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## THE SIMPLIFIED GUIDE TO FRACTIONAL DISTILLATION

A Complete Look at the Processes and Requirements for Fractional Distillation

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# Table Of Contents

Introduction	<b>01</b>
What Is Fractional Distillation	<b>02</b>
The Science Behind It	<b>03</b>
The Heating Process	<b>04</b>
Final Stages of the Process	<b>05</b>
Final Product	<b>06</b>
Why is Fractional Distillation Useful	<b>07</b>
Benefits of Fractional Distillation	<b>08</b>
Requirements for Fractional Distillation	<b>09-10</b>
Conclusion	<b>11</b>
Glossary	<b>12</b>

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# Intro to Fractional Distillation



## REMOVING AND IMPROVING

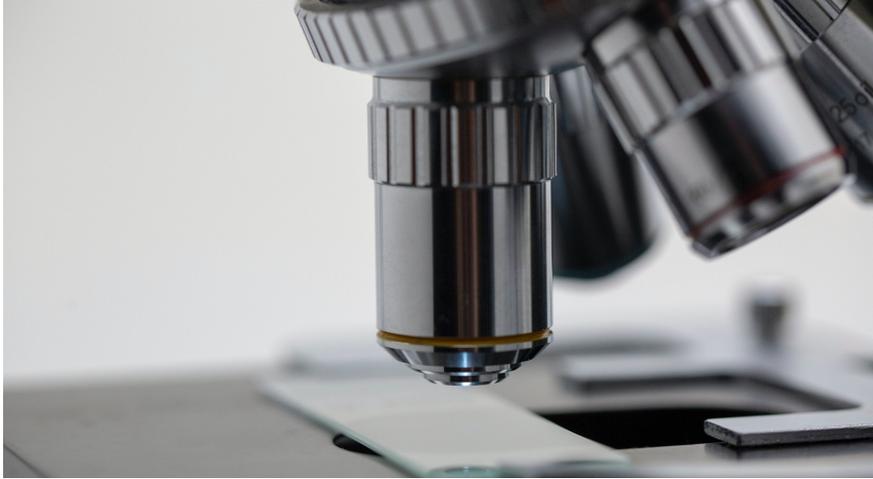
Removing the waste from your solvent – seems like a relatively easy process, right? When you've got tens of thousands of gallons of spent solvent, it can be a pretty tedious process.

Recycling solvent seems like a great idea because you are going green, you're saving the costs you would normally spend on brand new solvent, and you are able to save fees by doing the recycling on site. What possibly is there to lose?

In this Ebook, we will be going through what fractional distillation is, the benefits of fractional distillation over simple distillation, and what it can do for you!

WHAT

# What is Fractional Distillation



Fractional Distillation is a solvent recycling process for purifying as well as refining. It is a separation process that removes one component, usually a solvent, from a waste product.

To be put briefly – the chemicals are separated by heating them to a temperature where one of the components of the mixture will vaporize faster than the other. **The components will have different boiling points so that the separation process can take place.**

Fractional distillation creates a high purity product, with a process that requires less effort and turnaround time compared to running simple distillations repeatedly.

# The Science Behind It



With fractional distillation, you have several systems working together to run the process. The overall structure of the column includes the following:

- The feed system containing at least two components
- The column and heating system
- The distillate and production loop
- The still bottoms production loop

The first process is the feed system. As the mixture of chemicals gets pumped in, it gets filtered to make sure there are no solids or unwanted content going through the column. There is a continuous stream being pumped in and this goes through a heat exchanger that preheats the solvent mixtures.

# The Heating Process



Heat is supplied to the column through a constant external heat source, usually hot oil or pressurized steam. By connecting the heat source to one side of a heat exchanger, the fluid from the bottom of the column can be pumped through the other side to increase the temperature and boil the column contents.

The contents, now at their boiling point, are returned to the column and the vapors begin rising through column internals. As the vapor rises, a portion of it will cool and condense and the liquid will fall back to the reboiler. This liquid will mix with the rising vapor and improve separation efficiency.

This rising and falling of vapor and liquid will continue in a closed-loop inside the column until specified purities are reached.

# Final Stages of the Process



As the vapour rises to the top of the column it is pulled by vacuum to the condenser. Cooling water is constantly circulating through the condenser (working simultaneously with the feed system and heating loop) which then turns the vapour back into liquid form.

The liquid is then passed through a density meter as it flows to a collection tank called the reflux drum. This density meter alerts the system when the specified purity for the vapour product is reached and from here automated valves are controlled to discharge this liquid product from the reflux drum to the final product vessel, where the customer chooses what's next.

If the condensed product has not reached the specified purity, it is returned to the column as reflux, where it goes through the boiling and condensing process again.

# Final Product



Similar to the vapor product loop, there is a loop for the lower boiling point liquid that monitors the purity and controls discharge. This is called the bottoms product and usually consists of wastewater but is sometimes a value product. The bottoms flow through a density meter while going through the heating loop, and this is where the purity is measured.

The automated valves will change the flow patterns so that the wastewater can be pumped to an appropriate storage area for this liquid to be treated.

The fractional distillation process is composed of many systems working simultaneously for the products to be generated at the necessary purities. This differs significantly from simple distillation, which lacks the column mechanisms for increasing purity and the reflux of distillate for reprocessing.

WHY

# Why Is Fractional Distillation Useful

## What Challenges Make Fraction Distillation Necessary

Fractional distillation outperforms simple distillation when it comes to Isolation and recovery of multiple components in a single distillation. **Fractional distillation is highly effective and efficient for the separation of mixtures as it turns your energy into higher-purity alcohol.**

The waste streams, ratios, compounds, and concentrations it can handle are taken into account and can be customized.

Ethanol can contain water for a multitude of reasons. It could be atmospheric ingress (infiltration), meaning the water gets into the solvent due to where the solvent is being stored. Humid air is also a possibility depending on where you store the solvent.

When the air is too humid and the ethanol is exposed, the ethanol will absorb the water.

You also have extraction infiltration which is when your biomass is wet from incomplete drying, possibly too short a time frame, or there are different procedures. Some processes such as freeze-drying are not 100% moisture-free.

# Benefits of Fractional Distillation



Once you see that your ethanol solvent has too much water in it, the fractional distillation process with the F series equipment is the solution to remove the excess water because:

- The system can handle any waste streams
- It is custom designed and is able to be made to the exact requirements of the client, the precise ratios, compounds, and concentrations are taken into account to ensure the final product is the highest quality possible.
- It is more simple than simple distillation equipment because most are made to be as energy-efficient as possible.
- Environmentally friendly because it allows you to recycle used solvent instead of purchasing more
- Lowers your solvent costs as once the recycling process takes place, you can re-use your solvent that you've been able to recover.

# Requirements For Fractional Distillation

### What requirements are needed to run a Fractional Distillation Unit



When it comes to fractional distillation and managing a facility, there are a few things that we've discovered are required. It starts with the space.

To have a fractional distillation unit, similar to the F series, you will need between 1000-2000 square feet of space available. This not only has to do with the size of the machinery, but also the output.

There needs to be a container underneath the unit installed because should there be a rupture and the material spills out of the machine, it needs to be collected so it does not spill into the local environment harming the surrounding ecosystems.

The implementation will also require riggers and ironworkers to do the installation of the system. You will also need to have utilities such as electricity, cooling water, and a heating system on-site and ready for use.

# Requirements Continued



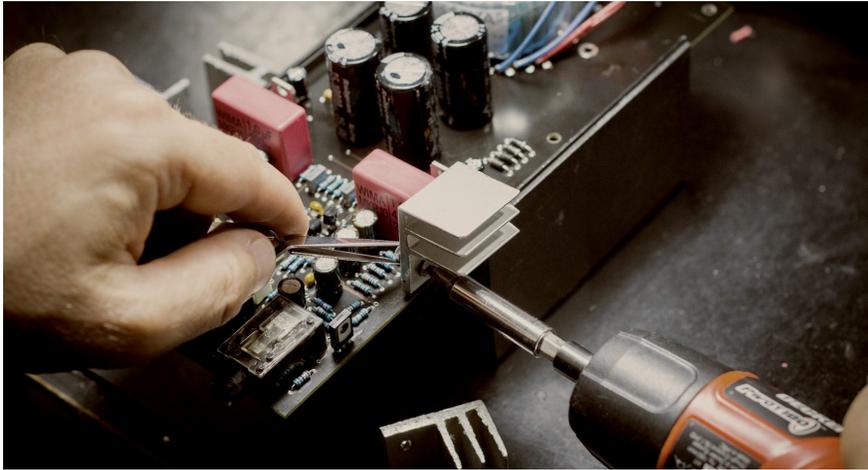
The bottoms discharge from the tower (wastewater) needs to be treated depending on the loading and solvents mixed in, it may require special treatment in addition to the standard wastewater treatment If there is too much ethanol residual in it.

The bulk storage capacity is important to design around especially if there are quality management standards that need to be maintained.

With a unit Maratek had previously sold and worked on, there was a 2000 gallon quality management tank and 15000-gallon storage tank required. This being said, these are extremely large units.

The amount of solvent to make it worthwhile is astronomical. However, if you have that amount of wastewater, this piece of equipment is your best way to recycle your solvent.

# Conclusion

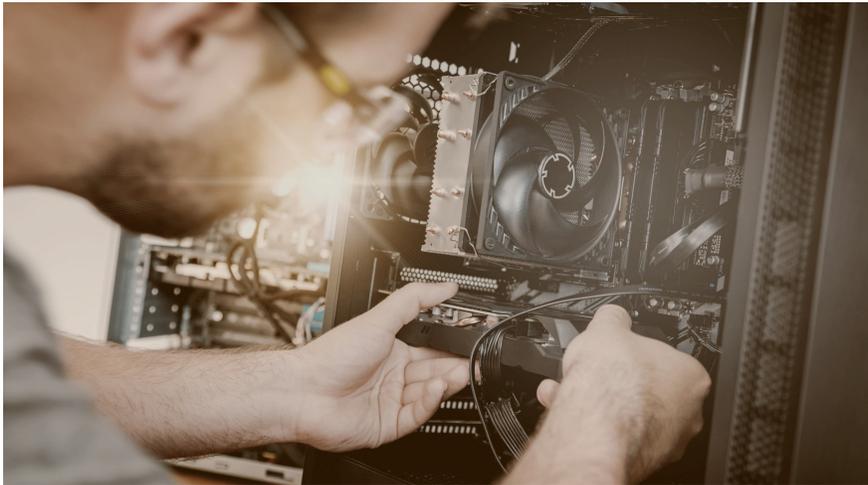


In summary, the fractional distillation process can benefit you in many ways. What seems to be a simple process actually requires a plan to make sure it is done properly and efficiently.

With equipment like the F series, although the processes used are simple, the machinery and equipment are not. Fractional distillation is an excellent way to separate your solvent from water and recover the ethanol.

Although it can require a lot of space, it is the best way, in our opinion, to remove water from your ethanol in order to recycle it, and save!

# Glossary



**Columns:** In this scenario, it is a fractional column being referred to. This is a distillation unit that is essential to the process with liquid mixtures to separate into fractioned parts ( Ethanol and water) based on the differences in volatilities.

**Heat Exchanger:** Heat from a fluid (liquid or gas (liquid or gas) passing to a second fluid without having to mix together or be in direct contact. A system that transfers heat without transferring the fluid that carries the heat.

**Distillate:** A liquid product condensed by vapor during distillation.

**Still Bottoms:** The contaminants removed from the spent solvent and accumulated within the unit

**Reboiler:** A heat exchanger that provides heat to the distillation columns, that is heated from the bottom so it generates vapors that then return to the column driving distillation separation.

**Condenser:** Used to condense a liquid into a vapor to later be collected.

## CONTACT

# About Maratek

As the Global Market Leader in Professionally Engineered Solvent Recycling and Cannabis/Hemp Extraction Technologies.

A Canadian-based, award-winning, industry leader – Maratek has proudly served industrial manufacturers globally for more than 50 years. Maratek manufactures environmentally conscious products that recycle waste for reuse from printing, coatings, automotive, aerospace, paint, and many other related manufacturers to help them stay competitive in the marketplace by cutting costs and saving money.

With a focus on development efforts to reduce, reuse, and recycle solvents and other liquid wastes in a wide range of industries, Maratek develops the latest technologies utilizing our vast experience of supplying clients worldwide to provide the best ROI possible.

Visit [www.maratekenvironmental.com](http://www.maratekenvironmental.com) to learn more about our solvent recycling services.

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