

Effect of VCR Engine on Its Performance & Emission Characteristics- A Review Paper

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Abstract— In order to find optimum compression ratio on which engine can produce better performance and emission characteristics a variable compression ratio engine is used. The study conducted in past authors noticed that engine produces different power and emission at different compression ratio and at different type of fuel blends. During full load conditions as we increase the compression ratio the power output of Variable compression ratio (VCR) engine increases and emissions like CO and HC decreases as compared with the conventional engine but on the another hand the NO_x emission increases.

Keywords— *Emission characteristics, direct Injection, variable compression ratio engine, Engine performance.*

Introduction-

Variable compression ratio (VCR) engine is relatively a new concept, which is still in its initial phase. In the past, several methods have been proposed about concept of VCR in engines. Some of them intensed on changing the cylinder head, engine aesthetics and piston geometry and a some are based on the variable arrangement of the crankshaft and connecting rod of the cylinder. Some methods include moveable cylinder block, use of eccentric bearings for crankshaft and connecting rod and use of adjustable lever rod between crankshaft and connecting rod.

Besides the efficiency, emissions of an engine are also a key factor as it directly affects the environment. The main constituents of the exhaust gas of an engine are unburnt hydrocarbons (HC) and oxides of carbon (CO_x) and oxides

of nitrogen (NO_x), which can be controlled by varying the engine operating conditions. Former researchers have tried to establish the relationship between emission of engine and its operating conditions such as load, power, rpm, size and torque output.

Apart from these characteristic parameters, it was found that the use of alternate fuels with better octane and cetane rating would improve the efficiency and emissions. It was investigated that lower carbon content, lower suit particals better blending capability and anti-knock characteristics of alcohols make it functional alternative fuel for SI engines. In the paper, it has been reviewed the effect of variable compression ratio on the optimum engine performance and fuel efficiency also the compression ratio effects the engine size and exhaust emission.

Diesel engine has more applications more than SI engine. Higher efficiency and lower cost encourages the Diesel engine for variety of uses.

From the exiting published results it can be deduced that a ton of research work has been completed on assessing the execution and outflow attributes distinctive pressure proportions till the present day.

This same work can be evaluated by using ECO gas analyser emission valus can be further reduced using two or three way catalytic convertors. Emission tesing and charaterstics are evaluated in some case studies shown below.

Case Studies :

The summary of existing published results are presented in table as shown below:

SN	Author	Title	Parameters	Results
1	k.Muralidharan, D.vasudevan, k.N sheeba(2011)	Performance, emission and combustion characteristics of biodiesel fuelled VCR engine	Single cylinder 4 stroke Water cooled VCR engine Waste cooking oil methyl ester and its	Maximum brake thermal efficiency of 38.46% for B40 which is 4.1% more than that of diesel. NOx emission only less for B20.
4	Y.Datta Bharadwaz, B.Govinda Rao V.Dharma Rao C. Anusha(2016)	Improvement of Biodiesel Methanolblends performance in a VCR engine using response surface methodology	Single cylinder, 4-stroke, water cooled, rpm 1500 BM 5, BM10, BM15	Max. Performance and minimum, emission using BM 5 at CR 18:1 and 9.03kg load. CO emission low at CR 18:1 at 16 kg load using BM5. HC emission low at CR 18:1 at 8 kg load using BM5.
5	Vishwanath Shavi, Adivappa Ramapuri, Chetan Mirje, Manjunath Mathapati, R.V Nyamagoud(2015)	Study of characteristic performance of VCR engine for different fuel	Single cylinder, 4-stroke VCR engine, Honge oil blended with diesel, B20, B40, D 100 blend, CR 16:1-18:1, rpm 1500	Using D100 min fuel consumption at CR 17:1. Using B20 min fuel consumption at CR 20:6:1. Using B100 low fuel consumption at CR 18:1.
6	k.Satyanarayana, Vinodh Kumar Padala, T.V.Hanumantha Rao, S.V.Umamaheswararao (2015)	VCR diesel engine performance analysis	Single cylinder, 4-stroke VCR engine, rpm 1500, CR 16.5:1, 17:1, 17.5:1, 18:1, 19:1	Max brake thermal efficiency at 19:1. Improved performance at 19:1 Min fuel consumption at 19:1 Exhaust Gas temperature min at 16.5:1
7	B.De, R.S. Panua	An experimental study on performance and emission characteristics of vegetable oil blends with diesel in a direct injection variable VCR engine	Single cylinder, 4-stroke VCR engine, rpm 1500, CR 16-18:1 at load 3.7KW	Thermal efficiency, exhaust gas temperature and emission at CR 18:1 for blend 30% jatropa oil with diesel fuel is close to diesel
8	V, Harriram, R. Vagesh Shangar	Influence of compression ratio on combustion and performance characteristics of direct injection compression ignition engine	Single cylinder, 4-stroke VCR engine, CR 16 to 18:1 rpm 1500	At CR 18:1, useful for without knocking with better brake thermal efficiency and brake specific fuel consumption
9	Mohammed EL Kassaby, Medhat A. Nemitallah	Studying the effect of compression ratio on an engine fuel with waste oil produced biodiesel/diesel fuel	Single cylinder, 4-stroke VCR direct injection engine, CR 14:1, 16:1 and 18:1, rpm 1000 to 2000, B10, B20, B30, B50	HC emission reduced by 14.28% and CO emission reduced by 37.5% when CR varies from 14 to 18:1
10	Rinu Thomas, M. Sreesankaran. Jeevan Jaidi, Dileep M. Paul, P. Manjunath	Experimental evaluation of the effect of compression ratio on performance and emission of SI engine fuelled with gasoline and n-butanol at different loads	Single cylinder SI engine CR 7.1, 8.5:1 and 10:1, B20 with gasoline	Using VCR at different loading gives better performance and emission characteristics

Discussions:

This paper has effectively explored shape the different examinations and examinations the effect of pressure proportions on the ignition, execution parameters and toxin emanation on the distinctive VCR diesel engines. Studies with various estimations of pressure proportion and diverse mixing rates has shown that expansion in pressure proportion enhances the execution of the motor utilized as a part of concentrate as to the motor execution measured as far as brake warm proficiency. Warm effectiveness, fumes gas temperature and emanation parameters, for example, NOX and COx increments with the expansion of CR and it

make the motor more cumbersome and boisterous. In any case, with the expansion of mixes builds the fumes gas temperature and emanation parameters like NOX, COx and reductions the warm productivity of the motor. Fumes gas temperature is low for every one of the mixes contrasted with diesel. The emanation of CO, HC dropped with an expansion in mixing proportion and pressure proportion of most extreme load. Along these lines the VCR motor has a gigantic potential for enhancing warm proficiency of motor and diminishing the fumes contaminations. In current time the test in reception the VCR in contrariness with real parts in current creation. To put it plainly, VCR will allow SI motors essentially to decrease fuel utilization and contaminations. Buying fuel-proficient, eco-accommodating and clean vehicles would be enormously empowered in future.

The future research work can be further continued on the emission testing with different fuel types and changing compression ratio by varying operating parameters. The reduction and measuring of pollutants emitted can also be good area of research work to be worked on this engine. Authors had chosen this as research work because very limited studies was found in this area of automotive sector.

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