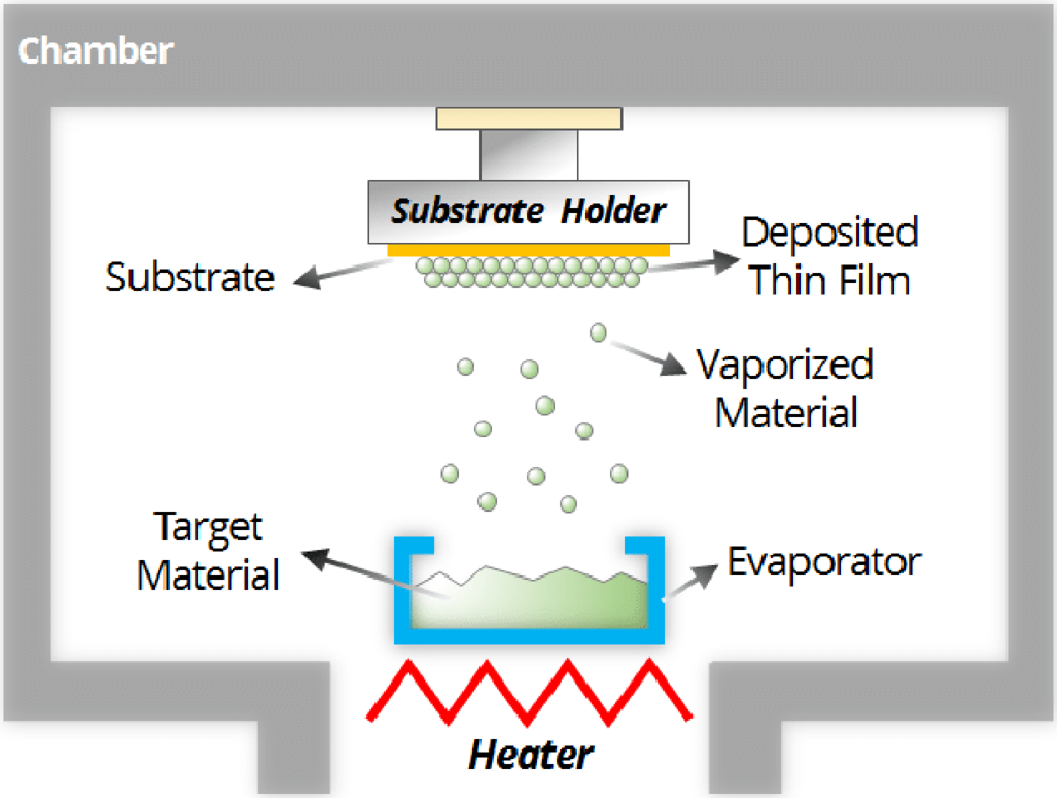
3. Thermal Evaporation:

Evaporation can take the form of vacuum distillation, atmospheric evaporation, and thermal evaporation. Vacuum distillation is accomplished by drawing a vacuum on a chamber and evaporating water at reduced temperatures, typically in the range of 90-150 degrees Fahrenheit. This technology is characterized by low energy cost, moderate to high manpower requirements, and very high capital cost.

Atmospheric evaporation involves spraying the wastewater across a high surface area medium and blowing large volumes of air across the medium. This type of evaporation is characterized by moderate energy cost, moderate capital cost, high manpower requirements due to the tendency for fouling and reduced throughputs caused by changes in atmospheric conditions.

Thermal evaporation/distillation is accomplished by heating the wastewater to a boiling temperature and evaporating the waste stream at various rates based on the amount of energy (BTU's) input into the system. This type of evaporation is characterized by moderate to high energy cost, low manpower requirements, moderate capital cost, high flexibility and high reliability. This system has the ability to exhaust water as clean water vapor or recover water as distilled water.


Chamber
Substrate Holder
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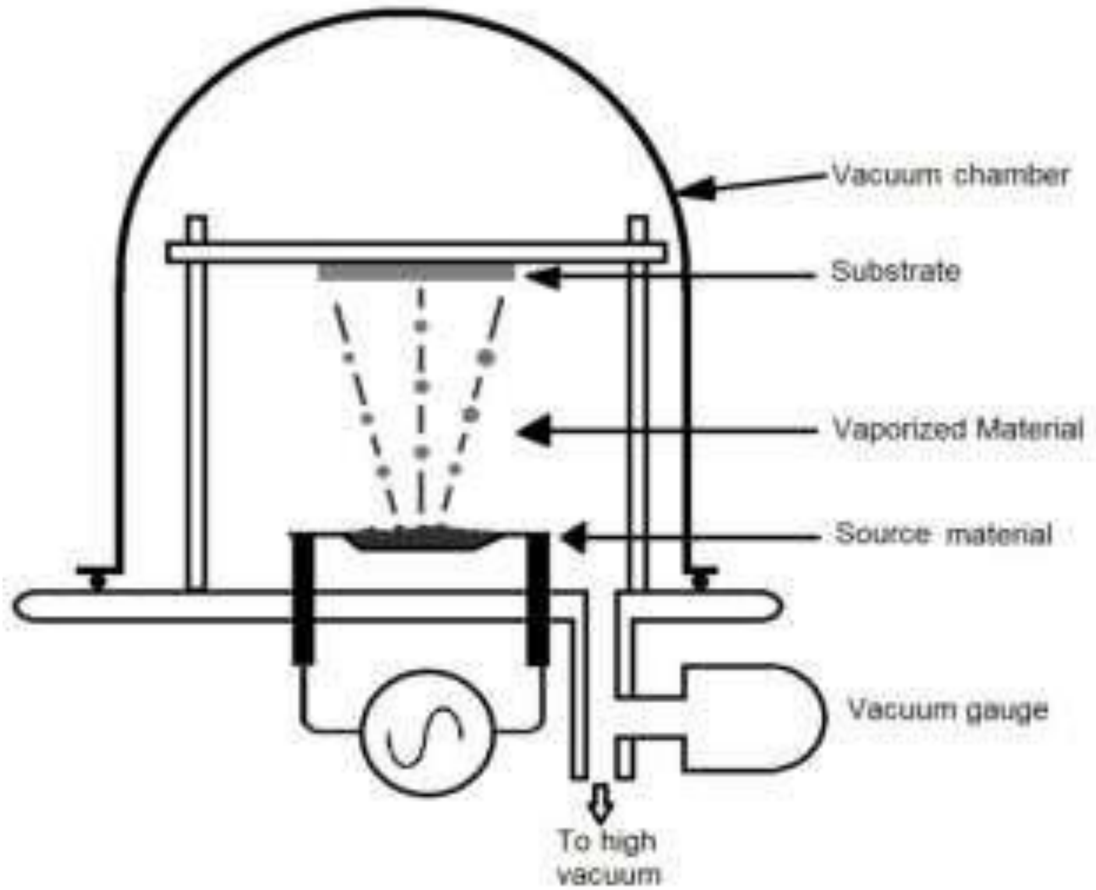

The advantages of Thermal Evaporation over Chemical Treatment are as follows:

Zero Discharge:

Evaporation completely eliminates your discharge effluent. This eliminates accountability to your pollution control Board as well as the hassle and expense associated with potential discharge violations.

Total Solution:

Chemical treatment does not completely address parameters such as emulsified oils, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), or dissolved solids in the discharge wastewater. This becomes more important each year as Pollution control discharge limits become increasingly strict

Lower Disposal Cost:

Due to the addition of chemistry, the sludge volume being generated will be greater for chemical treatment compared to evaporation which typically does not require the addition of chemistry. This translates to lower disposal liability and cost for evaporation.

4. Removal of Dissolved Organic Compounds:

One of the most commonly used techniques for removing organics involves the process of adsorption, which is the physical adhesion of chemicals on to the surface of the solid. The effectiveness of the adsorbent is directly related to the amount of surface area available to attract the particles of contaminant.

The most commonly used adsorbent is a very porous matrix of granular activated carbon, which has an enormous surface area (~ 1000 m2/g).

Adsorption on activated carbon is perhaps the most economical and technically attractive method available for removing soluble organics such as phenols, chlorinated hydrocarbons, surfactants, and colour and odour producing substances from waste water.

Granular activated carbon treatment systems consist of a series of large vessels partially filled with adsorbent. Contaminated water enters the top of each vessel, trickles down through granulated activated carbon, and is released at the bottom.

After a period of time, the carbon filter becomes clogged with adsorbed contaminants and must be either replaced or regenerated. Regeneration of the carbon is accomplished by heating it to 950 °C in a steam air atmosphere. This process oxidizes surface, with an approximately 10% loss of carbon Activated carbon is commonly used to adsorb natural organic compounds, taste and odor compounds, and synthetic organic chemicals in drinking water treatment. Adsorption is both the physical and chemical process of accumulating a substance at the interface between liquid and solids phases. Activated carbon is an effective adsorbent because it is a highly porous material and provides a large surface area to which contaminants may adsorb. The two main types of activated carbon used in water treatment applications are granular activated carbon (GAC) and powdered activated carbon (PAC).

GAC is made from organic materials with high carbon contents such as wood, lignite and coal. The primary characteristic that differentiates GAC to PAC is its particle size. GAC typically has a diameter ranging between 1.2 to 1.6 mm and an apparent density ranging between 25 and 31 lb/ft^3), depending on the material used and manufacturing process..