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ENSOLA WATER CHEMISTRY

– Neo WaterFX300 –

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Neo WaterFX300
New precipitant and flocculant

Neo WaterFX300 precipitates phosphorus with a low input quantity and generates little precipitated sludge – guaranteeing economical wastewater treatment.

Advantages
Very low consumption for phosphorus precipitation (approx. 4 – 8 x less input quantity compared to FeCl3)
20 – 40 % lower sludge production
Very good dewatering of the precipitated sludge
No hazardous material according to ADR – low acid input in waste water treatment

Application
Phosphate precipitation
Reduction of the sludge index
Soft water applications (low pH shift)
Removal of fine turbidity substances

Specification	
$LaCl_3$	30 M %
$CeCl_3$	70 M %
Density (20 °C)	1.55 ± 0.63 g/cm3
Appearance	amber, yellow solution
pH value	> 4
Storage	-40 °C storage stable

Operational experience through the use of Neo WaterFX300

- The direct ionic bonding of the phosphorus leads to a significant reduction in precipitant consumption (approx. 5 x lower quantity than iron III chloride)
- The lower product input and the significantly lower hydroxide sludge lead to a lower precipitated sludge production
- The higher molecular weight leads to an improvement of the sludge dewatering and to a better floc structure
- The lower dosing volume and alkalinity of **Neo WaterFX300** leads to a 300- to 500-fold reduction in the addition of acid during precipitation.

Change in organic / inorganic sludge content in the biological treatment due to the use of **Neo WaterFX300**.

- Activated sludge with FeCl3 precipitation

- 20 % Inorganic Hydroxide sludge
- 80 % Organic Activated sludge

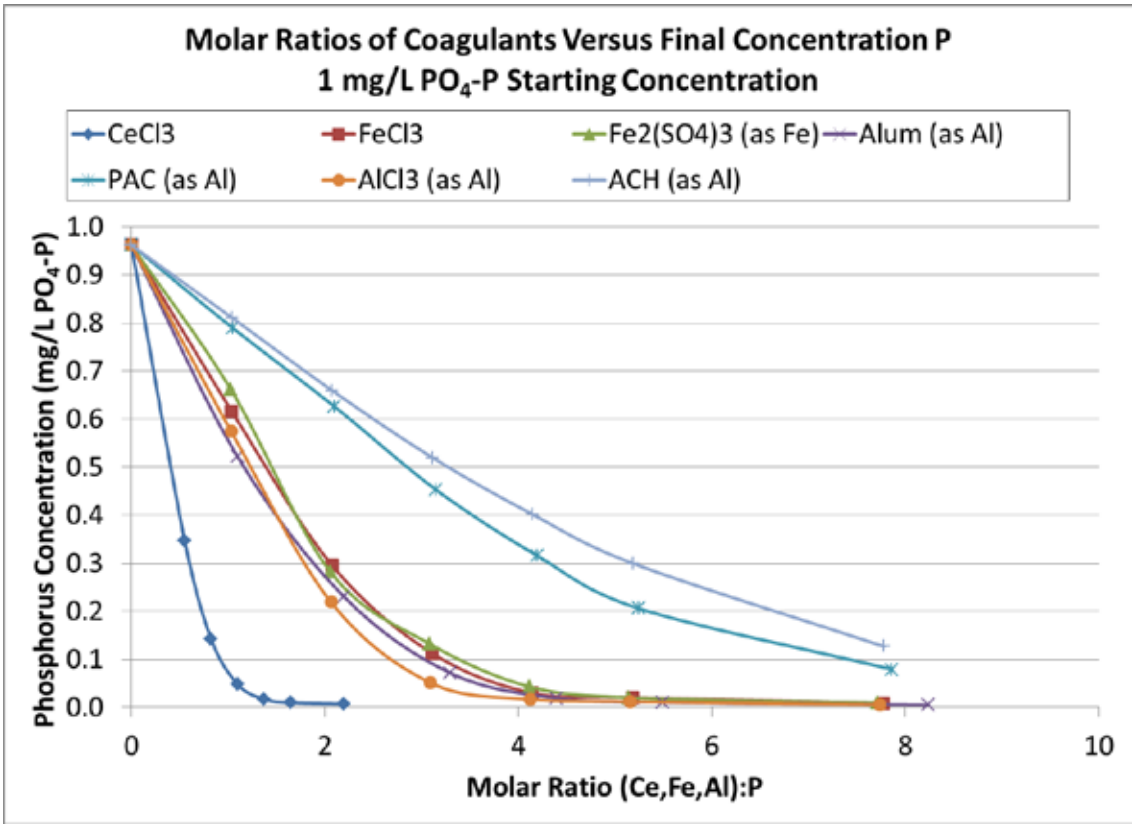
- Activated sludge with **Neo WaterFX300**

- 20 % saved amount of sludge
- 0 % Inorganic Hydroxide sludge
- 100 % Organic Activated sludge

The Molar Ratio of Neo WaterFX300 is 1:1 down to low phosphate concentrations

Another difference between Fe-, Al-based coagulants is the molar ratio of the coagulating metal to be required to remove P in the desired amount. The figure below shows the phosphate removal performance of various Fe-, Al-, and CeCl3-based coagulants, compared to the molar ratio of the coagulant to P. Regardless of the initial P concentration, the addition of **Neo WaterFX300** in the form of CeCl3 resulted in the lowest P concentration, with maximum molar ratio 1:1. In comparison, Fe- and Al-based coagulants must be added at higher molar ratio (at least 2.5:1 (Fe or Al):P) to achieve similar P concentrations.

This behavior shows us that especially plants with low P limits, such as 0.5 mg P/l and lower, will operate particularly efficiently with **Neo WaterFX300** will work.



The addition of **Neo WaterFX300** to wastewater has the potential to remove several different anions. In addition to P in the form of phosphate, **Neo WaterFX300** can form insoluble complexes with carbonate (CO32-), hydroxide (OH-) and fluoride (F-) and arsenic (As-).

Good sludge dewatering - good settling of the activated sludge

- Lanthanum and cerium are significantly heavier elements than iron and aluminum.
- This property manifests itself in the rapid settling of the activated sludge.
- The digested water separation in the sludge stack is subsequently improved by the application. This is a big problem with some aluminum based precipitants.
- And the sludge dewatering can also be optimized due to the heavy compact flake.
- There are fewer deposits in centrate water pipes, on dewatering machines as well as on final clarifier filters, since the lanthanum phosphate complex (Rhabdophan) does not form additional bonds and is therefore not deposited.
- In addition, the solubility product is much less soluble than iron phosphate, and has no redissolution mechanisms in the further process.

Resounding economic success with the use of NeoWaterFX300

Fig: Application at the SBR reactor in Avenches (SWITZERLAND)

Neo WaterFX300 can be used as the only precipitant in wastewater plants. It performs all functions, such as the dosing of iron salts or aluminum salts.

This complete changeover to **Neo WaterFX300** results in a significantly lower precipitated sludge quantity. As the inorganic content of the activated sludge is significantly reduced. **Neo WaterFX300** does not build up massive hydroxide sludge in the biology, such as iron or aluminum hydroxide. Therefore, the dosing point can also be moved to the outlet of the biology to precipitate the phosphorus. In addition, the inorganic sludge content should be measured and this decrease should be included in the total dry matter content. Otherwise, additional organic biomass will be built up. (Usually the dry matter is reduced by 20 % to maintain the same degradation performance).

Neo WaterFX300, similar to aluminum salts, does not make direct sulfide binding. Therefore, we recommend adding a partial amount of iron salts for wastewater treatment plants with digestion and subsequent digester gas utilization, which need to bind sulfur. According to our field experience, 5 –10 % of the iron precipitant quantity is usually sufficient for sulfide binding.

It is sufficient to dose a small quantity into the excess sludge by means of an IBC container.

However, a hybrid precipitant application can also be used as follows:

1. Precipitant quantity of ferric chloride is reduced by 50 %.
   (Example of 200 liters FeCl3/day reduced to 100 liters FeCl3/day).

2. The missing amount of iron chloride is supplemented by **Neo WaterFX300**,
   this corresponds to approx. 20 % of the original amount of iron.
   (Example 1/5 of 100 liters corresponds to 20 liters of Neo/day).

The advantage is that the acid addition is practically halved and the positive effects of **Neo WaterFX300** come into play:

→ The sedimentation can thus be improved (sludge volume index). It can replace special products.

→ At most, a higher dry matter can be run in winter operation and the nitrite concentration can be reduced.

→ The separation of digested water can improve significantly. This can result in less sludge disposal and thus reduce disposal costs.

→ The acid capacity as well as the pH can be increased. (This additionally reduces the use of lye, lime or chalk for pH stabilization).

→ The reduction in the amount of ferric chloride also results in fewer deliveries, which has a positive effect on personnel but also on the CO_2 balance of the logistics chain.

Fig:
Application in SoftWater at the SBR reactor in Zernez (SWITZERLAND)

Phosphate precipitation kinetics

Lanthanide elements

Lanthanide elements form strong, crystalline bonds with phosphorus.

- → The precipitate is CePO4 / LaPO4 (RE=rhabdophane)
- → Forms ionic bonds
- → Reacts preferentially with phosphat
- → Achieves a mole ratio of 1:1
- → Phosphorus is bound, it cannot be easily removed
- → Reduced precipitation sludge

Iron / aluminum chloride

Iron and aluminum chloride form an amorphous „cloud“ in solution.

They attract phosphate on metal hydroxide flakes.

- → Forms Fe/AlOOH and Fe/Al(OH)3 intermediate products for adsorption of phosphate
- → Phosphate is adsorbed on the surface of the flakes adsorbed (surface attraction chemistry)
- → Phosphate can be sheared off mechanically (pump, centrifuge)