ALChemia Solutions

Nano user guide and technical document

AlChemia Solutions Inc.
628, boulevard du Saguenay Ouest, Chicoutimi (Québec) G7J 1H4, Canada - +1 418 820-9177

The *Nano* is the second smallest Alchemia still. This unit is completely built in 304 stainless steel. It is easy to carry, simple, and sturdy. It has been developed with great care, and it is entirely built in Canada (QC). This unit has been designed for small-scale distillation of hydrolats and small volumes of essential oils. It can be used for self-production, education, and research.

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 let 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 Nano, 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.

Table of content

About this document

This document contains the technical information about the *Nano* and describes how to use it safely and efficiently. It also contains in *italicized grey 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 *Nano* can be used with a small gas burner, typically a kitchen gas cooktop burner or a standalone burner. It is a very efficient and stable heating source, which makes it one of the best options for steam or water distillation at this scale. Please note that the burner should not be larger than 6''/15 cm (the diameter of the still being 8''/20 cm) and the distillate flow rate should not exceed 1.5 L per hour

The *Nano* can also be used with an electric hot plate if it is stable and powerful enough. It cannot be directly used with an induction system, but it can be used with a ceramic hob (it works better if it delivers constant heat and if the bottom of the still is black coated - which we can do for you before shipping). It can also be used with a classic hot plate, but it is not always powerful enough to give a good distillation flow (0.6 to 1 L/h).

We do not recommend using it on a direct wood fire as it is much harder to control and less stable.

In all cases, be sure that the burner or the electric heating source you use is stable and leveled, and that it can support the weight of the apparatus when filled with plant material and water (up to 15 kg in steam distillation and 22 kg in water distillation).

Do not modify the system, do not overload it, and never block the outlet of the condenser during warming-up, distillation/reflux extraction or cool-down phase! Boiling water or any other solvent in a closed system makes the inside pressure rise and this is very dangerous if the system is not designed for that purpose, which is the case for the *Nano*. Be careful with hot surfaces and use suitable gloves during and after operation. If you use a propane burner, be sure you have a good combustion (blue flame), and if you use it outdoors, protect the unit and the burner from the wind. In all cases, stay far from any flammable substances (solvents, gas, wood, fabric…).

⚠ In the following text, you will see warning symbols in the margins. They indicate safety reminders.

Precautions and maintenance

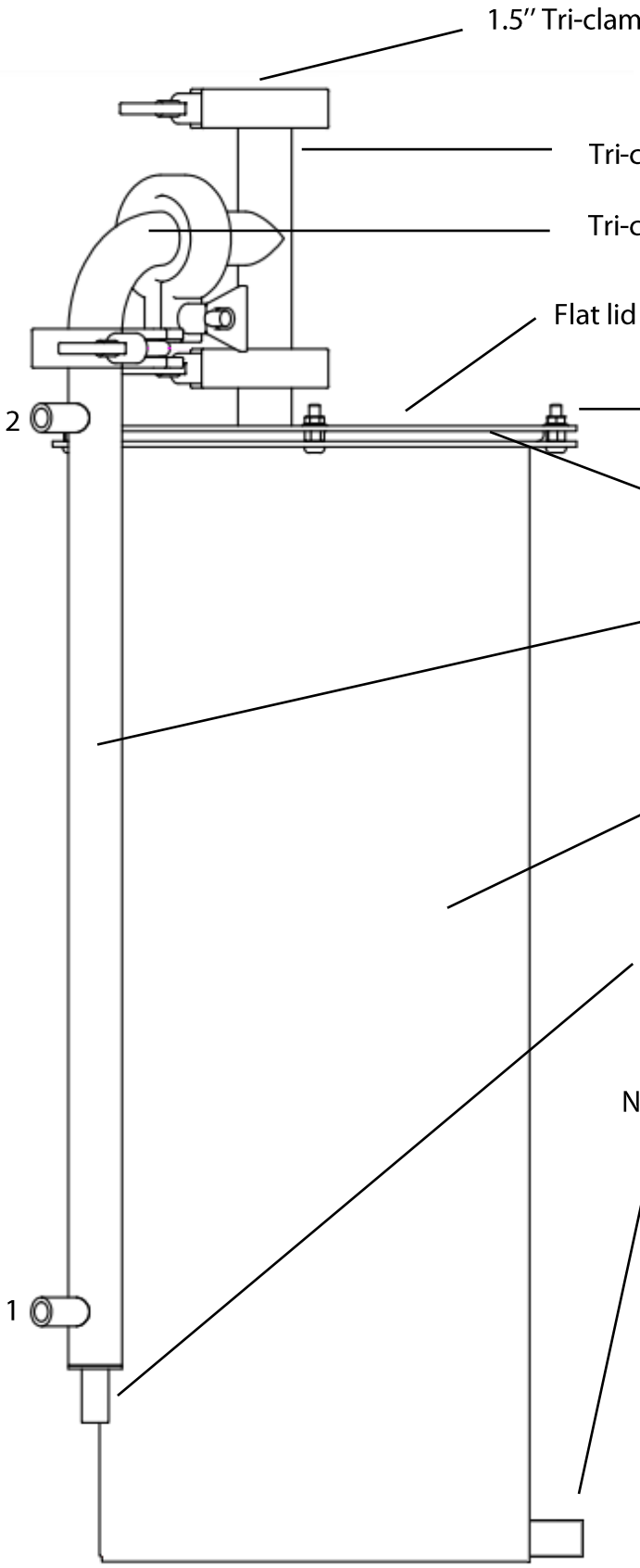
The whole unit is built in 304 stainless steel. It has been carefully cleaned and passivated to improve corrosion resistance. However, a few precautions must be taken to maintain its original appearance: do not use strong bases or acids, sodium hypochlorite (bleach) and/or steel wool to clean it. Dish soap or isopropanol and a microfiber cloth are fine. Avoid contact with salt and non-stainless steel. Wash it and dry it right after each use, and do not place it over direct heat without water inside; this could result in permanent deformation of the bottom of the unit.

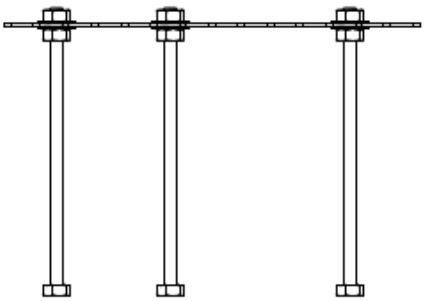
All parts of the unit, including the gaskets and O-ring, can be replaced individually, but should last for years if properly used. Contact us if you need any replacement parts.

Technical information

- Full construction in 304 stainless steel, TIG welded under inert atmosphere
- The tank is passivated and the whole unit is cleaned before shipping
- O-ring material: EPDM; tri-clamp gaskets material: PTFE
- Empty weight: approx. 11 kg
- Total volume of the tank: approx. 16.5 L
- Volume above the grid as delivered (for steam distillation): approx. 12 L
- Tank dimensions: approx. 8'' / 20 cm diameter, 21'' / 53 cm height
- Still height (tank + lid + column/condenser): approx. 27'' / 69 cm
- Tube-in-tube straight condenser (one 1/2'' inner tube), 20'' / 50 cm long
- Capacity: approx. 2–4 kg or up to 12 L of plant material per batch (steam distillation)

Nano overview





Grid on 6'' / 15 cm screws

The screws can be changed to 5'' / 12.5 cm

Unpacking and installation

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

- A large O-ring (already installed between the flange and the lid)
- A straight condenser with two 90° elbows, 3/8'' barbed fittings, and hose clamps
- A tri-clamp "T", a tri-clamp 90° elbow, clamps, and PTFE gaskets
- A 1.5'' cap, clamp, and PTFE gasket
- A stainless grid with two screw lengths: 5'' / 12.5 cm and 6'' / 15 cm
- A stainless wire with a piece of microfiber fabric to clean the condenser
- A 3/8'' drain valve and an 8'' / 20 cm tube with a 3/8'' NPT elbow
- A condenser spiral
- A replacement lid screw, nut, and thumb nut

Once everything is unpacked, you need to attach the tri-clamp "T" to the lid fitting, the tri-clamp elbow to the "T", and the condenser to the elbow. Install the 5'' or 6'' long screws on the grid, depending on the required height, and place the grid in the tank with the screws facing downward. Connect a 3/8'' water hose to the barbed inlet (1) and outlet (2) fittings of the condenser. Then install the drain valve (for hydrodistillation) or the 8'' / 20 cm tube with an elbow (for steam distillation) onto the 3/8'' NPT fitting at the bottom of the still (see the overview on the previous page). Your still is now ready to use.

How to use your still

⚠ In all cases, before starting any distillation, find a stable, level, and ventilated place. Stay protected from the wind if working outdoors. Keep away from flammable and hazardous products or materials when 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 *Nano*, install the 8'' / 20 cm tube with the elbow into the 3/8'' NPT fitting at the bottom of the still using Teflon tape. Screw it in tightly so that the tube points upward (once installed, **do not use it as a handle**). This tube acts as simultaneously a safety feature and an indicator that the water level is too low (more details below). Pour 3 to 3.5 litres of clean water into the still (no more than that), ensuring the water level remains at least 5 cm below the grid. It is important to measure how much water you add so you know the maximum volume of water you can safely distill. You must also consider that some plant material may absorb part of this water during the distillation.
- When the right amount of water is in the still, place the grid with the screws downward so that it stands above the water level.
- Pack the plant material evenly into the still and compress it by hand as uniformly 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 installed, put the O-ring on the flange between the tank edge and the lid screws. Make sure there is nothing (e.g. plant fragments) above or below the O-ring. Place the lid on top of the still (screws in the holes) and screw each thumb nut manually. Do not overtighten them—this is neither necessary nor recommended.
- Connect the condenser inlet hose to a water supply, slightly open your water regulation valve, and start the propane burner. Be careful not to burn the water hose with the flame. If the propane burner

is correctly sized and adjusted, distillation should begin within 15–20 minutes. Once it starts, make sure the water flow through the condenser is adequate during the first 30 minutes.
- During distillation, the condenser can be angled slightly, but it must always be oriented downward—in other words, the distillate outlet must always be lower than the lid.
- About the distillation flow rate, this unit should operate between 0.5 and 1 L/hour. You can calculate it by measuring the volume of distillate or hydrolate you collect in one minute, then multiplying 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 through the condenser should be regulated to ensure proper condensation without wasting water. A low flow results in a relatively warm distillate, while a high flow leads to a cooler one. A stainless spiral is installed inside the condenser. You can remove it if you prefer a warmer distillate, but for a colder distillate, we recommend leaving it inside. With the spiral in place, the distillate takes longer to exit the condenser, allowing more time for cooling after condensation. In all cases, make sure there is enough water in the condenser to condense all the steam—no steam should escape from the outlet. Avoid using excessive flow to prevent unnecessary water waste. Fine adjustment of the distillate temperature can be difficult if the water pressure or the heat source is unstable. If that's the case, open the water regulation valve slightly more than necessary to prevent the distillate temperature from rising too much when the water pressure (and flow) drops. Alternatively, you can use a 50 L water drum and a pump to recirculate water between the condenser and the drum. This will keep the distillate temperature relatively constant, rising slowly over time—which is not a bad thing.

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.

- For water distillation, you must install the 3/8'' valve onto the 3/8'' NPT fitting at the bottom of the still. You may need to remove the 8'' / 20 cm tube with the elbow if it is already installed. As before, use Teflon tape when installing the valve, screw it in properly, and position the blue handle facing upward.
- In water distillation, you do not need to use the grid as in steam distillation, but in some cases, it may be useful to leave it in place—either flipped upside down or simply resting on the connecting nuts (the long nuts attached to the grid) with the screws removed. This low grid prevents direct contact between the plant material and the bottom of the still.
- Add both water and plant material to the still (the plant-to-water ratio depends on the species, but the plant material should always be able to move freely during a water distillation), then boil the mixture using the same setup as previously described.
- Do not add more than 12 L of plant material and water combined.
- In water distillation, the warm-up phase is longer than in steam distillation, but once it starts, it can be carried out in a similar way.

Important notes

It is very important not to heat the still with a propane burner or electric hot plate when there is no water inside. Heating an empty still may cause permanent deformation of the bottom. We therefore strongly recommend measuring and noting the volume of water added at the beginning of the distillation (3 to 3.5 L for steam distillation), to avoid running it dry. Keep in mind that plant material may absorb part of the water during distillation.

For steam distillation, the 8'' / 20 cm tube with the elbow should be attached to the fitting at the bottom of the still. As soon as you hear noise coming from this tube or see steam escaping from it, it means the water level is critically low and water must be added immediately. In this case, pour 2.5 to 3 L of water through the tube using a funnel. This tube acts both as a safety outlet and as a water level indicator during steam distillation.

In water distillation, the risk of running dry is lower, but if you plan a long run, take note of the initial water volume. During water distillation, the drain valve should be installed instead of the 8'' / 20 cm tube, so you cannot add water through the tube. If needed, water can be added through the 1.5'' cap located above the tri-clamp "T" on the lid. To do so, carefully remove the cap, pour in the water, and quickly replace the cap on the "T".

For safety reasons, we also recommend not clamping the 1.5'' cap to the tri-clamp "T". The PTFE gasket and the weight of the cap alone are usually sufficient to prevent steam from escaping (as long as the condenser is receiving enough cooling water to fully condense the steam). If the condenser were to become clogged (which is very unlikely), this would function as a safety valve.

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