ALChemia Solutions

Trekker user guide and technical document

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The *Trekker* has been designed at the request of two partners who wanted a lightweight and portable device that could be taken into the field during scientific expeditions to distill plants on-site for research purposes. It was in this spirit that the smallest of the Alchemia Stills was developed. Ultimately, the *Trekker* is just as comfortable on an expedition as it is in a laboratory, a kitchen, or a garden. Therefore, you do not need to be a distillation adventurer to fully enjoy this small 3.5 L still. This device is entirely made of 304 stainless-steel. It is simple to use, robust, and easy to transport. It was carefully designed and is entirely built in Canada (QC).

Before going into technical details, a few personal words:

There are plenty of botanical treasures all around the world and in everyone's living environment. Aromatic plants, medicinal plants, toxic plants, plants we feel connected with, plants we do not... A vast and fascinating world that provides healing substances… and dangerous ones. So, learn as much as you can from reliable sources about the plants around you. Be careful of misidentifications. Grow and/or harvest them with respect and awareness. Always leave enough for others (humans and animals), for future years and for future generations. Enjoy the magic of distillation and plant extraction. Develop your skills, learn how to use your own essential oils and plant extracts safely and efficiently. If you have any questions regarding distillation/extraction and your Trekker, please contact us. We are here to support you in your quest that leads you into your garden, the fields, and the forests.

Benoit ROGER Ph. D.

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About this document

This document contains the technical information about the *Trekker* and describes how to use it safely and efficiently. It also contains in *italicized gray text* some general information about distillation that should help you get a better understanding of what happens in the still and how the distillation method and parameters may affect the quality and yield of the products you are looking to craft.

Safety and heating sources

The *Trekker* can be used with a small gas burner, typically a stovetop burner or a small camping/expedition burner. It provides a stable and efficient heat source, and is therefore one of the two options we recommend for steam distillation and water distillation. Note that the burner diameter must not exceed 10 cm (the tank diameter being 15 cm) and the distillation flow rate must not exceed 1 L/h.

The *Trekker* can also be used with an electric hot plate if it is sufficiently stable and powerful. It cannot be used directly with an induction system but can work with a ceramic cooktop (this works best if the cooktop provides constant heating and if the bottom of the tank is painted black – we can apply this coating before shipping). It can also be used with a traditional hot plate, but it is not always powerful enough to achieve a good distillation flow rate (typically around 0.5 L/h). We do not recommend direct use over a wood fire (the device is too small, and this heating method is difficult to control). Regardless of the heat source used, ensure that it is stable and level.

Never modify the system, do not overload it, and never block the condenser outlet during the temperature rise, distillation, or cooling phase! Boiling water in a closed system causes a pressure build-up inside the device, which is extremely dangerous if the device was not designed for this — and the Trekker is not designed to withstand pressure. Pay attention to hot surfaces and use suitable gloves during and after use. If using a propane burner, ensure proper combustion (a blue flame), and if working outdoors, protect the burner and the device from the wind. In all cases, keep away from any flammable substances (solvents, gas, wood, fabrics…).

In the text below, you will see warning symbols (located in the margin). They indicate safety reminders or important clarifications within the text.

Precautions and maintenance

This unit is made of 304 stainless-steel. It has been carefully cleaned and passivated to improve its corrosion resistance. However, certain precautions must be taken to maintain an appearance close to its original one: never use strong acids, sodium hypochlorite (bleach), and/or steel wool for cleaning. Dish soap or isopropanol, combined with a microfiber cloth, is perfectly suitable. Avoid prolonged contact with salt or non-stainless metals. Wash and dry the device immediately after each use. Never place the still over a direct flame without water in the tank: this could lead to permanent deformation of the bottom of the device.

Each component can be replaced individually, but if the device is used correctly, all parts – including the O-rings – should last several years. Contact us if you need replacement parts.

Technical information

- Full 304 stainless-steel construction, TIG welded under inert atmosphere
- Passivated tank and device fully cleaned before shipping
- Tank seal material: EPDM; condenser seal material: Silicone
- Empty weight: approx. 3.5 kg
- Total tank volume: approx. 5 L
- Volume above the grid: approx. 3.5 L
- Tank dimensions: approx. 15 cm diameter, 30 cm height
- Total height of the still (tank + lid + column/condenser): approx. 40 cm
- Straight condenser: one tube (3/8'') inside another one (3/4'')
- Approximately 1 kg of plant material per distillation using steam distillation

Trekker overview

Unpacking and installation

The unit is shipped with all parts inside the tank. Inside the tank, you should find:

- An EPDM O-ring installed between the flange and tightening nut
- A straight condenser with a silicone O-ring
- Two 6 mm (1/4'') plastic tubes for the condenser water inlet and outlet + two adapters for 10 or 12 mm (3/8'' and 1/2'') hoses
- A fine stainless-steel rod with a piece of microfiber cloth for cleaning the condenser
- A stainless-steel spiral for the condenser
- A replacement screw for the lid with its nut and a thumb nut

Once all parts are unpacked, the only steps required to assemble your still are to attach the condenser to the lid and place the grid inside the tank on the 3 support tubes (for steam distillation only).

To attach the condenser to the lid, simply insert the threaded part into the hole, place the silicone seal around the thread and against the lid, then tighten the nut by hand. You can then place the lid on the tank (with the O-ring) and position the condenser as desired.


For the grid (steam distillation), place the 3 tubes inside the tank as shown in the following pictures and place the grid on top of them.

Once the condenser is connected to the water (inlet at the bottom, outlet at the top), your still is ready for use.

How to use your still

Before starting any distillation, find a stable, flat, level, and well-ventilated area. Shield the still from the wind if working outdoors. Avoid any flammable surfaces or materials if using a gas burner.

Steam distillation

Steam distillation may not be the oldest technique used to distill aromatic plants, but it is the main method used nowadays, as it generally yields better essential oil (EO) quantity and quality than water distillation. In steam distillation, the plant material is not immersed in water: it is placed directly in the still, resting on a grid above the bottom. No water is added when the steam comes from an external boiler. When the steam is generated inside the still, the grid is set higher, and a small amount of water is boiled at the bottom. This latter method is sometimes called water and steam distillation. In all cases, the steam rises through the plant material, volatilizing and carrying its volatile compounds to the condenser and the separator (if one is used).

We recommend using this technique (steam or water and steam distillation), as it generally provides good results in terms of EO yield and quality. It is faster and requires less energy than water distillation. However, resins, wood/bark sawdust, certain crushed seeds or roots, and some very delicate flowers are not easily distilled by steam. In these cases, the steam may not pass evenly through the material, as it tends to melt or swell and become compacted, creating steam channels that reduce distillation efficiency. For these cases, consider using water distillation (described below).

It should also be noted that some hydrolate distillers prefer water distillation over steam distillation for certain plants, even when steam distillation is technically feasible. If you are distilling for yourself, the best technique is the one that gives you the essential oils and hydrolates you prefer.

- Before starting a steam distillation with the *Trekker*, add approximately 1 L of water in the tank. The water level should be a few cm below the grid. It is important to measure the amount of water added to the tank to know the maximum volume you can distill before **running out of water, which must absolutely be avoided** for safety reasons and to prevent damage to your device. You must also consider that a portion of this water may be absorbed by the plant material during distillation.

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- Fill the tank with the plant material as evenly as possible (a very important point), then pack it down by hand (again, as evenly as possible).

Compaction is one of the most important parameters a distiller must control. The first and most critical point is to achieve uniform compaction, allowing steam to rise evenly through the plant material. If compaction is uneven, steam will follow the path of least resistance, and parts of the plant may be poorly distilled, resulting in lower yields or longer distillation times. The optimal level of compaction depends on the type of plant material. Firm pressure can generally be applied to plants with good structural integrity, such as conifer needles, as long as they are not ground into a fine powder. Conversely, plants with less structure—such as soft leaves or flowers—or finely crushed material should not be compacted too tightly, as they naturally tend to pack during distillation and may clog more easily.

- If not already done, place the O-ring on the flange between the rim of the tank and the lid screws. Check that there is nothing (no plant fragments) underneath or on top of the O-ring. Then place the lid on the still (screws in the holes) and manually tighten each thumb nut (do not over-tighten them — this is neither necessary nor recommended).

- Connect the condenser water inlet hose to a water source, slightly open the control valve (not included), then light the propane burner. Always be careful not to burn the water hose with the burner. If the burner is properly sized and adjusted, distillation should start within 10-15 minutes. Once distillation has started, ensure that the water flow rate in the condenser remains correct for the first 30 minutes.
- Regarding the distillation speed or flow rate, this unit is designed to operate at approximately 0.5 L/h. You can calculate this by measuring the volume of distillate or hydrolate (if you are using a Florentine flask) obtained in one minute, then multiplying the result by 60.

As for steam flow, the optimal rate depends on the plant you're distilling, whether it is crushed or not, the amount and nature of the volatile compounds it contains, their location within the plant, and whether you are distilling primarily for essential oil or hydrolate. The ideal flow may also vary between the beginning and the end of the distillation. The best approach is to conduct your own tests: compare two or three different steam flow rates for the same plant material (keeping all other parameters unchanged) and see which gives the best results. It should be noted, however, that doubling the steam flow requires more than twice the amount of energy per unit of time but usually does not produce the same amount of oil in half the time. In some cases, an excessively high steam flow (without cohobation) may even reduce the EO yield, as continuous separation can become more difficult. On the other hand, with a steam flow that is too low, you'll need to distill longer to obtain the same amount of oil, and the plant material will remain at 100 °C for a longer period, which may result in greater chemical degradation. In the end, the optimal steam flow is a compromise depending on the plant, your still, and your objectives.

- The water flow rate circulating through the condenser must be adjusted to ensure proper condensation without waste. A low flow rate results in a relatively warm distillate; a high flow rate results in a cooler distillate. Inside the condenser is a stainless-steel coil. You can remove it if you want a warmer distillate, but if you want a cooler distillate, we recommend leaving it in place. With the coil, the distillate takes longer to exit the condenser, giving it more time to cool down after the condensation phase. In any case, it is important to use enough water in the condenser to condense all the vapor (no vapor should escape from the condenser outlet during distillation), but you should not use a flow rate that is too high, to avoid wasting water. It can be difficult to finely adjust the distillate temperature at this scale. If this is the case, simply open the water control valve a bit more than necessary to ensure everything is condensed. You can also use a 20 L water tank with a pump to recirculate the water between the condenser and the

tank; this allows the distillate temperature to rise slowly during distillation (which is not a problem as long as it does not reach excessively high values).

For essential oils that are difficult to separate from the hydrolate due to their density being close to that of water (such as myrrh or vetiver), the temperature of the distillate becomes a very important parameter. As the temperature increases, the density of both water and essential oil decreases—but the density of the essential oil usually decreases faster, which increases the difference in density between the two. Additionally, the viscosity of water decreases, making it easier for essential oil droplets to coalesce. Therefore, it is generally recommended to distill such essential oils at a higher distillate temperature, around 50–55 °C. (As a reminder, this refers to the distillate temperature, not the temperature inside the tank.) On the other hand, higher temperatures also increase the evaporation rate and the solubility of organic compounds in water. As always, it is a matter of balance. The best way to determine the optimal distillate temperature for a specific essential oil is to test and compare different distillate temperatures, keeping all other parameters constant.

Water distillation

Water distillation consists of placing the plant material directly in water and boiling the mixture. This technique is not recommended for all plants (see previous sections for explanations), but it is the only suitable method for resins, wood or bark sawdust, some crushed seeds or roots, and certain very delicate flowers.

As previously described, however, it should be noted that some hydrolate distillers sometimes prefer this distillation technique for certain plants that could otherwise be distilled using steam distillation. If you are distilling for yourself, the best technique is the one that gives you the essential oil and hydrolate you prefer.

- In water distillation, you do not need to use the grid as you would for steam distillation (to support the plant material), but in certain situations, it can be useful to leave it in without the support tubes so that it simply rests at the bottom of the tank. This prevents direct contact between the plant material and the bottom of the tank.
- Place the water and plant material into the tank (the plant-to-water ratio depends on the plant, but the plant material must always be able to move freely during hydrodistillation), then bring the mixture to a boil using the same setup as described previously.
- Do not put more than 3.5 L of plant material + water in the tank.

- In water distillation, the heating phase is longer than in steam distillation, but once started, it can be conducted in a similar manner to steam distillation.

Important notes

⚠ It is very important to never heat the still with a propane burner or an electric hot plate if there is no water inside. **Heating an empty tank can lead to permanent deformation of the bottom of the still. This is why we strongly recommend measuring and noting the volume of water added to the tank** (approximately 1 L at the start of a steam distillation) to avoid boiling dry. You must also consider that the plant material may absorb some of the water during distillation.

If necessary, even if it is not ideal, it is always possible to stop the distillation, add water, and then restart the distillation.

Enjoy distilling, and please let us know if there is anything you don't understand about using your still. We are here to help.