Falling Film Evaporator - FFE Series Ethanol Evaporation System

The innovative FFE Series falling film evaporator is ideal for botanical oil separation and ethanol alcohol recovery from your extracted biomass tincture. The system maintains a high evaporation rate, which significantly increases the throughput of crude oil production, eliminating the need for multiple large rotary evaporator systems.

Specifications	
Evaporator&PumpCart	15’Lx7’Dx9’H
Dimensions Evaporator	41”L x 32”W x 99”H104cm L x 81cm W x 249cm H
Dimension Pump cart	52”Lx32”W x74”H132cm L x 81cm W x 188cm H
Weight Evaporator	Approx.400lbs
Weight Cart	Approx.600lbs

Included Ancillary Equipment

Recirculating Electric Heater

- Heating power:

1. (Option 1)36 kW /97 amps@240V three-phase
2. (Option 2)36 kW /48 amps@460V three-phase (Requires Professional Installation)

- Transfer Fluid Flow: 25GPM (25PSI)
- Max temp: 250°F (120°C)
- Transfer Fluid Line Connections: 1.5” FNPT
- Dimensions: 33”L x 17”W x 52”H
- Approx. 255 lbs

Recirculating Water Chiller

1. (Option1) 70amps @230V, three-phase
2. *(Option2) 31amps @460V, three-phase (Requires professional installation)

- Cooling Power: 14 ton
- Evaporating Temperature: 122°F - 180°F
- Coolant Line Connections:1.5”FNPT
- Dimensions: 84”L x 48”W x 62”H
- Shipping Weight: 1850lbs
- Professional Install sheets from Manufacture

Pump Chiller

- 5.7kW /25amps @230V, single-phase
- Cooling Power: 1.5 ton
- Coolant Flow: 3.5 GPM
- *Ambient Temperature: -10°F - 35°F (Low or High)
- Dimensions: 30.5”L x 19”W x 26”H
- Weight: 340lbs

*(Please Specify Power Preference)

*(Specify Low or High Ambient Condition Options)

Throughput

With its unique design, the FFE-Series Falling Film Evaporator greatly increases the throughput of botanical oil production boasting an impressive 60 gallons per hour of alcohol recovery.

Residence

Less contact with high heat alongside speed of processing makes the FFE-Series an essential part of the processing line. Short residence time is ideal for heat sensitive botanical compounds and decreases the risk of burning oil.

Falling Flim Evaporation with the FFE

The **Falling Film Evaporator (FFE)** has its own take on the technology, incorporating improved features that keep the operator in mind. As a large portion of the tincture processed using a falling film evaporator is coming from a **cold ethanol extraction**, the design takes advantage of the cooling power that is already a sunken cost in the form of the electricity used to generate it. This power is harnessed as the vaporous ethanol is condensed on a heat exchanger channel that shares a surface with the inlet through which cold tincture flows as it is prepped for evaporation. This small touch of engineering relieves stress from the Falling Film's chiller that is working independently to cool that heat exchanger.

Among the other benefits the FFE unit is the ability to run a clean-in-place procedure. This means that the inlet and outlet of the evaporator can be linked to a clean ethanol supply and allowed to recirculate virgin tincture to concentrate the waste and clean the inner surfaces of the evaporator. Maintenance of this level ensures the longevity of this premium platform and makes for consistent end-product.

In keeping with the scaling nature of a biomass lab, the base 45 gallon per hour model of the falling film can be easily upgraded to the 60 gph version by simply upgrading the chiller to a larger size.

Lastly, with regard to the high viscosity of flower oil, and the tendency to lose yield along the surfaces of the vessels used to transfer the products. As the crude oil is concentrated by the falling film, a dilution of 5%-12% ethanol is left in the mixture to give the concentrate a workable texture. This makes it very easy to transfer the concentrate to a decarboxylation vessel where any moisture and residual solvent will be evaporated off ahead of the removal of the acidic groups found on the cannabinoids.

All in all, with few movable parts to break, and the ability to make it a close loop machine, the Falling Film Evaporator should be a welcome upgrade to any lab wanting to move closer to full automation and avoid a cumbersome maintenance schedule.

Learn More About Evaporation and the FFE

The origin of the first alcohol produced still is a matter of debate. Whether the first apparatus considered a still was the **tribikos** of Ancient Greece (a kind of alembic with three arms that was used to obtain substances purified by distillation), or Abu Musa Jabir ibn Hayyan's alembic, they sought the same end-product.

Alcohol refinement that started as a niche branch of alchemy would readily become commonplace across almost all cultures. The process used is relatively simple in nature and involves the heating of a mixture containing Ethanol (EtOH) to the point that it vaporizes and then condensing it on a cooler section of an apparatus for the purpose of purifying it. This purified alcohol could be used for a myriad of purposes, namely botanical extraction or in our case, flower or hemp extraction.

Within the industry, a step common to all solvent extractions on their way to a fully refined distillate is one in which the crude oil is **dissolved** in ethanol. Whether this tincture be the direct result of an extraction or the product of a **winterization methodology**, the task of removing the solvent and re-concentrating the crude oil is ubiquitous.

Ethanol is liquid at room temperature and boils at a temperature of 78°C. The **dipole moment** exhibited by the stereochemistry of Ethanol also makes it relatively difficult to squeeze out of a tincture unless considerable heat and agitation are used. Unless, that is, the pressure within the system is decreased enough so that the boiling point of ethanol is lowered to the point that it was more readily evaporated.

A tool synonymous with the biomass lab space is the **rotary evaporator**, and it was designed as a rudimentary evaporating solution that took advantage of these concepts to efficiently distill off solvents.

In operation, the tincture is heated and agitated along the inner surface area of a glass vessel at it rotates on an angled axis at vacuum. This vessel sits in a heat-controlled water bath that is dialled in to the temperature at which the target compound boils at a specified pressure. Along the vapor path is placed a hollow condensing coil through which chilling fluid is run at a subfreezing temperature that liquefies the solvent as it is pulled toward the vapor path to the pump.

At the base of this condenser is a collection flask that can be isolated and emptied periodically to obtain the reclaimed solvent. This technology proved effective while it was used to reclaim solvent from smaller batches of tincture. However, the extraction technology quickly caught up to the limitations of this system as the volume of tincture capable of being extracted at once rose dramatically. Between emptying each vessel after each batch as well as the cleaning of the glassware for the purposes of compliance, rotary evaporation falls short of what is needed in a production setting.

It was only a matter of time before industrial **falling film evaporators** started showing up in the labs of processors who were "in the know". This is arrangement is a semi-continuous, very rugged, and reliable solvent recovery platform. In its operation, the tincture is syphoned into a closed system at low pressure. A flowmeter regulates the rate at which the tincture is shotgun fed onto a heated evaporator column down which it flows in a laminar fashion. This thin film distribution of the tincture allows for very efficient exposure of the solvent to the heat from the column. Gravity pulls the concentrated oil down the column and into a collection column below.

As the solvent and some residual crude oil are turned to vapor, they travel along the vapor path to another shorter column and must travel against gravity toward the heat exchangers.

Any residual moisture or crude oil that managed to make it through to the secondary column is separated there due to their having greater molecular weights than Ethanol. The distilled Ethanol is then re-condensed along the heat exchanges before being delivered back as reproofed solvent.

It remains to be noted that when a throughput capacity calls for this volume of solvent to be on a manufacturing floor at one time, safety in the lab must be called into question.

Falling film evaporators are capable of processing upwards of **60 gallons per hour** of tincture, requiring quantities of solvent on hand that any fire marshal would want to have a word about. As such, a facility must be equipped to allow for safe operation of the machinery in compliance with Class 1 Division 2 certification as per NEC article 500 through 503/CEC section 18.

This is simply a classification system indicating a hazardous work environment as Ethanol vapor is flammable and long-term exposure can be neurotoxic. There is no end to the safety measures that can be taken, but there are some that key features that will make happy your governing agencies and operators alike.

Most notably, explosion proof fittings must be adopted throughout the workspace in which solvent above a certain quantity will be present. Sniffers to detect the levels of ethanol in the air, and fire suppression are also givens in a compliant facility. With all the proper precautions having been taken, a safe, high throughput is an achievable feat.