

DIRECTIONS FOR USING 2L STEAM DISTILLATION APPARATUS, NC-13223

WARNING: For use by adults with knowledge of general laboratory safety procedures.
Always wear proper eye and hand protection when handling glass labware and heat!

SAFETY FIRST

This apparatus uses a hot plate to boil water and generate steam. Use caution when handling to prevent burns! Protect eyes and skin from hot gasses and broken or chipped glassware.

Be sure all components are properly set up (Refer to Figure 1). This apparatus is an open system so steam pressure is relieved at the drip end of the condenser. Material may crystallize in the condenser, which, over time, could block steam causing a dangerous build up of pressure and possible explosion. When finished with distillation, allow system to cool, then drain the condenser of cooling water. Always work with clean glassware.

Use caution when handling glassware, especially when cleaning. Pad your sink with a towel or rubber mat to help prevent accidental breakage. Use a wooden dowel to help remove spent plant material from Biomass Flask.

Ground glass joints can sometimes become stuck together. Use silicone vacuum grease to prevent "frozen" joints.

KIT CONTAINS (Refer to Figure 1)

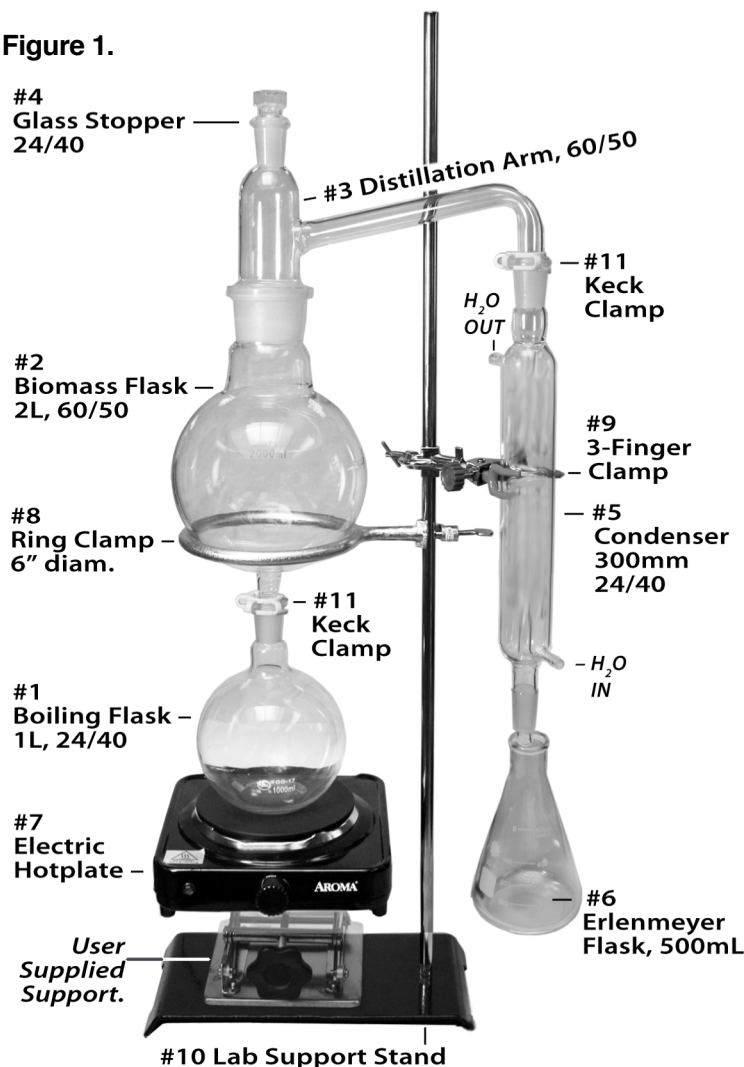
Borosilicate (Heat Tempered) Glassware:

1. Boiling Flask, 1L – 24/40 ground glass joint.
2. Biomass Flask, 2L – 24/40 joint on bottom and large 60/50 joint on top.
3. Distillation Arm – 60/50 joint with 24/40 joint to attach Condenser and 24/40 top joint for stopper.
4. Glass Stopper – for Distillation Arm.
5. Condenser, 300mm – 24/40 ground glass joint.
6. Erlenmeyer Flask, 500mL – for receiving.

Hardware:

7. Electric Hotplate, 1000W.
8. Ring Clamp, 6" – to hold Biomass Flask.
9. 3-Finger Clamp – double adjustable with bosshead.
10. Lab Support Stand – with 3 ft. rod and 6x11 base.
11. Keck Clamps (2) – 24/40, to hold together Condenser with Distillation Arm and Biomass Flask with Boiling Flask.
12. 5 ft. Amber Latex Tubing (2) – for condenser water.

Figure 1.



Also included but not shown...
#12 Amber Latex Tubing (2), 5 ft.

ASSEMBLY

Assemble the Lab Support Stand by attaching the support rod to the metal base. Then attach the 6" Ring Clamp to the support rod. You may have to slide the clamp over the top of the rod. Refer to the photo for proper placement of clamps and glassware. Do not force glassware to fit. Adjust angle and height of clamps until glass joints seat properly. (Cont. next page)

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ASSEMBLY Cont.

Fill Biomass Flask with plant material. Cut plants into one inch or smaller pieces. If material falls out of Biomass Flask, use a wire or nylon mesh screen (not provided) as a porous stopper in the bottom opening of the flask. Position the Biomass Flask on the ring clamp as shown. Fill Boiling Flask about 1/2 full of clean water. You may wish to use distilled water to produce extra pure steam. Exact amounts of water and plant matter and length of time of distillation will vary depending on the type of plant used. Research and experience will help you refine these variables.

After all glassware is in place, attach Keck Clips to the 24/40 size joints. Clip one between the Biomass Flask and Boiling Flask, the other between the Distillation Arm and top of Condenser.

Raise Hotplate with user-supplied supports or optional Laboratory Extension Jack until it meets bottom of Boiling Flask. Finally, attach one length of rubber hose to the **bottom** of the condenser. This is the water supply **inlet**. Attach the other hose to the top of the Condenser. This is the water outlet port. Cooling water can be supplied from a nearby sink (requires a user-supplied faucet adapter) or a water bucket with submersible pump (also user-supplied).

With everything in place, plug Hotplate in and turn to HIGH. Be sure cooling water for the condenser is turned on and running properly. A typical distillation run may take several hours or more. Never let boiling water flask run dry. Do not leave a running system unattended for long.

EXPLANATION

Steam distillation is a method of separating and purifying organic compounds. The organic compound must be insoluble or slightly soluble in water. Plants naturally produce essential oils, which, upon extraction by distillation, can be collected and concentrated for use in aromatherapy for numerous therapeutic benefits. All plants contain different mixtures of essential oils in various degrees of concentration. Proper research into your specific plant of interest will give information about potential essential oil yields, duration of distillation required (typically several hours), optimal harvesting conditions of the plant material, and other useful specifics.

Because oil and water separate when mixed (like oil and vinegar salad dressing), the essential oils extracted by

steam distillation will form a distinct layer in the collection flask. The less dense oil will float in a layer above the water. It can be drawn off the underlying water layer using a pipet or dropper. To aid separation, drop the oil collected by the pipet into a tall, thin vessel such as a test tube. This will accentuate the oil and water layers, making it easier to further separate the oil out of the water mixture.

The water layer that is collected from the distillation is called hydrosol and may contain beneficial components, depending on the plants used in the distillation. Any unwanted hydrosol may be discarded or it can be recycled and used in the boiling water for a new round of essential oil distillation.

OPERATION NOTES

Often times, while a distillation is in progress, steam may condense inside the biomass flask and the distillation arm before it makes it's way into the condenser. This is simply a property of a distillation system that contains a large surface area of glass. Hot steam tends to condense back into water as soon as it can. To minimize the amount of steam that condenses too soon and thus drips back into the boiling flask, insulation like cloth or foam may be wrapped around the biomass flask and distillation arm. Additionally, make sure that the plant material in the biomass flask is not packed too tightly. In any case, some steam will inevitably condense and drip back into the boiling flask during operation. It is typical for some of the boiling water to remain (or drip back down) in the boiling flask for the duration of the distillation. This water may also take on a yellow to brown color as water soluble components of the material are released from the plant during distillation.

Essential oils are often much less dense than water or steam and are commonly among the first components to make their way through a distillation to be collected off the end. Monitoring the progress of the distillation is a skill that requires practice, patience, and research into the specifics of the plant material being used. Many people prefer to end their distillation when the hydrosol water dripping from the end of the condenser loses the pleasant aromas prominent at the beginning stages of the process. Again, it is not unusual that some water will remain in the boiling flask when it is time to end a successful distillation. Best of luck and happy distillations!

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