Oxygen Enriched Air Aeration (OEAA)

PSA & Oxygen-enriched air reuse for membrane nitrogen generators

Drivers of the OEAA program

SMC:

1. Sales - Inward Growth?
2. Market development entry points?
3. Value-added technical services?
4. Competitiveness supplement?
5. Corporate image (environmental philosophy) enhancement?
6. Technical) knowledge accumulation?

Customer Choice:

1. Lower electricity consumption for sewage treatment.
2. Wastewater treatment equipment maintenance costs are reduced.
3. Sewage treatment downtime reduced.
4. Energy saving and emission reduction new project declaration opportunities.
5. Safe to use.
6. No water discharge for retrofit installation.

Origin of the activated sludge process

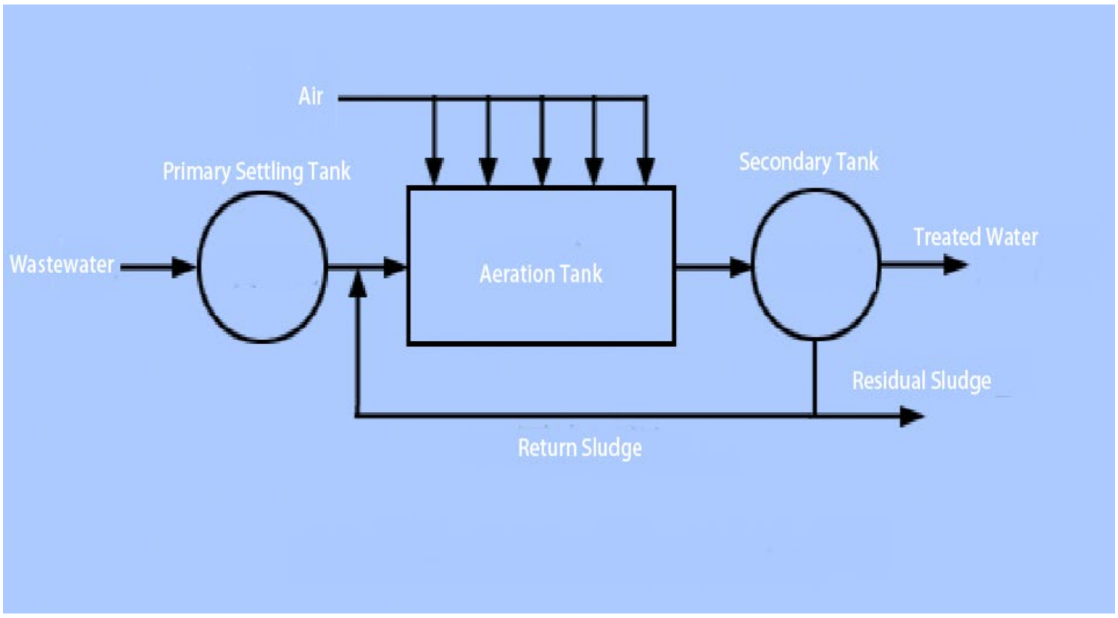
In 1912, the British Clark and Cage found that prolonged aeration of wastewater would produce sludge and significantly improve water quality. Later, Arden and Lackett further researched and found that due to the lack of cleanliness of the experimental containers, the walls of the bottles were left with residues that improved the treatment effect, which led to the discovery of active microbial colloid clusters, which were named as activated sludge.

Basic components of the activated sludge process

This process is still in use in about 90% of all wastewater treatment plants

Reducing the cost of wastewater treatment electricity

The first activated sludge sewage treatment plant built in England in 1916.



General activated sludge treatment system

Aeration Tanks:

Visible gas agitation flow pattern

Open - flow pattern visible

Closed - flow pattern not visible, extraction

Three elements of the activated sludge method

Activated sludge - microorganisms that adsorb and oxidize organic matter Food - organic matter in the water column

Oxygen (dissolved oxygen) - Necessary for the survival of microorganisms and their oxidative reactions – Aeration

Aeration

1. Aerating process to provide dissolved oxygen to water (liquid)
2. Air aeration - the use of natural air, using pressurized and non-pressurized way, widely used
3. Oxygen aeration-liquid oxygen and oxygen generator as a gas source, pressurized gas supply, the application is gradually expanding
4. Oxygen-enriched aeration-rarely seen engineering application reports
5. The main points of aeration: eight words
6. No more, no less, mixed evenly

The importance of aeration in wastewater treatment

Emission compliance: one of the most important key elements

Treatment cost: 40 ~ 60% Total cost

Currently about 90% of the sewage treatment are used activated sludge method (aeration); in this type of sewage treatment process, electricity consumption accounts for 60 to 70% of the total cost; aeration power consumption is 70 to 80% of the total power consumption;

Why Oxygen Enriched Aeration Saves Energy

Differences in oxygen transfer efficiency:

Oxygen Transfer Efficiency > Oxygen Enriched Transfer Efficiency > Air Transfer Efficiency

Oxygen transfer efficiency = actual amount of oxygen absorbed by the water body / total amount of oxygen added

Theoretical equations for double membranes

Oxygen transfer rate Rm

$Rm = KLa \times (Cs-Cp)$

Oxygen concentration difference, the greater the value, the higher the oxygen transfer rate

Kla: total mass transfer coefficient (with the aerator, water temperature, water quality, etc.)

Cs: saturated dissolved oxygen under specific conditions in the water can reach the maximum value of dissolved oxygen

Cp: operation of dissolved oxygen, water treatment operation of dissolved oxygen required values

Henry's Law

$CS = H-Px$

Cs: saturated dissolved oxygen

H: Henry's constant

Px: partial pressure of gas components

Dalton's Law of Partial Pressure:
The partial pressure of a gas component is proportional to its percentage of volume

Dalton's Law of Partial Pressures:
The partial pressure of oxygen in oxygen-enriched air is greater than the partial pressure of oxygen in air.

Henry's Law:
The saturated dissolved oxygen concentration Cs of oxygen-enriched air is greater than the saturated dissolved oxygen concentration Cs of air

Double membrane theory formula Rm = KLa × (Cs - Cp) oxygen-enriched aeration oxygen transfer rate must be greater than air aeration

Sample：

35% oxygen-enriched air as an example

Dalton's law of partial pressure

Henry's law CS = H-Px -- At 1 atmospheric pressure, air aeration saturated dissolved oxygen Cs is 9.08, oxygen-enriched aeration saturated dissolved oxygen Cs = (36/21) × 9.08 = 15.57

Double membrane theory formula
Rm = KLa × (Cs-Cp)

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