



Fuels that Mix with Petrol Jel™ for Use with Aerial Ignition Devices

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Introduction

Over the past four decades, wildland fire protection agencies in North America have used aerial ignition devices as the preferred tool to initiate prescribed burns. The fuel most commonly used for aerial ignition devices was Jet B mixed with a liquid gelling agent labeled Petrol Jel™. Unfortunately Jet B fuel is no longer available for civilian use and agencies are unable to find an alternative fuel that provides similar performance in aerial application. Jet A, the replacement product for Jet B, does not gel to the desired viscosity and does not ignite consistently when mixed with Petrol Jel™.

Fire-Trol Canada Company distributes the liquid Petrol Jel™ and a similar powdered gelling agent trade named Surefire. Petrol Jel™ is the preferred gelling agent used by wildfire managers in western Canada because of its favourable solubility properties when mixed with petroleum fuels. Petrol Jel™ is also easier to transport and handle than Surefire.

Petroleum fuels mixed with Petrol Jel™ must have a low flash point (ignite easily) when used in an aerial ignition device. Short-chained carbon petroleum fuels (C_7H_{16} through $C_{11}H_{24}$) mix well with Petrol Jel™ as these carbon chains are unstable and will bond with other chemicals. A component of petroleum fuels called benzene bonds easily with the powdered metallic stearate present in both Petrol Jel™ and Surefire. Benzene has a low flash point and is a very unstable compound. Petroleum fuels such as diesel and kerosene with long carbon chains (C_{12} to C_{15}) are stable compounds and do not easily bond with other chemicals. As well, long chain carbon fuels contain only a trace of benzene.

The octane rating of gasoline indicates how much the fuel can be compressed before it spontaneously ignites. "Octane" describes a hydrocarbon chain of 8 carbon atoms, while heptane is a seven carbon chain. Eighty-seven-octane gasoline contains 87-percent octane and 13-percent heptane (or some other combination of fuels that has the same performance of the 87/13 combination of octane/heptane). It spontaneously ignites at a given compression level, and can only be safely used in engines that do not exceed that compression ratio.

Objectives

FERIC's Wildland Fire Operations Research Group was asked to evaluate readily available petroleum fuels as alternatives to Jet B for mixing with Petrol Jel™ to create a mixture suitable for aerial ignition devices.

Method

Seven different petroleum fuels were evaluated for their ability to gel and ignite when mixed with Petrol Jel™. The fuels were mixed in a one-litre plastic bottle at a ratio of 1 part Petrol Jel™ to 50 parts fuel for a duration of 15 minutes (recommended mixing time by Fire-Trol).

The mixed fuels were poured into a fireproof pit with an open flame ignition source (butane lighter). This process was used to simulate the pumping of the fluid out of the 200-litre fuel drum of the drip torch and the ignition of the gelled fuel with the drip torch propane igniter.

Results

Table 1 shows the results of the tests. Four of the seven petroleum fuels tested provided satisfactory gelling and igniting characteristics when mixed with Petrol Jel™. **Kerosene (Jet A), diesel, and ethanol blended gasoline, however, did not provide desirable characteristics for use with aerial ignition devices.** Although D-2000 performed the best of all the products evaluated, it will be the least available to the fire community. Unleaded gasolines (both regular and premium) performed well for the tests and is commonly available. While aviation gasoline performed as well as unleaded gasoline, it is a more expensive and a less available option.

Table 1. Gelling and igniting results when mixing the various petroleum fuels with Petrol Jel™.

Fuel Type	Flash Point	Gelling Success	Ignition Success
Aviation gas 100/130	-40°C (-40°F)	gelled after 15 minutes	ignited immediately
Regular unleaded gasoline	-43°C (-45°F)	gelled after 15 minutes	ignited immediately
Premium unleaded gasoline	-43°C (-45°F)	gelled after 15 minutes	ignited immediately
Ethanol blended gasoline	13°C (55°F)	not gelled after 15 minutes	difficult to maintain ignition
Diesel	38°C (100°F)	not gelled after 15 minutes	difficult to maintain ignition
D-2000 (oil well fracture product)	-23°C (-10°F)	gelled after 1 minute	ignited immediately
Kerosene (Jet A)	7°C (45°F)	not gelled after 15 minutes	difficult to maintain ignition
Jet B	-23°C (-10°F)	not tested	not tested

Recommendations

Use unleaded gasoline (regular or premium), or aviation gasoline (Av-Gas) if it is available, as the best alternative to Jet B for aerial ignition. D-2000 is not readily available at this time and requires further testing.

Do not use Jet A,¹ diesel, or ethanol blended gasoline as they do not gel properly or readily ignite.

Follow the mixing directions on the Petrol Jel™ label. Increasing the ratio of Petrol Jel™ to fuel may be required in cold temperatures.

If you want more information about this study, please call Rory Thompson at 780 914 7353.

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¹ FireTrol Canada advises a new formulation for Petrol Jel™ is being developed that will mix with Jet A fuels.