLOW DIAGRAM

# CHARCOAL IN EXHAUST

Carbon dioxide is the one of the gases in atmosphere bearing percentage of 0.04, it plays an important role in maintaining optimal condition of earth by enriching photosynthesis in plants and other benefits, but it has also become a major issue in the recent decade due to its increase in percentage leading to increasing the global temperature, which causes melting down of glaziers and increasing water levels, heavy changes in temperature.

# **UREA**

Commercial deployment of urea-SCR systems depended on the development of not only the catalyst, but also the urea dosing and injection system. The increase in NOx conversion efficiency of SCR systems that has been seen since the launch of SCR technology on diesel engines around 2005 is largely owed to advances in SCR control and urea injection. The main functions of the urea dosing and injection system include:

- Dosing of the precise amount of urea necessary for the SCR reactions with NOx, and
- Mixing urea and ammonia thoroughly with the exhaust gas.

### REACTION CHAMBER WITH WIRE MESH CHARCOAL

Carbon dioxide is a major cause of natural calamities and changes in climatic conditions. Of all the sources of emission, the amount of carbon dioxide from automobiles is approximately 65%, which is more than any other sources of emissions. Raise in carbon dioxide content in atmosphere is causing global warming which is evolved from greenhouse gases. To reduce the emission and control of carbon dioxide percentage in atmosphere form automobiles, theoretical and practical methods of absorption of carbon dioxide using activated charcoal (carbon) in diesel operated engines is conducted. Charcoal is one of the best adsorption material due to its high pours valve and capture capacity, when reacted with other reagents in order of activation, it increases its adsorption capacity than that of regular charcoal



Urea

(Heating)  $NH_2 - CO - NH_2 + H_2O \longrightarrow 2NH_3 + CO_2$  (Urea) (Ammonia)

 $4NH_3 + 4NO + O_2$  $8NH_3 + 6NO_2$ 

#### CONCLUSIONS

An Experimental Investigation was conducted to examine the performance and exhaust emission of diesel Engine by using Selective Catalytic Reduction (SCR) concept fuelled with diesel and exhaust SCR catalyst coated with chromium in order to reduce the emission from engines. A test was conducted in twin cylinder direct injection diesel engine with different loading condition. Urea with distilled water solution was sprayed at the Exhaust manifold before it enters the SCR setup for different concentrations and the emission parameters HC,NOX and smoke capacity were investigated. The result showed that the Ammonia derived from urea showed comparable performance in the Selective Catalytic Reduction system (SCR). Results indicated that a maximum of 58.46% of NOX reduction was achieved with variant

flow rate of (1.5, 2.0, and 2.5) kg/hr with a urea concentration with different normality is injected in Selective Catalytic Reduction (SCR) System.

 $V_2 + 6H_2O$ 

12H,O

#### REFERENCES

- Livio, S., Strockbine, N.A., Panchalingam, S., Tennant, S.M., Barry, E.M., Marohn, M.E., Antonio, M., Hossain, A., Mandomando, I., Ochieng, J.B. and Oundo, J.O., 2014. Shigella isolates from the global enteric multicenter study inform vaccine development. *Clinical Infectious Diseases*, 59(7), pp.933-941..
- 2. Duraisamy, M.K., Balusamy, T. and Senthilkumar, T., 2011. Reduction of NO emissions in jatropha seed oil fueled CI

International Journal of Trend in Scientific Research and Development (IJTSRD) ISSN: 2456-6470

engine. ARPN Journal of Engineering and Applied Sciences, 6(5), pp.34-9.Kanhangad, V., Kumar, A. and Zhang, D., 2011. Contactless and pose invariant biometric identification using hand surface. *IEEE transactions on image* processing, 20(5), pp.1415-1424.

- Divya, S., Kumar, H.A. and Vishalakshi, A., 2015, January. An improved spectral efficiency of WiMAX using 802.16 G based technology. In Advanced Computing and Communication Systems, 2015 International Conference on (pp. 1-4). IEEE.
- Loni, J., Ayub, S., Singh, V.K., Ghosh, S., Ravindranath, C.C. and Pratapkumar, A.V., CSNT 2014.
- 5. Bharathiraja, B., Chakravarthy, M., Kumar, R.R., Yuvaraj, D., Jayamuthunagai, J., Kumar, R.P. and Palani, S., 2014. Biodiesel production using chemical and biological methods-a review of process, catalyst, acyl acceptor, source and process variables. *Renewable and Sustainable Energy Reviews*, 38, pp.368-382.
- 6. Sivasami, K., Selladurai, V., Devadasan, S.R. and Rajan, K., 2013. Reduction of NOx and Smoke Emission with the effect of Biodiesel-Water Emulsion Mixture Fuel in a Diesel Engine. International Journal of Engineering and Technology, 5(5)

• ISSN: 2456-6470