The SRI Medical Herb Potency 8610C GC is shown at right. This GC can also be used to test for residual solvents (i.e., butane, acetone, gasoline residue, etc.) in medical cannabis. These solvents are used in the extraction process to create medical cannabis hash oils and concentrates.

The 12 vial sample heater (incubator) aids in extraction of samples for potency testing, but can also be helpful in residual solvent analysis. The added heat helps release any solvents trapped in the sample into the headspace of the vial.

The GC includes SRI’s Flame-Ionization Detector (FID) which is sensitive to hydrocarbons (e.g., solvents, terpenes, and cannabinoid molecules).
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

Solvents used to make cannabis extractions include:
- Isopropyl Alcohol
- Acetone
- Ethyl Alcohol (Ethanol)
- Methyl Alcohol (Methanol)
- Petroleum Ether

But most commonly, Butane is used. And in some cases Naphtha or even Gasoline (which contains hazardous chemicals like Benzene, Toluene, and Xylene, also known as BTEX).

Many types of columns could be used to separate these molecules, but, for butane, SRI suggests a 3 foot Hayesep D column.

For gasoline, SRI suggests a 15m MXT-1 capillary column with a 5 micron film.

The residual solvent and terpenes analyses can also be performed on the MXT-500 column that comes standard with the Potency GC, but the separation will not be as good. For the best separation of terpenes molecules, a 30 meter MXT-Wax is recommended.

As with all GC analysis, the operator must decide what compounds are most important to detect and select the proper column accordingly.
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

For a butane analysis, using the 3’ Hayesep D column, set the column oven temperature as shown.

Init temp: 180.00
Hold: 10.000
Ramp: 0.000
Final temp: 180.00

Set the Integration parameters as shown.

( The operator of the GC may find that different integration parameters work better for their analysis. )
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

In order to identify residual solvents in cannabis samples, a known standard must be injected. There are many ways to do this, but SRI recommends using a C1-C6 gas standard at 0.1% concentration (1000 ppm for each gas). You can acquire a gas standard from Grace Davison (part # M7017).

1. Pressurize the gas cylinder by turning the release valve slightly counterclockwise.
2. Close the valve by turning it clockwise.
3. Pierce the septum with a 3 mL gas syringe and withdraw 1 mL of gas (keep in mind that there might be ~200 psi behind the septum).
4. Remove the syringe from the gas sample bottle.
5. Without puncturing the septum, position the syringe in the injection port.
6. Press the Start Run button on the GC.
7. Insert the syringe through the septum as far as it will go, depress the plunger, and then remove the syringe.
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

After injecting the C1-C6 standard we see six peaks: ethane, methane (which can elute together); propane, butane, pentane, and hexane; in that order. Identify the peaks so that each peak is defined by a “retention window”. See the PeakSimple tutorial describing the process of creating retention windows.
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

To prepare samples for residual solvent testing, you will need: 40mL voa vials, 1 per sample; a balance capable of reading down to 1 milligram (0.001 gram), and 100 milligrams (0.100 grams) of analyte per sample.

Follow the steps listed below to prepare the sample for analysis.

1. Remove the cap from the 40mL voa vial
2. Place the uncapped vial on the balance, once the balance settles, tare the reading (making the reading 0.000).
3. Add 100 milligrams of analyte (concentrate, hash, waxes, butter, etc.) to the vial. The reading on the balance should be ~0.100.
4. Put the cap back on the vial.
5. Place the vial into the sample heater, and let sit for at least 15 minutes.

The sample is now ready for a headspace analysis.
Follow the steps listed below to analyze the headspace in the vial.

1. Keep the cap of the 40mL vial sealed.
2. Use a 3mL gas syringe (if using the same syringe that was used for calibration, flush the syringe with room air or purge gas to prevent carry over) to puncture the septum of the vial, and pull 1mL of gas from the headspace of the vial.
3. Follow the same injection procedure that was used for the calibration standard (position syringe, start run, puncture septum and insert syringe as far as it will go, depress syringe plunger, and remove syringe).

Real world medical cannabis samples will contain some concentration of organic solvents (plant matter gives off trace amounts of ethane, methane and other gases as it slowly decays), so the presence of minute quantities of these gases should not be alarming. As the operator gains experience they will be more qualified to determine what acceptable and unacceptable levels of these compounds are.
Residual Solvents in medical cannabis analysis using the SRI 8610C FID GC

To make a calibration for residual butane, inject a known amount of butane into an empty 40ml VOA vial.

In the photo at right, we have injected 1ml of 1000ppm calibration gas in the VOA vial, so there is now 2.42ug of butane in the vial.

The calculation goes this way:

1 mole of butane weighs 58.1 grams, and occupies 24000ml at room temp. One ml of butane (in a syringe, not under pressure) therefore weighs 2.42mg. The standard is .1% butane (1000ppm) so the weight of butane in the 1ml syringe (and also now the 40ml vial) is 2.42ug.

Inject 1ml of the vial headspace gas into the GC and record the area of the butane peak. In another vial place 100mg of concentrate and let it equilibrate. Inject 1ml of the concentrate headspace. If the peaks are the same size (area) then the amount of butane given off by the concentrate must also be 2.42ug.

2.42ug (2420 nanograms) divided by 100mg (100,000,000 nanograms) equals .0000242 (24.2ppm). So a peak of this size is equivalent to a butane concentration (in the concentrate) of 24.2ppm.

So the calibration curve would like the one at right.