GASOLINE

Petrol (petroleum spirit) redirects here.

Gasoline (or petrol) is a petroleum-derived liquid mixture consisting primarily of hydrocarbons, used as fuel ininternal combustion engines.

Word usage

Many Commonwealth of Nations [[1]]use the term petrol (abbreviated from petroleum spirit). The termgasoline is commonly used in North America[[2]]. The word is commonly shortened in colloquial[[3]] usage to "gas" (see other meanings). The term mogas, short for motor gasoline, for use in cars is used to distinguish it from avgas, aviation gasoline used in light aircraft. This should be distinguished in usage from genuinelygaseous fuels used in internal combustion engines such as hydrogen.

Production

Gasoline is produced in oil refineries. Material that is separated from crude oil via distillation, called natural gasoline, does not meet the required specifications for modern engines (in particular octane rating; see below), but will form part of the blend.

Chemical composition

The bulk of a typical gasoline consists of hydrocarbons with between 5 and 12 carbon atoms per molecule.

The various refinery streams blended together to make gasoline all have different characteristics. Some important streams are:

Reformate, produced in a catalytic reformer with a high octane rating and high aromatic content, and very low olefins (alkenes)[[4]].

Cat Cracked Gasoline or Cat Cracked Naphtha, produced from a catalytic cracker, with a moderate octane rating, high olefins (alkene) content, and moderate aromatics level. Here, "cat" is short for "catalyst".

Hydrocrackate (Heavy, Mid, and Light), produced from a hydrocracker, with medium to low octane rating and moderate aromatic levels.

Natural Gasoline (has very many names), directly from crude oil with low octane rating, low aromatics (depending on the crude oil), some naphthenes (cycloalkanes[[5]]) and zero olefins (alkenes).

Alkylate, produced in an alkylation[[6]] unit, with a high octane rating and which is pure paraffin[[7]] (alkane), mainly branched chains.

Isomerate (various names) which is made by isomerising Natural Gasoline to increase its octane rating and is very low in aromatics.

(The terms used here are not always the correct chemical terms. Typically they are old fashioned, but they are the terms normally used in the oil industry. The exact terminology for these streams varies by oil company and by country.)

Overall a typical gasoline is predominantly a mixture of paraffins (alkanes[[8]]), naphthenes (cycloalkanes), aromatics[[9]] and olefins (alkenes). The exact ratios can depend on

the oil refinery that makes the gasoline, as not all refineries have the same set of processing units.

the crude oil used by the refinery on a particular day.

the grade of gasoline, in particular the octane rating.

Gasoline can also contain some other organic compounds: such as organic ethers (deliberately added), plus small levels of contaminants, in particular sulfur[[10]] compounds such as disulfides[[11]] and thiophenes[[12]]. Some contaminants, in particular thiols [[13]]and hydrogen sulfide[[14]], must be removed because they cause corrosion in engines.

Volatility

Gasoline is more volatile than diesel oil or kerosene, not only because of the base constituents, but because of the additives that are put into it. The final control of volatility is often by blending of butane. The desired volatility depends on the ambient temperature.

The maximum volatility of gasoline in many countries has been reduced in recent years to reduce emissions during refueling.

Octane rating

Template:See details The most important characteristic of gasoline is its octane rating, which is a measure of how resistant gasoline is to premature detonation (knocking). It is measured relative to a mixture of 2,2,4-trimethylpentane (an isomer of octane) and heptane[[15]]. An 87-octane gasoline has the same knock resistance as a mixture of 87% isooctane and 13% n-heptane. The octane rating system was developed by the chemist Russell Marker.

Dangers

Many of the non-aliphatic hydrocarbons naturally present in gasoline (especially aromatic ones like benzene), as well as many anti-knocking additives, are carcinogenic. Because of this, any large-scale or ongoing leaks of gasoline pose a threat to the public's health and the environment, should the gasoline reach a public supply ofdrinking water. The chief risks of such leaks come not from vehicles, but from gasoline delivery truck

accidents and leaks from storage tanks. Because of this risk, most (underground) storage tanks now have extensive measures in place to detect and prevent any such leaks, such as sacrificial anodes.

Gasoline is rather volatile (meaning it readily evaporates), requiring that storage tanks on land and in vehicles be properly sealed. The high volatility also means that it will easily ignite in cold weather conditions, unlike diesel for example. Appropriate venting is needed to ensure the level of pressure is similar on the inside and outside.

Gasoline also reacts dangerously with certain common chemicals; for example, gasoline and crystal Drāno(sodium hydroxide) react together in a spontaneous combustion.

It is also one of the few liquids that you are not supposed to vomit out of your system because of its tendency to burn your throat.

Gasoline is also one of the sources of pollutant gases. Even gasoline which does not contain lead or sulfurcompounds produces carbon dioxide, nitrogen oxides, and carbon monoxide in the exhaust of the enginewhich is running on it.

Through misuse as an inhalant, gasoline also contributes to damage to health. "Petrol sniffing" is a common way of obtaining a high for many people and has become epidemic in many poorer communities such as withIndigenous Australians. In response, Opal fuel has been developed by the BP Kwinana Refinery in Australia, and contains only 5% aromatics (unlike the usual 25%) which inhibits the effects of inhalation.

Energy content

Gasoline contains about 45 megajoules per kilogram (MJ/kg) or 135MJ/US gallon.
Volumetric energy density of some fuels compared to gasoline:

Fuel type	MJ/L	MJ/kg	BTU/imp gal	BTU/US gal	Research octane number (RON)
Gasoline	29.0	45	150,000	125,000	91–98
LPG	22.16	34.39	114,660	95,475	115
Ethanol	19.59	30.40	101,360	84,400	129
Methanol	14.57	22.61	75,420	62,800	123
Gasohol (10% ethanol + 90% gasoline)	28.06	43.54	145,200	120,900	93/94
Diesel	40.9	63.47	176,000	147,000	N/A (see cetane)

A high octane fuel such as LPG has a lower energy content than lower octane gasoline, resulting in an overall lower power output at the regular compression ratio an engine ran at on gasoline. However, with an enginetuned to the use of LPG (ie. via higher compression ratios such as 12:1 instead of 8:1), this lower power output can be overcome. This is because higher-octane fuels allow for a higher compression ratio - this means less space in a cylinder on its combustion stroke, hence a higher cylinder temperature, less wasted hydrocarbons (therefore less pollution and wasted energy), and therefore higher power levels coupled with less pollution overall because of the greater efficiency.

The main reason for the lower energy content (per litre) of LPG in comparison to gasoline is that it has a lowerdensity. Energy content per kilogram is higher than for gasoline (higher hydrogen to carbon ratio).

Different countries have some variation in what RON (Research Octane Number) is standard for gasoline, or petrol. In the UK, ordinary regular unleaded petrol is 91 RON (not commonly available), premium unleaded petrol is always 95 RON, and super unleaded is usually 97-98 RON. In the US, octane ratings in fuels can vary between 86-87 AKI (91-92 RON) for regular, through 89-90 (94-95) for mid-grade (European Premium), up to 90-94 (RON 95-99) for premium unleaded or E10 (Super in Europe)

Additives

Lead

The mixture known as gasoline, when used in high compression internal combustion engines, has a tendency to ignite early (pre-ignition or detonation) causing a damaging "engine knocking" (also called "pinging") noise. The discovery that lead additives modified this behavior led to the widespread adoption of the practice in the 1920s and therefore more powerful higher compression engines. The most popular additive was tetra-ethyl lead. However, with the recognition of the environmental damage caused by the lead, and the incompatibility of lead with catalytic converters found on virtually all automobiles since 1975, this practice began to wane in the 1980s. Most countries are phasing out leaded fuel; different additives have replaced the lead compounds. The most popular additives include aromatic hydrocarbons, ethers and alcohol (usually ethanol or methanol).

In the U.S., where lead was blended with gasoline, primarily to boost octane levels, since the early 1920s, standards to phase out leaded gasoline were first implemented in 1973. In 1995, leaded fuel accounted for only 0.6 % of total gasoline sales and less than 2,000 tons of lead per year. From January 1, 1996, the Clean Air Act banned the sale of leaded fuel for use in on-road vehicles. However, fuel containing lead may continue to be sold for off-road uses, including aircraft, racing cars, farm equipment, and marine engines. The ban on leaded gasoline was presumed to lower levels of lead in people's bloodstream and led to thousands of tons of lead being removed from the air.

A side effect of the lead additives was protection of the valve seats from erosion. Many classic cars' engines have needed modification to use lead-free fuels since leaded fuels became unavailable.

Gasoline, as delivered at the pump, also contains additives to reduce internal engine carbon buildups, improvecombustion, and to allow easier starting in cold climates.

MMT

Methylcyclopentadienyl manganese tricarbonyl (MMT) has been used for many years in Canada and recently in Australia to boost octane. It also helps old cars designed for leaded fuel run on unleaded fuel without need for additives to prevent valve problems.

There are currently ongoing debates as to whether or not MMT is harmful to the environment and toxic to humans. However, US Federal sources state that MMT is suspected to be a powerful neurotoxin and respiratory toxin.

Oxygenate blending

Oxygenate blending adds oxygen to the fuel in oxygen-bearing compounds such as MTBE[[16]], ethanoland ETBE, and so reduces the amount of carbon monoxide and unburned fuel in the exhaust gas, thus reducing smog. In many areas throughout the US oxygenate blending is mandatory. For example, in Southern California, fuel must contain 2% oxygen by weight. The resulting fuel is often known as reformulated gasoline(RFG) or oxygenated gasoline. The federal requirement that RFG contain oxygen is being dropped, effective May 6, 2006[17].

MTBE use is being phased out in some states due to issues with contamination of ground water. In some places it is already banned. Ethanol and to a lesser extent the ethanol derived ETBE are a common replacements. Especially ethanol derived from biomatter such as corn, sugar cane or grain is frequent, this will often be referred to as bio-ethanol. An ethanol-gasoline mix of 10% ethanol mixed with gasoline is calledgasohol. An ethanol-gasoline mix of 85% ethanol mixed with gasoline is called E85. The most extensive use of ethanol takes place in Brazil, where the ethanol is derived from sugarcane. Over 3,400 million US gallons (13,000,000 m^3) of ethanol mostly produced from corn was produced in the United States in 2004 for fuel use, and E85 is fast becoming available in much of the United States. The use of bioethanol[[18]], either directly or indirectly by conversion of such ethanol to bio-ETBE, is encouraged by the European Union Biofuels Directive.

However, German aviation engines were of the direct fuel injection type and could use methanol-water injection and nitrous oxide injection, which gave 50% more engine power for five minutes of dogfight. This could be done only five times or after 40 hours run-time and then the engine would have to be rebuilt. Most German aero engines used 87 octane fuel (called B4), while some high-powered engines used 100 octane (C2/C3) fuel.

Stability

When gasoline is left for a certain period of time, gums and varnishes may build up and precipitate in the gasoline, causing "stale fuel." This will cause gums to build up in the cylinders and also the fuel lines, making it harder to start the engine. Gums and varnishes should be removed by a professional to extend engine life. Motor gasoline may be stored up to 60 days in an approved container. If it is to be stored for a longer period of time, a fuel stabilizer may be used. This will extend the life of the fuel to about 1-2 years, and keep it fresh for the next uses. Fuel stabilizer is commonly used for small engines such as lawnmower and tractor engines to promote quicker and more reliable starting.

Source : http://engineering.wikia.com/wiki/Gasoline