Technology

- DAF vs conventional sedimentation
- MBBR vs activated sludge
- MBR vs conventional biological treatment
- Wastewater recycling technologies
- Sludge dewatering technologies

DAF vs Conventional Sedimentation

Dissolved air flotation (DAF) and conventional sedimentation both remove solids from wastewater, but they work differently. Sedimentation relies on gravity: dense particles settle to the bottom of a clarifier. DAF uses fine air bubbles that attach to solids, oil, and grease, lifting them to the surface for removal.

DAF is usually more effective for light solids, fats, oils, grease, algae, and chemically coagulated particles. It is widely used in food processing, dairies, slaughterhouses, and oily industrial wastewater. Conventional sedimentation is simpler and often better suited to heavier, readily settling solids.

DAF generally requires more energy and chemical control, while sedimentation usually needs more settling area and longer retention time.

MBBR vs Activated Sludge

Moving bed biofilm reactor (MBBR) and activated sludge are biological treatment systems that use microorganisms to remove organic pollution and nutrients.

In activated sludge systems, microorganisms grow as suspended flocs in aeration tanks. The mixed liquor then flows to a secondary clarifier, where solids settle and part of the biomass is returned to the aeration tank. This process is widely used, flexible, and proven, but depends on good settling performance.

MBBR systems use small plastic carrier media that provide a protected surface for biofilm growth. The carriers move continuously in the reactor through aeration or mixing. MBBR can handle variable loads well, has a smaller footprint, and avoids dependence on secondary-sludge settling within the biological reactor. However, it requires media-retention screens and can have higher equipment costs.

MBR vs Conventional Biological Treatment

A membrane bioreactor (MBR) combines biological treatment with membrane filtration. Conventional biological treatment usually separates biomass from treated water using a secondary clarifier.

Because membranes physically retain solids and microorganisms, MBR systems can produce very clear, low-turbidity effluent. They require less space than many conventional plants and are well suited to water reuse, strict discharge limits, or sites with limited land.

Conventional systems are usually less expensive to build and operate, and they are simpler to maintain. MBR systems require more energy for membrane aeration and filtration, as well as regular cleaning and replacement of membranes. Effective pretreatment is essential to prevent membrane fouling.

Wastewater Recycling Technologies

Wastewater recycling treats used water to a quality suitable for reuse rather than discharge. The appropriate technology depends on the intended use, such as cooling, washing, irrigation, boiler feed, or process reuse.

A typical recycling system may include screening, equalization, biological treatment, clarification or membrane filtration, activated-carbon treatment, disinfection, and—where very high quality is needed—ultrafiltration, nanofiltration, reverse osmosis, or advanced oxidation.

Low-risk reuse, such as landscape irrigation or floor washing, may need only biological treatment, filtration, and disinfection. High-quality industrial reuse may require membranes and desalination to control dissolved salts. Reuse systems should always separate recycled-water piping from drinking-water systems and include monitoring for the intended purpose.

Sludge Dewatering Technologies

Sludge dewatering reduces the water content of sludge generated during wastewater treatment. This lowers transport, disposal, and treatment costs.

Common technologies include:

- **Drying beds:** Simple, low-cost beds that use drainage and evaporation; suitable where land is available.
- **Belt filter presses:** Sludge is compressed between moving belts; commonly used for continuous municipal and industrial applications.
- **Screw presses:** A slow rotating screw compresses sludge; compact, relatively simple, and often low in energy use.
- **Centrifuges:** High-speed rotation separates solids from water; compact and effective, but energy and maintenance needs are higher.
- **Filter presses:** Hydraulic pressure squeezes sludge in filter plates; can achieve relatively high cake solids, especially for industrial sludge.

Most systems require polymer conditioning before dewatering. The best choice depends on sludge type, required cake dryness, available space, operator capacity, energy cost, and final disposal or reuse route.