polymetron

Wastewater treatment: pH, ORP in Denitrification / Dephosphatation

application note

9135 transmitter

8350 probe

1. THE PROCESS

This part of the process is also called the tertiary treatment and is more and more required due to new regulations regarding nitrates and phosphates effect on the environment.

When rejected in too big amount in rivers or lakes, these elements are responsible of eutrophisation phenomena, which is an uncontrolled growth of alguies and plants.

The effect is a decrease of oxygen and the death of fishes.

The secondary treatment (for example in activated sludge basin) will approximately eliminate 35 % of nitrogen and phosphorous. It is not sufficient today as a rate between 70 and 95 % is required.

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For the nitrogen elimination, the first phase consists in a strong oxygenation in an activated sludge basin : this is an aerobic reaction also called nitrification.

The reaction is an oxydation of nitrates (NO_3) into nitrites (NO_2).

The second phase is the real denitrification : this is an anoxic reaction, where the nitrites will be reduced into nitrogen gas which evaporates.

For the phosphates removal (dephosphatation), a physico-chemical process is applied : a reagent (iron, aluminium, lime) is injected in order to create a precipitation (flocculation) of phosphorous coumpounds, which will be eliminated by filtration.

An other way to eliminate the phosphates is a biological process based on the fact that bacteria will consume a lot of phosphates if they have been starved of oxygen.

2. INTEREST OF A pH MEASUREMENT

➢ ***For nitrification :***

In the aeration tank, the pH must always be greater or equal to 7. The nitrification will always induce an acidification of the medium but the optimal activity of the bacteria is around 7,6 / 7,8. It is therefore important to control and often correct the pH by base injection for example.

➢ ***For denitrification :***

Here also, the pH must always be greater or equal to 7.
It is used to calculate the rH.

➢ ***For dephosphatation :***

Depending on the reagent, the pH must be carefully controlled, for a better efficiency of the reaction of course, but also in order to use a minimum of often costly reagent. The pH has generally to be corrected by lime or sodium carbonate injection. We give hereafter infos depending on reagents :

with Al_2SO_4 :	range : 5 to 8	optimal : 6,6
with Na_2AlO_2 :	range : 4 to 7	optimal : 6
with $FeCl_3$:	range : 4 to 7	optimal : 5,5
with $FeClSO_4$:	range : 4 to 7	optimal : 5,5
with $FeSO_4$:	range : 5 to 9	optimal : 8
with $Ca(OH)_2$:	range : 7 to 9	optimal : 8

3. INTEREST OF AN ORP MEASUREMENT

➢ ***For denitrification :***

During the anoxic phase, the rH must be controlled, as it is linked to the dissolved oxygen level. The rH, in case of an Ag/AgCl electrode, is given by the following formula:rH= (eH + 199) / 0,029 + 2 pH.

The correct range is : 15 ≤ rH ≤ 23.

4. pH loop : 9135 + 8350 IMMERSION

➢ ***System configuration :***

It is made of 3 parts in standard : the 9135 transmitter + the 8350 combined sensor with its 10m cable + an immersion probe equiped with a loose flange (3 lengthes are proposed).
These complete loops can be ordered under the following references:

9135/P06/1 or 9135/P06/2 : 0.5 m immersion
9135/P07/1 or 9135/P07/2 : 1 m immersion
9135/P08/1 or 9135/P08/2 : 1.5 m immersion

➢ ***Description of the optional cleaning device :***

Air, water or chemical cleaning available.

➢ ***Advantages :***

The 8350 is a combined pH probe constituted by the following parts :

- a glass bulb installed in a recessed area in order to protect it from shocks
- a double junction reference system (KNO_3 then KCl)
- an integrated Pt100 for automatic temperature compensation by the transmitter
- a built-in low noise 10 m cable

The process liquid junction is made of a special porous Teflon and the first stage of reference system of KNO_3 : these 2 features allows excellent results against polluting ions.
For very dirty samples (coating mediums), the optional chemical cleaning kit can be installed.
There is no maintenance needs on reference part (electrolyte supply).

5. ORP LOOP : 9135 + 8351 IMMERSION

➢ ***System configuration :***

It is made of 3 parts in standard : the 9135 transmitter + the 8351 combined sensor with its 10m cable + an immersion probe equiped with a loose flange (3 lengthes are proposed).

These complete loops can be ordered under the following references :

9135/R01/1 or 9135/R01/2 : 0.5 m immersion
9135/R02/1 or 9135/R02/2 : 1 m immersion
9135/R03/1 or 9135/R03/2 : 1.5 m immersion

➢ ***Description of the optional cleaning device :***

Air, water or chemical cleaning available.
It can be ordered under the following reference: 8543/N01/2

➢ ***Advantages :***

The 8351 is a combined ORP probe constituted by the following parts:

- a platinum measuring element
- a double junction reference system (KNO_3 then KCl)
- a built-in low noise 10 m cable

The process liquid junction is made of a special porous Teflon and the first stage of reference system of KNO_3 : these 2 features allows excellent results against polluting ions.
For very dirty samples (coating mediums), an optional chemical cleaning kit can be installed.
There is no maintenance needs on reference part (electrolyte supply).