



Types of gases produced in combustion and their consequences

The gases emitted by an internal gasoline combustion engine are mainly of two types: inoffensive and contaminants.

The first are Nitrogen, Oxygen, Carbon Dioxide, water vapour and Hydrogen. The second (contaminants) are mostly Carbon Monoxide, Hydrocarbons, Nitrogen Oxides and Lead.

Inoffensive

Nitrogen is an inert gas present in a concentration of 79% of the air we breath. Although it is an inert gas at room temperature, Nitrogen oxidises to form small quantities of Nitrogen Oxides, due to the high temperatures in the engine.

Oxygen is one of the indispensable elements for all combustion and makes up 21% of our air. If the mixture is either too high or too low in oxygen than not all of the hydrocarbon bonds will be oxidised and it will emitted with the rest of the exhaust fumes.

Water vapour is produced as a result of the combustion by the oxidation of Hydrogen and is released with the exhaust fumes.

Carbon dioxide produced by the complete combustion of carbon is not toxic for human beings and is a source of energy for green plants thanks to photosynthesis. It is a logical product of combustion, or to put it another way, combustion improves as its concentration increases. Nonetheless, a huge increase in the concentration of carbon dioxide in the atmosphere can produce large climatic changes (the so called green house effect).

Contaminants

Carbon monoxide, in high concentrations and after long periods of exposure, can produce an irreversible transformation of Haemoglobin, the molecule used to transport oxygen from the lungs to the cells of the organism, into Carboxy-haemoglobin which cannot transport oxygen. A CO concentration of more than 0,3% volume can be deadly.

The lack of oxygen does not allow for complete combustion and carbon monoxide is formed instead of carbon dioxide. In a vehicle, the appearance of greater concentrations of CO in the exhaust indicate that the initial mixture is rich in or has a lack of oxygen.



Hydrocarbons have different toxic effects, depending on their molecular structure. Benzol, for example, is poison all by itself. Exposure to this gas causes irritation of the skin, eyes and respiratory pathways,. If in high concentrations it will provoke depression, dizziness, headaches and nausea. Benzol is one of the multiple causes of cancer. Its presence is due to the incombustible components of the mixture or to the intermediate reactions of combustion which are also, in turn, responsible for the production of Aldehydes and Phenols.

The simultaneous presence of Hydrocarbons, Nitrous oxides, ultraviolet rays and atmospheric stratification produces photochemical smog which has serious consequences on the health of living beings.

Nitrogen Oxides do not only irritate the mucous layer, but, in combination with Hydrocarbons in smog and air humidity, produce Nitrous Acids. These later fall to the earth in the form of acid rain and contaminate extensive areas, sometimes situated hundreds of kilometres away from the source of contamination.

Lead is the most dangerous metal in the combustion additives. If inhaled it can provoke the formation of coagulates or thromboses in the blood which have serious pathological consequences. It is present in gasoline in the form of Tetra-ethyl lead and is used to increase the level of octane and also, in older engines, as a lubricant of valve seats. In unleaded gas this metal has been substituted by other less contaminating components that also provide a high octane index.