ALChemia Solutions

Nano user guide

and technical document

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

The *Nano* is the smallest Alchemia still/extractor. This unit is completely built in 304/316 stainless-steel. It is easy-to-carry, simple, sturdy, it has been developed through our care and it is completely built in Canada (QC). This unit has been designed for small scale distillation of hydrolats and small volume of essential oils as well as for plant extraction. It can be used for auto-production, education and research.

And before going into technical details, a few personal words:

There are plenty of botanical treasures all around the world and in everyone is living environment. Aromatic plants, medicinal plants, toxic plants, plants we fell connected with, plants we do not... A vast and fascinating world that provides healing substances… and dangerous ones. So, learn as far as you can from reliable sources about the plants around you. Be careful of misidentifications. Grow and/or harvest them with respect and consciousness. Always let enough for others (humans and animals), for next years and for next generations, enjoy the magic of distillation and plant extraction, develop your skills, learn how to use your own essential oil and plant extracts safely and efficiently and if you have any question regarding distillation/extraction and the Explorer, please contact us. We are here to support you in your projects and your quest leading you out in 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 *Nano* and describes how to use it safely and efficiently. It also contains in *italic grey font* some general information about distillation that should help you to 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 for crafting.

Safety and heating sources

The *Nano* is primarily designed to be used with a small gas burner, typically a kitchen gas cooktop burner. It is a very efficient and stable heating source, so we recommend it for distillation (not for reflux extraction with flammable solvents). Please note that the burner should not be larger than 6''/15cm (the still being 8''/20cm diameter) and the distillation flow should not be higher than 1 L per hour.

The *Nano* can also be used with an electric hot plate if it is enough stable and powerful. It cannot be directly used with an induction system, but it can be used with a vitroceramic hob (it works better if the vitroceramic hob delivers a constant heating and if the bottom of the still is black coated - which we can do for you before the shipping). It can also be used with a classic hot plate, but it is not always enough powerful to give a good distillation flow (0.7-0.8 L/h).

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

In all cases be sure that the burner or the electric hot plate you use is stable and levelled, and that it can stand the weight of the apparatus (approx. 11 kg empty) with plant and water inside (up to 15 additional kg for 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 to hot surfaces and use suitable gloves during and after operation. Be sure the condenser gets much more that enough cold water when condensing flammable solvent (distillation or reflux mode) and never use direct fire to heat the unit when using/distilling flammable solvents (ethanol or other). If you use a propane burner, be sure you have a good combustion (blue flame), and if you use it outdoor, protect the unit and burner from the wind. In all cases stay far from any flammable substances (solvent, gas, wood, tissue…).

In the following text you will see some warning pictograms (see in the margins). They indicate some safety reminders or additional explanation in the text.

Precautions and maintenance

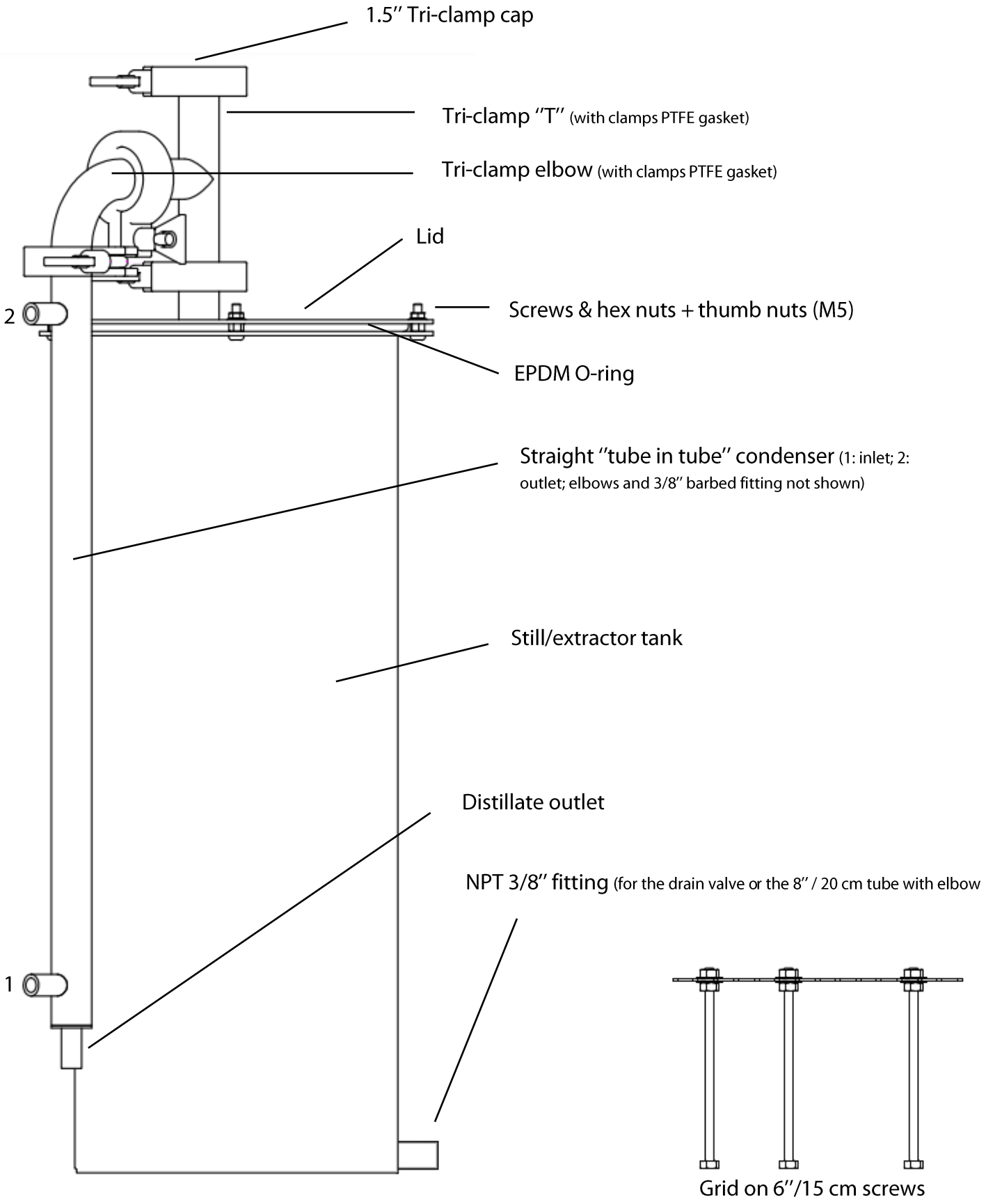
The whole unit is built in 304 and 316 stainless-steel. It has been carefully cleaned and passivated to improve the corrosion resistance. However, a few precautions must be taken to keep an aspect close to the initial one: do not use strong bases or acids, sodium hypochlorite (bleach) and/or steel wool to clean it! Dish soap or isopropanol and microfiber cloth are fine. Avoid contact with salt and non-stainless steel. Wash it and dry it right after each use and do not put it on direct fire without any water in, it could result in a permanent deformation of the unit bottom.

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

Technical information

- Full construction in 304 or 316 stainless-steel (316 for the tank bottom, tri-clamp pieces and the condenser tube), TIG welded under inert atmosphere (purged tank and tubes)
- The tank is passivated and the whole unit is cleaned before shipping
- O-ring material: Buna-N; tri-clamp gaskets material: PTFE
- Empty weight: approx. 11 kg
- Total volume of the tank: approx. 16.5 L
- Volume above the grid (for steam distillation): 11- 12 L
- Tank dimensions: approx. 8'' / 15 cm diameter, 21'' / 53 cm height
- Still height (tank + lid + column/condenser): approx. 27'' / 70 cm
- Up to 2-4 kg / 11-12 L of plant per batch

Nano overview



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 and 3/8'' barbed fittings + clamps
- A tri-clamp ''T'' and a tri-clamp 90° elbow
- A 1.5'' cap and four clamps + PTFE gaskets
- A grid mounted on three 6'' / 15 cm screws (the plant stand)
- A stainless wire with a piece of microfiber fabric to clean the condenser
- A drain valve and a 8'' / 20 cm tube with an elbow
- A condenser spiral
- A replacement lid screw, nut and thumb nut

Once everything is unpacked, you will have to attach the tri-clamp ''T'' to the lid fitting, the tri-clamp elbow to the ''T'' and the condenser to the elbow (please refer to the Nano overview on the previous page). Then turn the grid upside down and connect a 3/8'' hose to the inlet (1) and outlet (2) barbed fittings of the condenser. The still is ready to be used.

How to use your still

In all cases, before starting any distillation or extraction, find a stable, levelled ventilated place. Stay protected from the wind if you work outside. Stay far from flammable or hazardous products/material if you use a gas burner and far from ignition source for extraction with flammable solvents.

Steam distillation

Steam distillation is not the oldest technique that has been used to distill aromatic plants, but it is the main technique used nowadays as it generally gives better EO yields and quality than water distillation. In steam distillation, the plant material is not immersed in water. It is loaded as is in the still and stands on a grid above the bottom of the still. No water is added when the steam comes from an external boiler. When the steam is generated inside the still, the grid is higher, and some water is brought to boil at the bottom of the still. This latter technique is sometimes called ''water and steam''. In any cases, the steam that rises through the plant volatilizes and drives its volatile compounds out of the tank to the condenser and separator (if using one).

We recommend using this technique (steam or ''water and steam'' distillation) as soon as you can as it generally gives good results (EO yield and quality), it is faster and requires less energy than water

distillation. However, resins, wood/bark sawdust, some crushed seeds or roots and some very fragile flowers cannot easily be distilled by steam distillation because steam cannot go through the plant material homogeneously (they melt or swell and get compact then steam escapes by some channels and the plant material is inefficiently or poorly distilled). In these cases, consider the water distillation (described below).

- Before starting a steam distillation with the *Nano*, install the 8'' / 20 cm tube with the elbow on the 3/8'' NPT fitting at the bottom of the still with some Teflon. Screw it correctly so that it is upward (once installed, **do not use it as a handle**). This tube is a safety and an indicator of a too low level of water (more details below). Put 3 to 3.5 litres of clean water into the still (not much). The level of the water should be around 5 cm below the grid. It is important to measure the amount of water you put in the still to know the maximum volume of water you can distill. You also must consider that some plant material may absorb some of this water during the distillation.
- When the right amount of water is in the still, place the grid with the screws down so that the grid stands above the water level.
- Pack the plant as homogeneously as possible into the still (very important point) and compact it by hand (again, as homogeneously as possible).

The compaction is one of the most important parameters the distiller must play with. The most important point is to get a homogeneous compaction so that the steam rises homogeneously through the plant. If the compaction is not homogeneous, the steam will escape using the easiest way and some of the plant material may be poorly distilled resulting in a low yield or a longer distillation. The optimal compaction depends on the plant material, but a good strength can generally be applied on plants with a good "structure" (conifer needles for instance) if they are not turned into a fine powder. On the other side, plants with much less structure (soft leaves or flowers) or finely crushed plant material should not be compacted with too much strength as they already tend to pack during the distillation and may clog more easily.

- If not installed, put the O-ring on the flange between the tank edge and the lid screws. Be sure you have nothing (no plant fragment) below or above the O-ring, put the lid on the top of the still (screws in the holes) and screw each thumb nuts manually (do no overtighten them, this is not necessary nor recommended).
- Connect the condenser inlet hose to a water supply, open a bit the water regulation valve (not included) and start the propane burner (be careful to not burn the water hose with the burner). If the propane burner is well sized and set, the distillation should start within 15-20 minutes. When it does, be sure the water flow in the condenser is correct during the firsts 30 minutes.
- Regarding the distillation speed/flow, this unit should work between 0.5 and 1 L/hour. You can calculate it by measuring the volume of distillate or hydrolat (if you use a Florentine flask) you get in one minute and multiply the result by 60.

As for the compaction, the optimal steam flow depends on the plant you distill, if it is crushed or not, the amount and nature of volatile compounds it contains, where they are in the plant, (etc.) and whether you primarily distill for essential oil or hydrolat. The best is to do your own tests, compare 2 or 3 different steam flows for a plant (the other parameters remaining unchanged) and see if a given steam flow gives better results. It should however be noted that using twice a given steam flow requires more than twice the amount of energy per unit of time does not give the same amount of oil two times faster. In some conditions, a too high flow (with no cohobation) may also reduce the EO yield as continuous separation could more difficult. On the other hand, with a too low steam flow, you will have to distill longer to get the same amount of oil and the plant will stay longer at 100°C which may result in more chemical degradation. So, the optimal steam flow is a compromise depending on the plant, your still and your purpose.

- The flow of the water running through the condenser must be regulated before the inlet hose. A low flow gives a relatively high temperature for the distillate and a high flow gives a cooler temperature for the distillate. In the condenser you have a stainless spiral. You can remove it if you want a warm distillate but if you want a cold distillate, we recommend letting it in the condenser. With the spiral, the distillate takes more time to get out of the condenser thus it has more time to cool down after the condensation phase. In any cases, always use enough water in the condenser to condense all the steam (no steam should escape from the condenser outlet during a distillation) and do not use a too high flow to not waste water. It may be hard to finely adjust the temperature of the distillate if the water pressure and the heating source are not perfectly stable. If it is the case, open the water regulation valve a bit more than necessary to avoid the distillate temperature to rise too much when the pressure (thus flow) of the water decreases. You can also use a 50 L water drum and a pump to recirculate the water between the condenser and the drum, you will have a constant distillate temperature that slowly rises during the distillation (which is not a bad thing).

For some EO that hardly separate from the hydrolat because of their too close densities (myrrh and vetiver for instance), the temperature of the distillate is a very important parameter. When temperature rises, the density of EO generally changes faster than those of water and the density difference generally increase, the water viscosity decreases and the coalescence of EO droplet is facilitated. Thus, it is generally recommended to distill the EO that hardly separate at higher temperature (as a reminder, here we talk about the distillate temperature, not the temperature inside the tank). On the other hand, when temperature rises, both evaporation and solubility of organic compounds in water rise too so as always, this is a question of compromise and the better way to know the ideal distillate temperature for a given EO distillation is to test and compare.

Water distillation

Water distillation consists in placing the plant material in the water and boil the mixture. This technique is not recommended for all plants (see why in the previous sections), but it is the only one that can be used for resins, wood/bark sawdust, some crushed seeds or roots and some very fragile flowers.

- For water distillation, you must install the 3/8'' valve on the 3/8'' NPT fitting at the bottom of the still. You may have to remove the 8'' / 20 cm tube with the elbow if it is installed. As previously, use some Teflon to install the valve, screw it correctly and put the blue handle upward.
- In water distillation, you do not need to use the grid as in steam distillation (the plant stand) but in some circumstances, it can be good to let it and put it up-side-down or just removing the screws so that it just stands on the connecting nuts (the long nuts attached to the grid) before adding the plants and water. This low grid will avoid the contact between the plant material and the bottom of the still.
- Put the water and the plant (the ratio plant/water depends on the plant, but the plant should always be able to move freely during a water distillation) in the still and boil the mixture with the same setup as described previously.
- Do not put more than 12 L of plant + water into the still
- In water distillation, the warm-up phase is longer than in steam distillation but when it starts, it can be run similarly to a steam distillation.

Important notes

It is very important to not heat the still with a propane burner or electric hot plate with no water inside. Heating an empty still may result in a permanent deformation of the still bottom. Thus, we highly recommend measuring and note the volume of the water you put in the still (3 to 3.5 L at the beginning of a steam distillation) to not run it dry. You also must consider that the plant material may absorb a part of the water during the distillation.

If you perform a steam distillation, you should have the 8'' / 20 cm tube with elbow attached to the fitting at the bottom of the still. **As soon as you hear some noise from this tube and or see some steam escaping from it, it means the water level it critically low and that water must be added immediately**. In this case you can add 2.5 to 3 L by this tube using a funnel. You can see this tube as a safety outlet and water level indicator for steam distillation

For water distillation you have much less chance to run dry but if you plan a very long distillation, note the volume of water you initially add in the still. In water distillation, you should have the drain valve installed instead of the 8'' / 20 cm tube, thus you cannot add water by this tube, but you can add water by the 1.5'' cap above the tri-clamp ''T''. If you want to add water, remove the cap with cautious, poor the water in the tank and quickly put the cap on the ''T''.

For safety, we also recommend to not attach the 1.5'' cap on the tri-clamp ''T''. Just the PTFE gasket and the weight of the cap is enough to avoid the steam to escape from the top of the ''T'' (if the condenser gets enough water to condensate all the steam). If for any reason the condenser was getting clogged (which is very unlikely), this would act as a safety valve.

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