

Advantages and disadvantages of particulate removal devices

Nano Control particle separator

Advantages

- High collection efficiencies for coarse and fine particles ($\geq 99.85\%$)
- Capability to handle large gas flow rates ($\sim 1\text{-}1000\text{ m}^3/\text{s}$)
- Can be operated at high temperatures ($\sim 1000^\circ\text{C}$) and high pressure or under vacuum
- Low capital cost
- Low energy consumption
- Low pressure drop
- Constant flow rate
- Simple maintenance
- Dry and wet collection
- Relatively small space requirements
- Simple operation
- Recovery of collected material for subsequent processing and disposal

Disadvantages

- Inability to handle sticky materials
- Wear problems in some place

Inertial or impingement (cyclone) separators

- Low capital cost
- Relative simplicity and few maintenance problems
- Low pressure drop (ca. 2–6 w.c.)
- Dry collection and disposal
- Relatively small space requirements

- Offer low particulate collection efficiencies especially for particulate sizes below $5\text{ }\mu\text{m}$
- Inability to handle sticky materials

Wet scrubbers

- No secondary dust as residuals
- Relatively small space requirement
- Ability to remove gases as well as particulates (especially “sticky” ones)
- Ability to handle high temperature, high-humidity gas streams
- Low capital cost
- Insignificant pressure drop
- High collection efficiency of fine particulates and gaseous emission

- Potential water disposal/effluent treatment problem
- Corrosion problems (more severe than with dry systems)
- Potentially objectionable steam plume opacity or droplet entrainment
- High pressure drop for some units
- Relatively high maintenance costs for systems with column internals

Electrostatic precipitators (ESPs)	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Collection efficiencies of $\geq 99.9\%$ for coarse and fine particulates at relatively low energy consumption • Dry collection and disposal of dust • Low pressure drop typically • Continuous operation with minimum maintenance • Relatively low operation costs • Can be operated at high temperatures ($\sim 700^{\circ}\text{C}$) and high pressure or under vacuum • Capability to handle relatively large gas flow rates ($\sim 50,000\text{m}^3/\text{min}$) 	<ul style="list-style-type: none"> • Generation of dusts as secondary residuals • High capital cost [ca. U.S.\$160/m² of plate area] • High sensitivity to fluctuations in gas stream conditions (flow rates, temperature, particulate and gas composition, and particulate loadings) • Difficulties with the collection of particles with extremely high or low resistivity • Relatively large space requirement • Explosion hazard for combustibles • Safety needed for personnel from high voltage exposure during ESP maintenance • Production of ozone by the negatively charged electrodes during gas ionization • Highly trained maintenance personnel required
Fabric filter systems (Bag Houses)	
<ul style="list-style-type: none"> • Relative insensitivity to gas stream fluctuations and large changes in inlet dust loadings (for continuously cleaned filters) • Can be operated at high temperatures • Recirculation of filter outlet air • Dry recovery of collected material for subsequent processing and disposal • No corrosion problems • Simple maintenance, flammable dust collection in the absence of high voltage • High collection efficiency of submicron smoke and gaseous contaminants through the use of selected fibrous or granular filter aids • Relatively simple operation 	<ul style="list-style-type: none"> • Temperatures in excess of 290°C • Need for fabric treatment to remove collected dust and reduce seepage of certain dusts • Relatively high maintenance requirements • Explosion and fire hazard of explosive dusts • Shortened fabric life at elevated temperatures and in the presence of acid or alkaline particulate or gas constituents. Potential crusty caking or plugging of the fabric, or need for special additives due to hygroscopic materials, moisture condensation, or tarry adhesive components • Respiratory protection requirement for fabric replacement • Medium pressure drop