The attitude of CO, HC, NO and smoke emissions on different temperatures

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Abstract: - The following essay presents the gas emissions attitude in afour-stroke diesel engine in relation to different temperature of fuels. Specifically, the experiments were taken place under the following temperatures: 20^{o}C, 30^{o}C, 40^{o}C, 50^{o}C, 60^{o}C, 70 ^{o}C and 80 ^{o}C. It has been measured the emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) and smoke in relation to the above temperatures. Additionally the fuel consumption has been examined.

Key-Words: - Gas emissions, Fuel temperature, CO, HC, NO, smoke

1 Introduction

In the days before the proliferation of large cities and industry, nature's own systems kept the air fairly clean. Wind mixed and dispersed the gases, rain washed the dust and other easily dissolved substances to the ground and plants absorbed carbon dioxide and replaced it with oxygen[1]. With increasing urbanization and industrialization, humans started to release more wastes into the atmosphere than nature could cope with. Since then, more pollution has been added to the air by industrial, commercial and domestic sources. Air pollution is made up of many kinds of gases, droplets and particles that reduce the quality of the air[2]. The main causes of air pollution are the carbon monoxide, the carbon dioxide, the sulfur dioxide, the nitrogen dioxide, the combustion of fuels in automobiles and jet planes, the burning of fossil fuels etc[3]. Volcanic eruptions, natural radioactivity, wind erosion, forest fires are all among the natural sources of air pollution. Additionally there are many forms of air pollution that are human made, such as the burning of fossil fuels, including coal, oil and gas in our homes, factories and vehicles[4].

Air pollutants are classified either primary or secondary. A primary pollutant is one that is released directly to the air, such as the carbon monoxide from combustion and the secondary pollutant is formed in the atmosphere through chemical reactions of primary pollutants[5]. Either primary or secondary air pollution has both acute and chronic effects on human health. Health effects range anywhere from minor irritation of eyes and the upper respiratory system to chronic respiratory disease, heart disease, lung cancer and death. How sick people will get depends on the pollutant type, its concentration on the air, length of the exposure and other pollutants in the air[6]. Air pollution does not have discriminations in the age. Even the younger children can be affected seriously from the air pollution[7]. By taken into consideration all the above, there is a big need to prevent the air pollution, in order to breath in a clean and healthy environment[8].

The question that arises is how a four-stroke diesel engine behaves on the side of pollutants and operation, when it uses diesel as fuel in different temperatures.

2 Instrumentation and experimental results

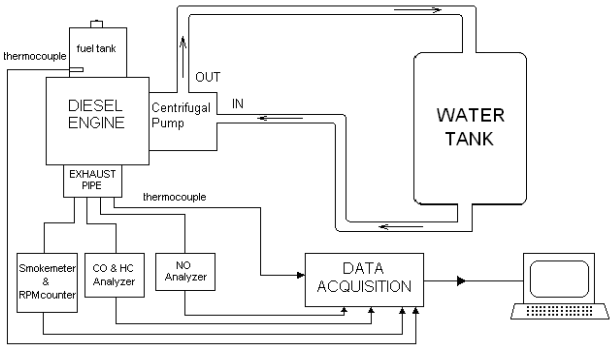
Specifically it has been used fuel diesel at different temperatures: 20^{o}C, 30^{o}C, 40^{o}C, 50^{o}C, 60^{o}C, 70^{o}C and 80^{o}C in a four-stroke diesel engine named Ruggerini type RD-80, volume 377cc, and power 8.2hp/3000rpm, who was connected with a pump of water centrifugal. Measurements were made when

the engine was function on max rpm(average value 2805rpm).

2.1. Experimental measurements

During the experiments, it has been counted:

- The percent of (CO)
- To ppm(parts per million) HC
- To ppm(parts per million) NO
- The percent of smoke
- Fuel consumption



Picture1. Experimental layout

The measurement of rounds/min of the engine was made by a portable tachometer (Digital photo/contact tachometer) named LTLutron DT-2236. Smoke was measured by a specifically measurement device named SMOKE MODULE EXHAUST GAS ANALYSER MOD 9010/M, which has been connected to a PC unit. The CO and HC emissions have been measured by HORIBA Analyzer MEXA-324 GE. The NO emissions were measured by a Single GAS Analyser SGA92-NO.

2.2. Experimental results

The experimental results are shown at the following tables and figures:

%smoke						
20 °C	**30 °C**	**40 °C**	**50 °C**	**60 °C**	**70 °C**	**80 °C**
50,05	54,00	55,21	44,49	37,75	44,42	35,06

Table 1. The %smoke average value variation on max rpm regarding to the fuel temperature.

%CO						
20 °C	**30 °C**	**40 °C**	**50 °C**	**60 °C**	**70 °C**	**80 °C**
0,10	0,08	0,07	0,08	0,06	0,08	0,06

Table 2. The %CO average value variation on max rpm regarding to the fuel temperature.

HC(ppm)						
20 °C	**30 °C**	**40 °C**	**50 °C**	**60 °C**	**70 °C**	**80 °C**
11,01	35,07	29,47	27,6	22,56	20,98	19,14

Table 3. The HC average value variation on max rpm regarding to the mixture.

NO(ppm)						
20 °C	**30 °C**	**40 °C**	**50 °C**	**60 °C**	**70 °C**	**80 °C**
844,6	876,8	775,7	786,3	770,8	767,2	745,3

Table 4. The NO average value variation on max rpm regarding to the mixture.

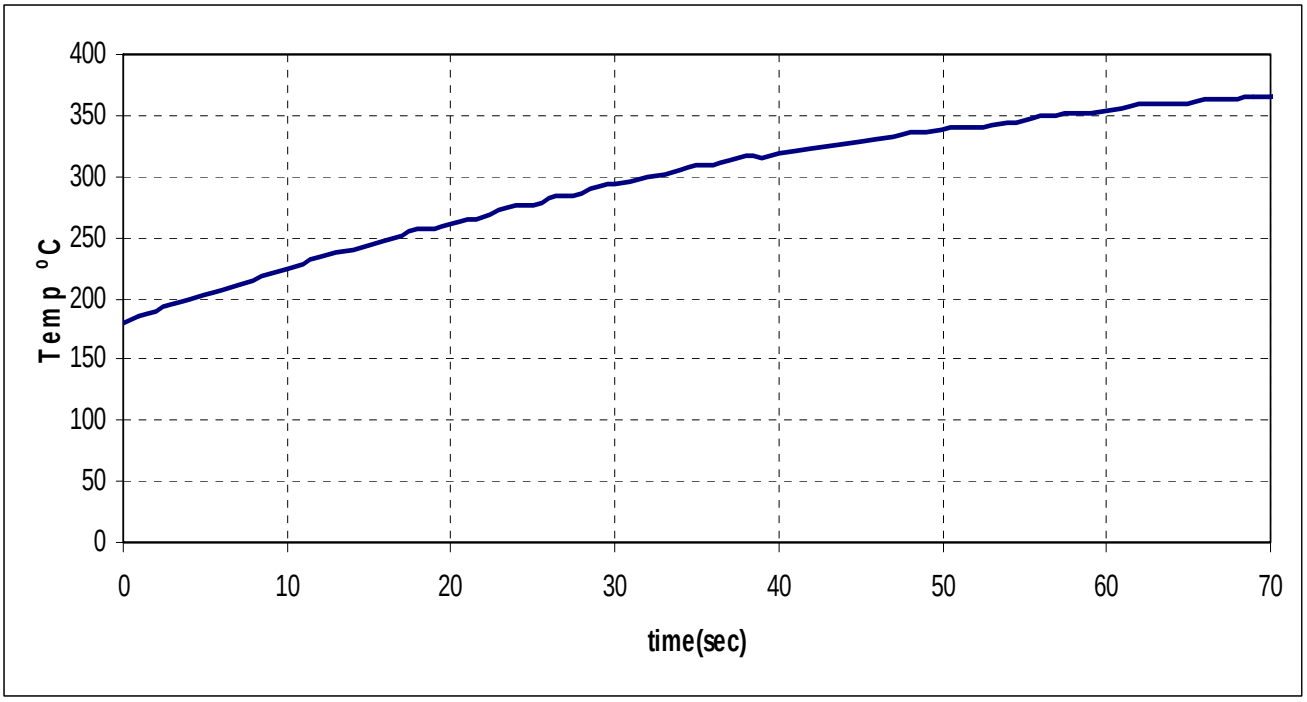


Figure 1. The gas emissions temperature

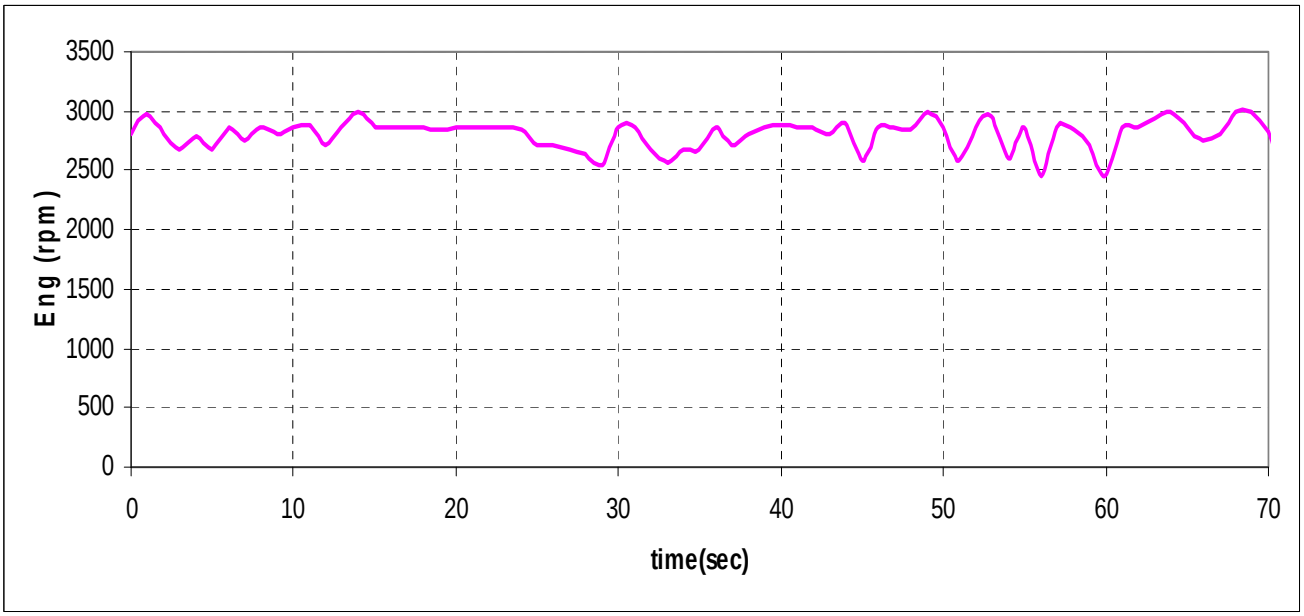


Figure 2. The engine rpm

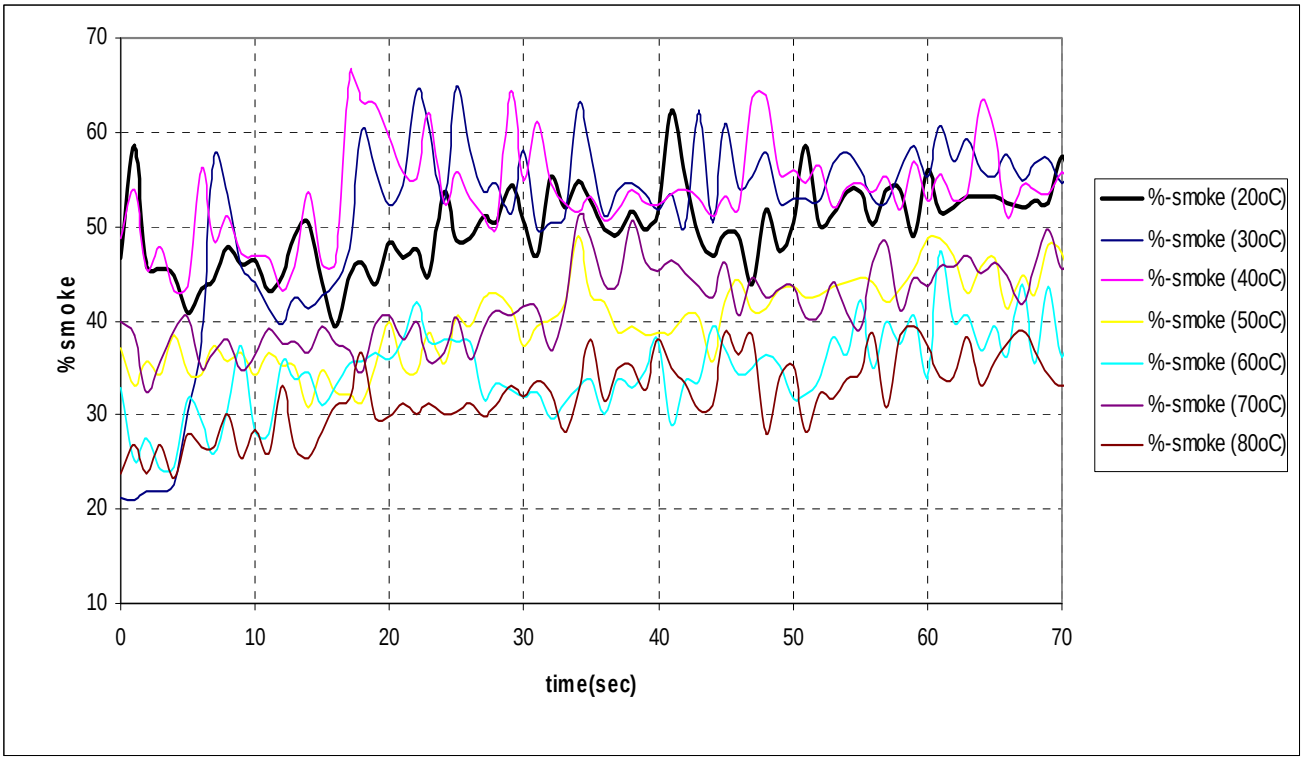


Figure 3. The smoke variation on different rpm regarding to the fuel temperatures

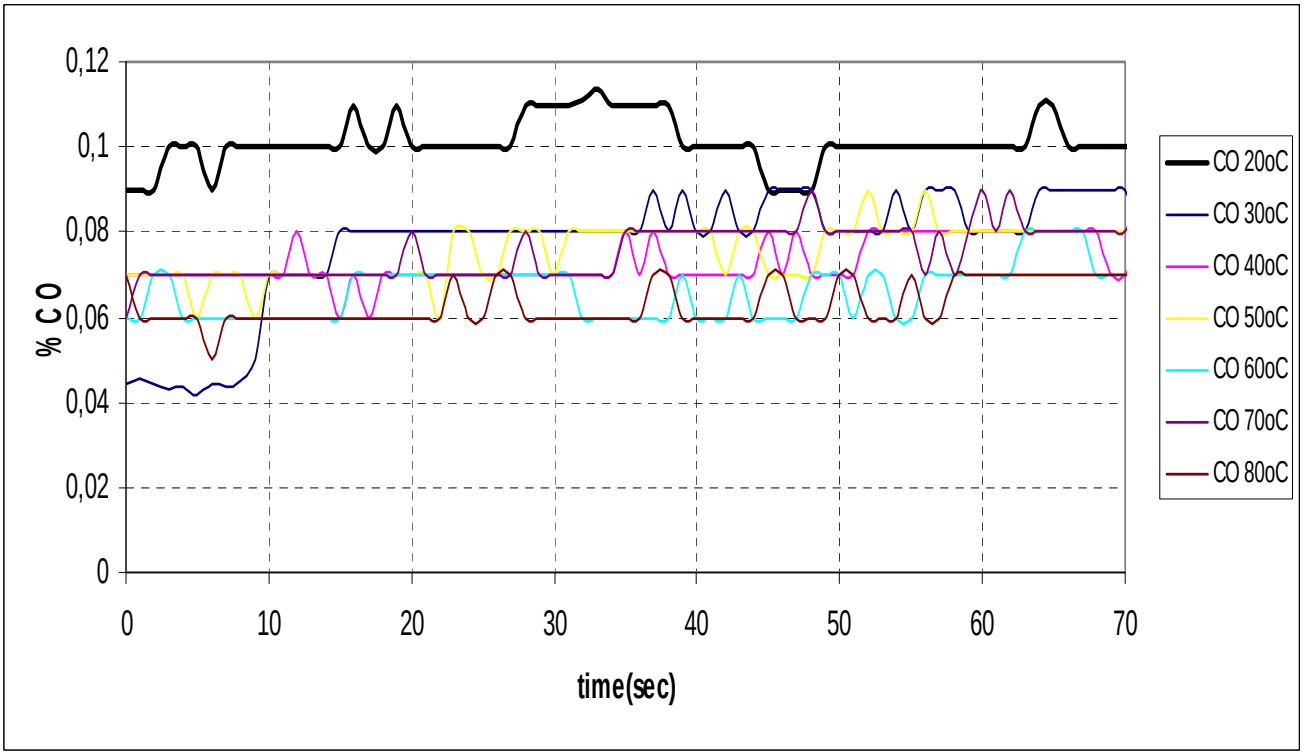


Figure 4. The % CO variation on different rpm regarding to the fuel temperatures

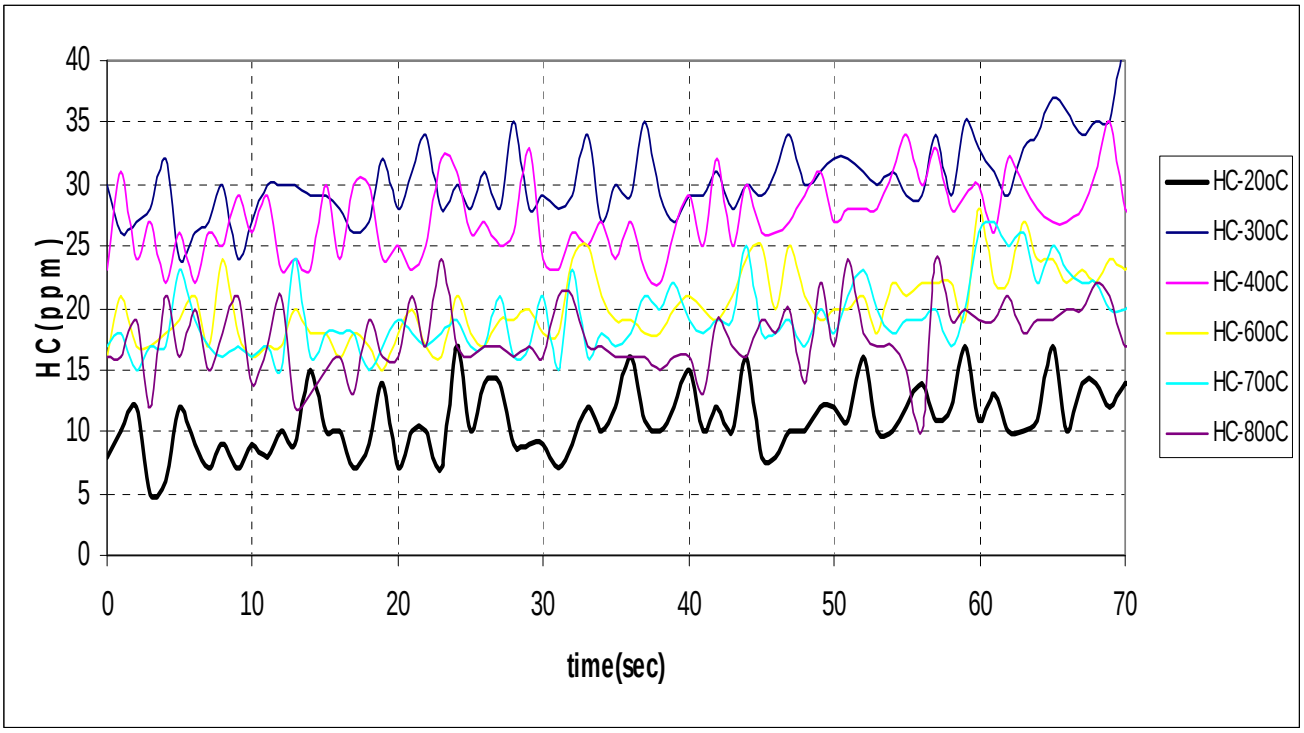


Figure 5. The HC variation on different rpm regarding to the fuel temperatures

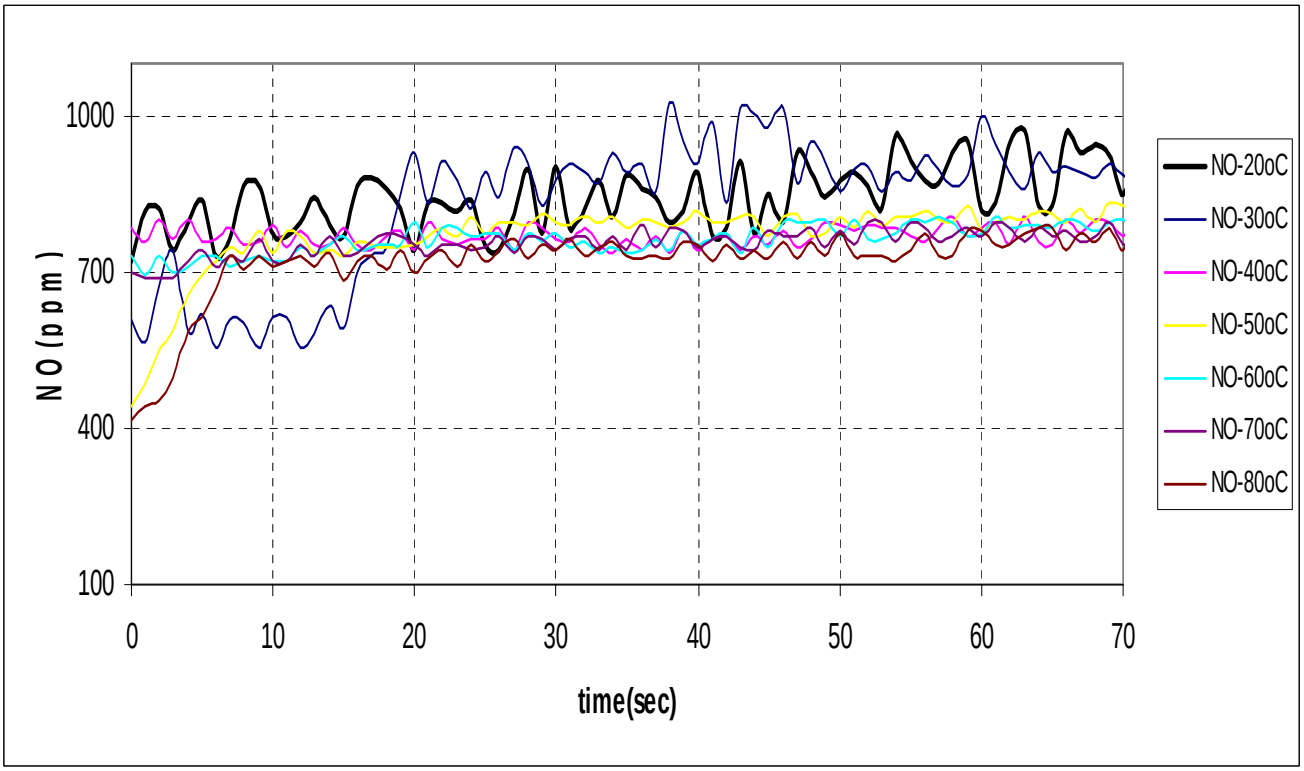


Figure 6. The NO variation on different rpm regarding to the fuel temperatures

From figure 3 it is clear that when the diesel temperature is 80^{o}C the smoke emissions are lower. From figure 4 it can be noticed the biggest reduction of CO in case of the 20^{o}C fuel temperature. From figure 5 it can be noticed the biggest reduction of HC in the case of the fuel temperatures 20^{o}C. From figure 6 it can be seen the lower value of NO in 80^{o}C of fuel temperature. It is also important the fact that there was no changes in the rounds of the engine, as well as in the supply of water. Finally as far as the consumption is concerned 0,426ml/sec.

3 Conclusion

The different temperatures of diesel have the following impacts:

- The smoke is lower in the case of 80^{o}C of fuel temperature.
- About CO it can be noticed that when the diesel temperature is 20^{o}C the CO emissions are lower.
- About it can be noticed the biggest reduction of HC in case of the 20^{o}C.
- About NO it can be noticed the lower value in 80^{o}C of fuel temperature

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