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LEVAPOR

High Performance Biocarrier

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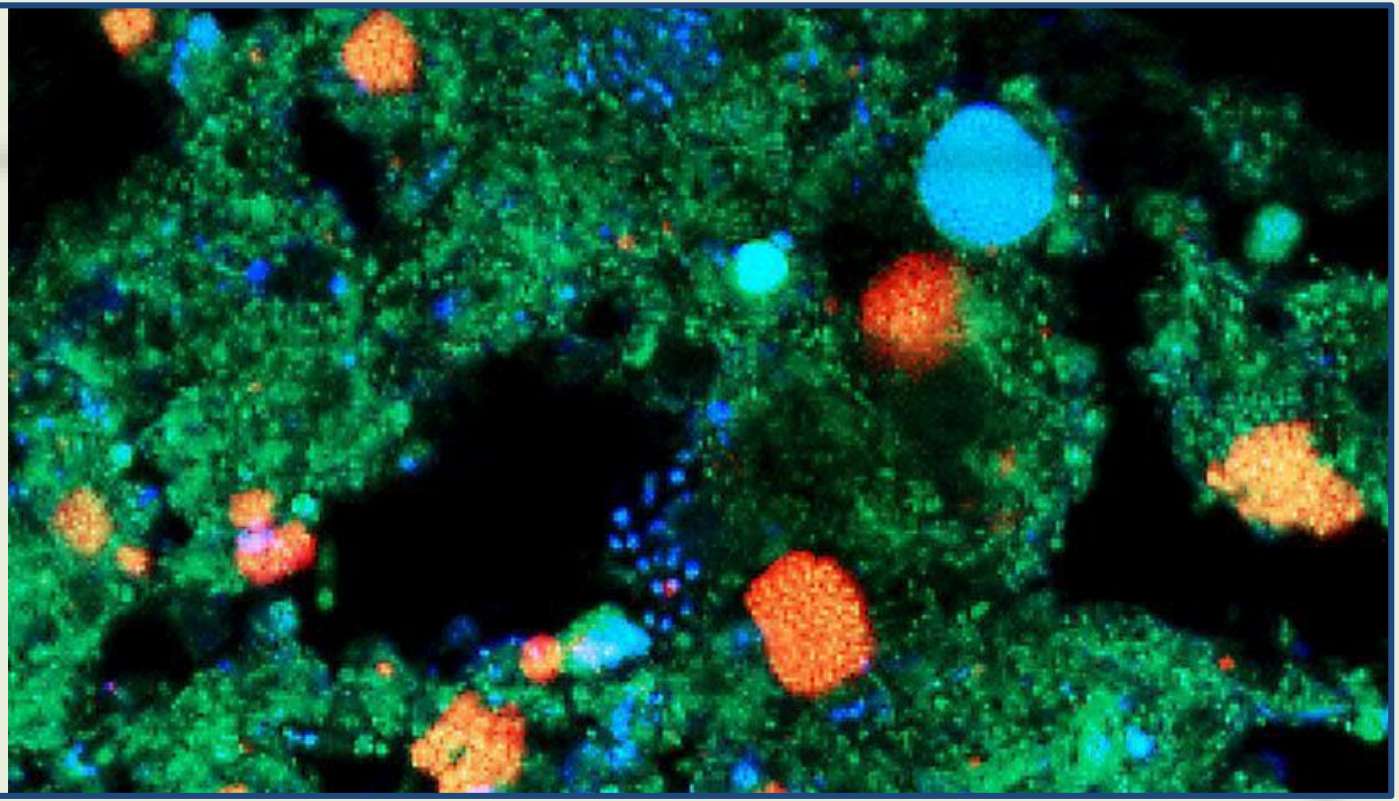
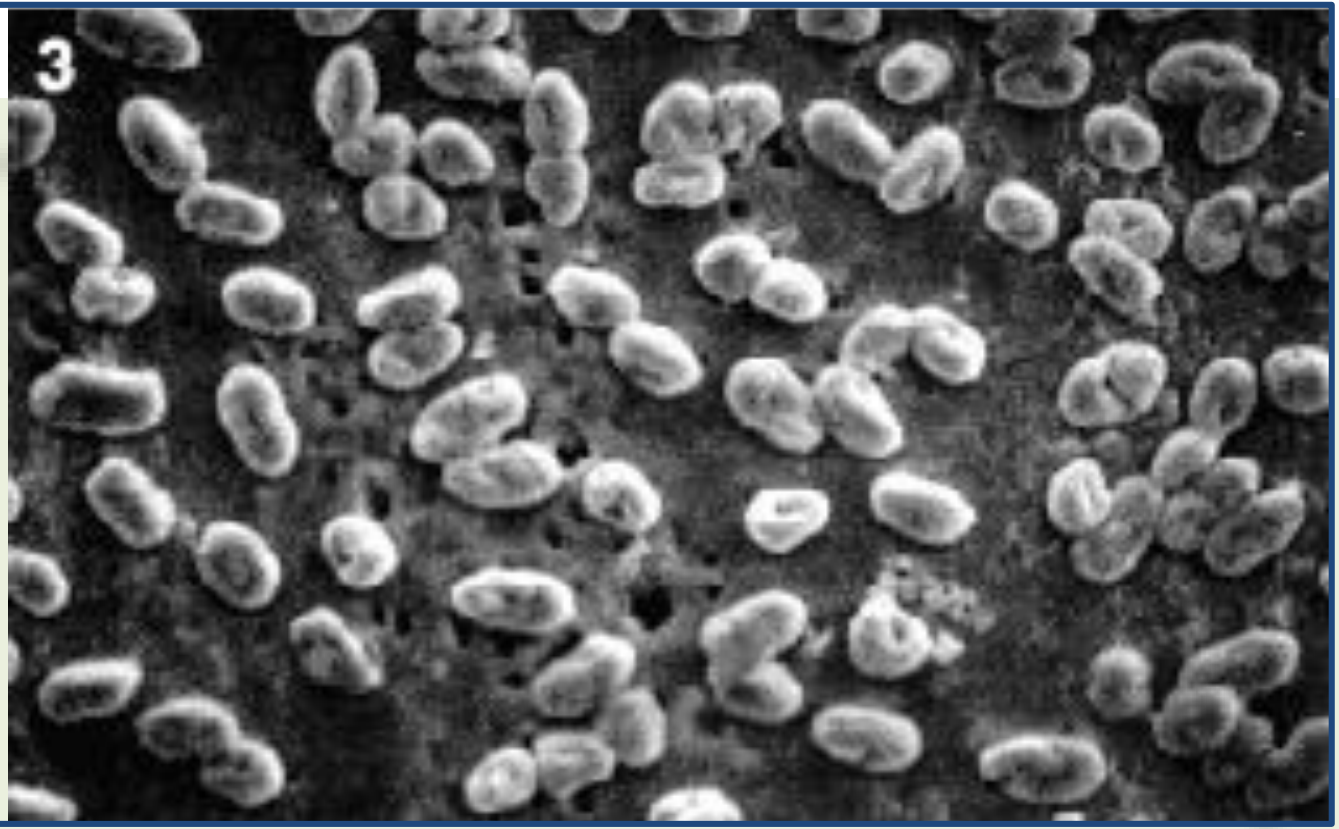
Removal of pollutants

The removal of pollutants from wastewater occurs through a team-work of several different specialized microbial strains, present in the required quantity.



Removal of pollutants

Some of those special degrading organisms flocculate weakly, grow and settle slowly and will be washed out from the treatment plants, resulting in damage to the natural process.

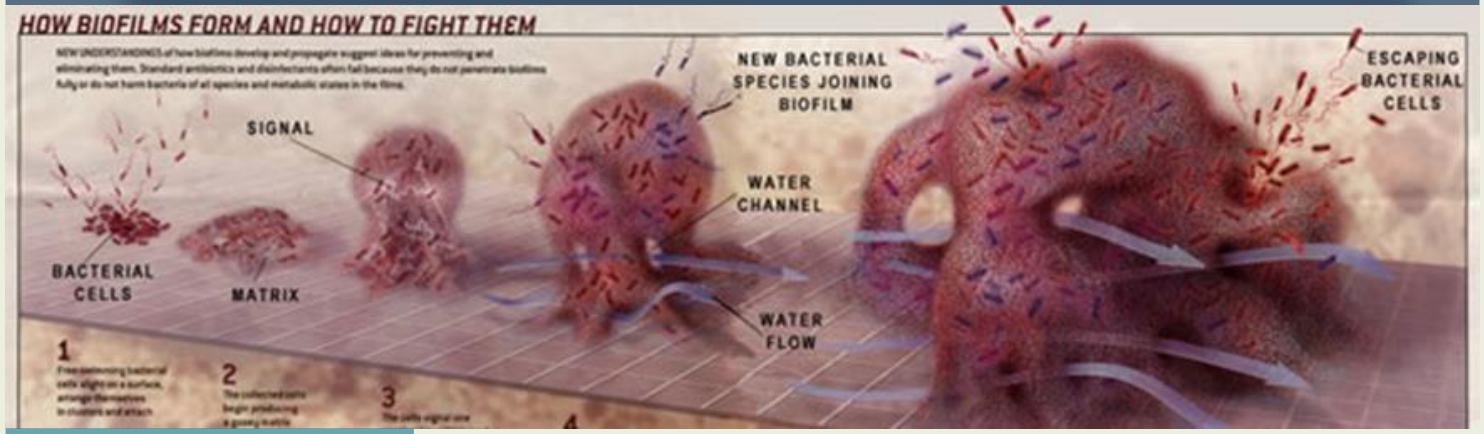


The biofilm technology

Main Question :

How to retain the biomass in the reactor ?

Best solution is the **biofilm technology,** microbial cell growth on solid surfaces, **carriers,** forming **biofilms**.



In this form the cells show

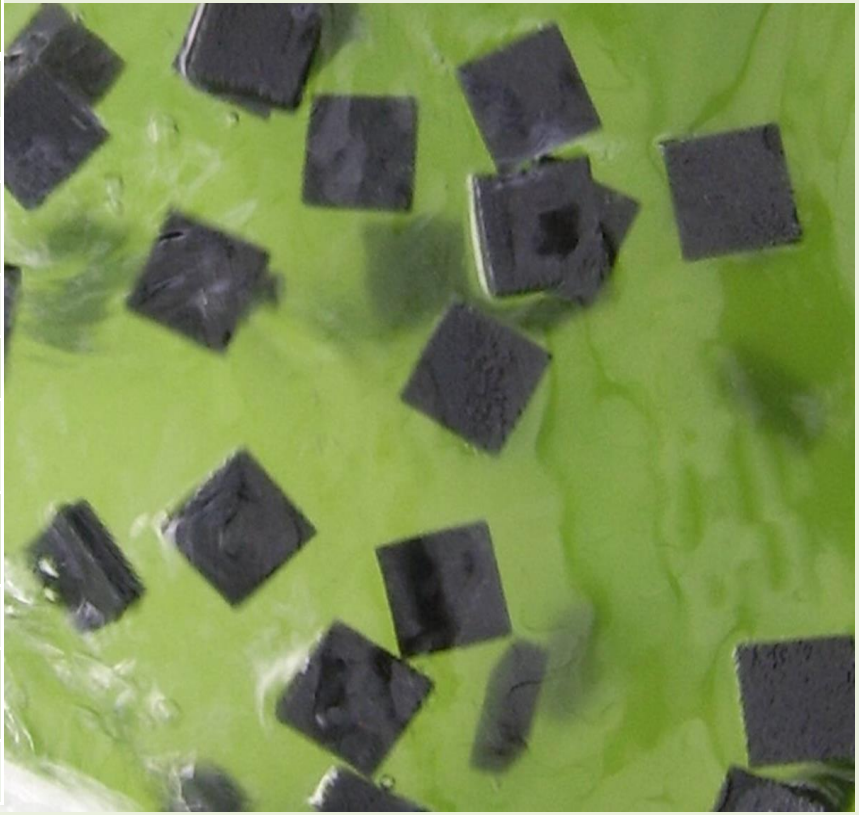
- much **higher performance** and
- up to 50-time **higher stability** than free suspended cells.

Plastic biocarrier

Dimensions	20x20x7 mm
Bulk weight	26 kg/m³
Wetting	few hours
Surface	1.34 mio. m²/m³
Biofilm generation	120 - 300 min.

LEVAPOR biocarrier

Attribute	LEVAPOR	Plastic carriers
Total surface (m^2/m^3)	1.34 Million	500 to 1000
Adsorbing capacity	very high	low
Degree of reactor filling	12 to 15 %	30 to 70 %
Porosity	85 to 90 %	50 – 75 %
Water uptake	up to 250 %	negligible
Colonization by microorganisms	120 to 180 min.	several weeks
Full fluidization at air flow (m^3/m^2xh)	5 to 7	10 to 11
Carrier retention	8-10 mm screens	Screens
Aeration	fine bubble aeration	coarse bubble
Energy for fluidization	not required	added aeration

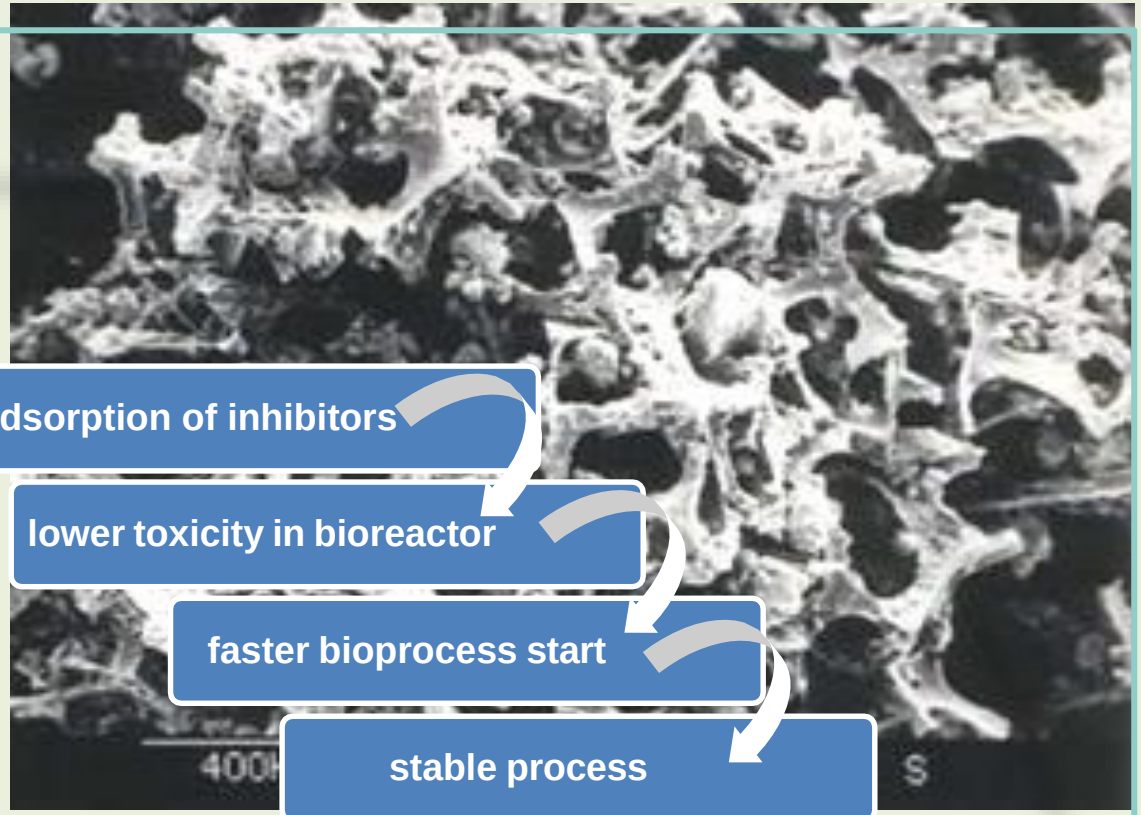


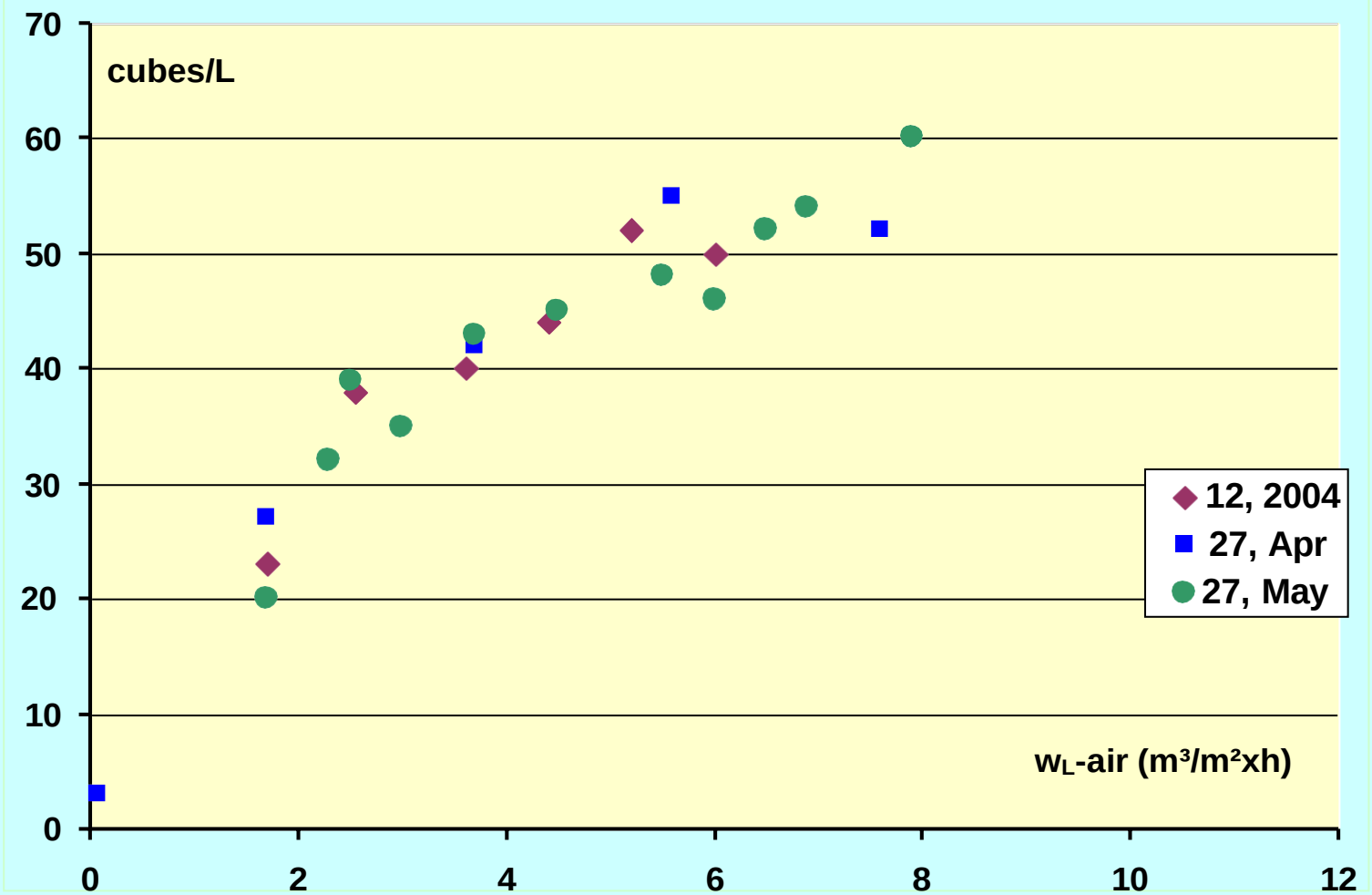
Unique effects of LEVAPOR

Specialty:

High content of powdered activated carbon enables unique effects, not only simple cell adhesion

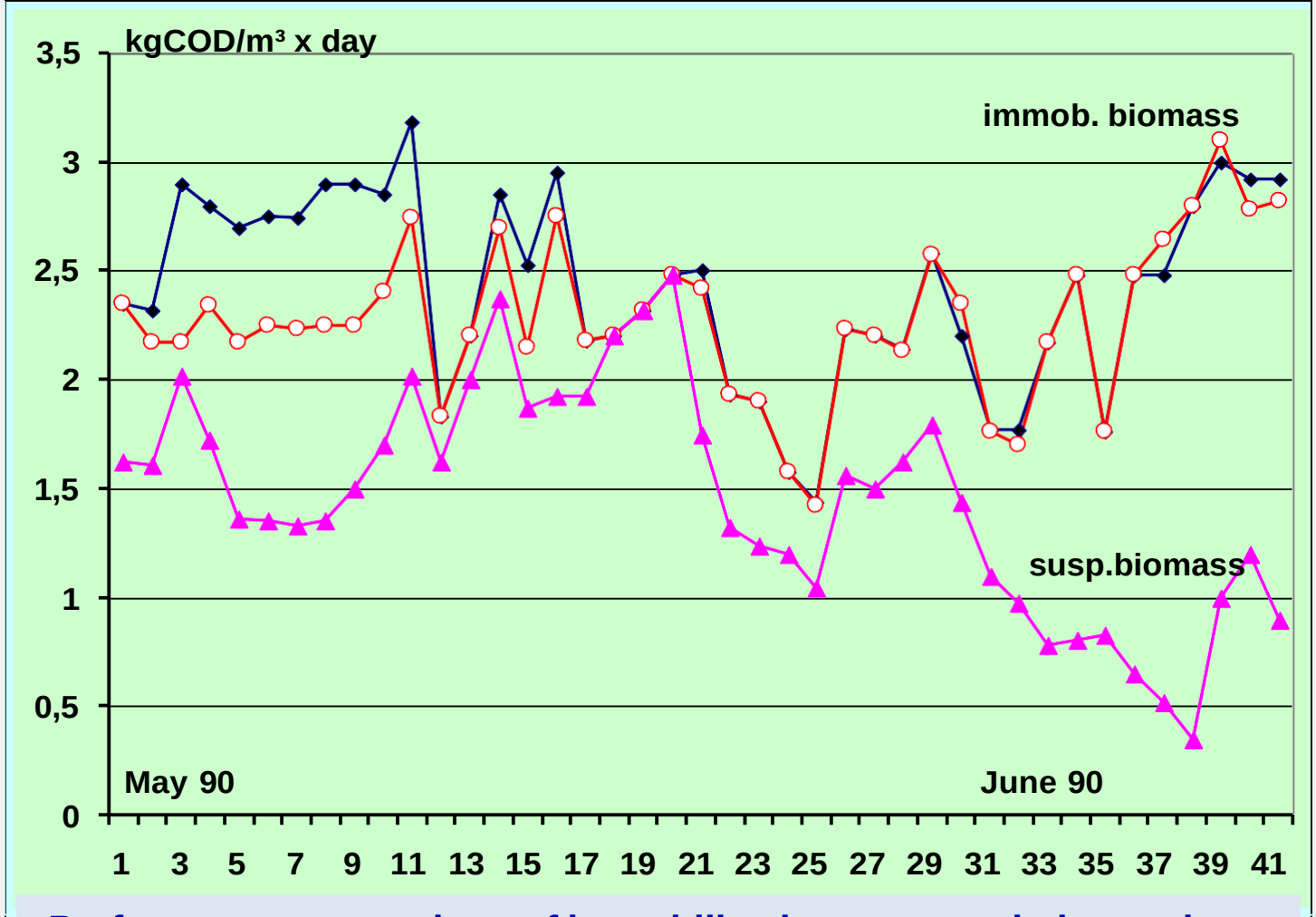
Effects:





Typical aeration intensity enables a nearby quantitative fluidization

Anaerobic-aerobic WWTP for the treatment of toxic pulp mill effluents by microorganisms fixed on LEVAPOR-biocarriers

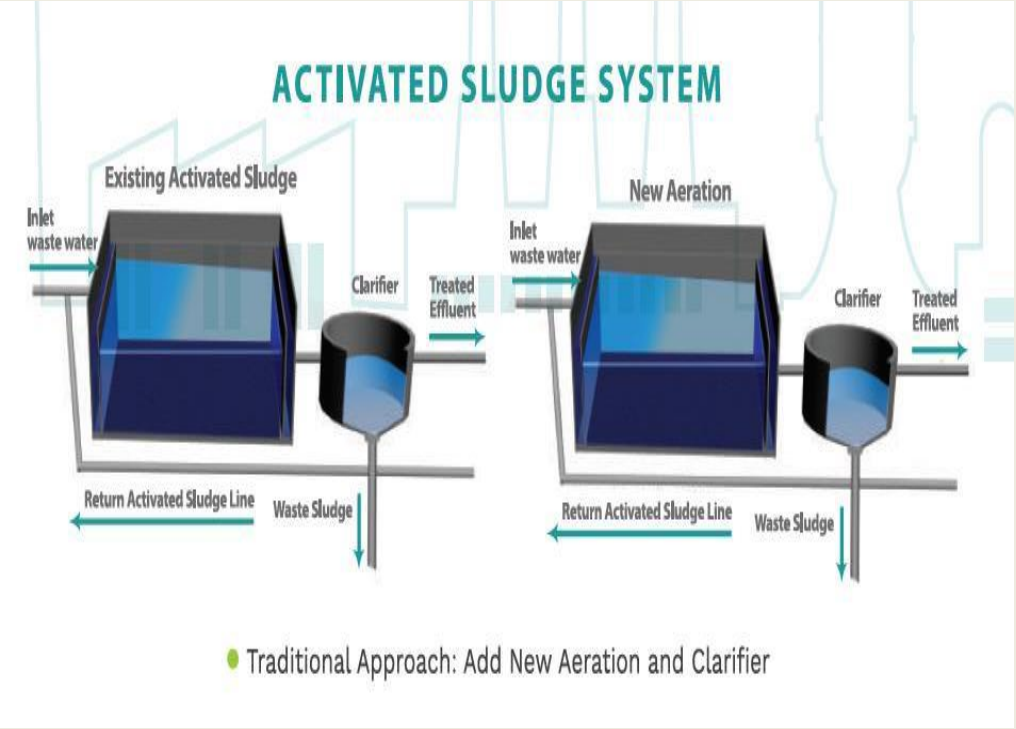


Performance comparison of immobilized vs. suspended organisms

Upgradation of Existing Activated sludge plants

Conventional Approach

- Add additional Aeration volumes
- Add additional clarifiers
- Additional space and capital costs
- Instable Nitrification,
- Frequent washouts



Upgrade of existing municipal sewage treatment plant

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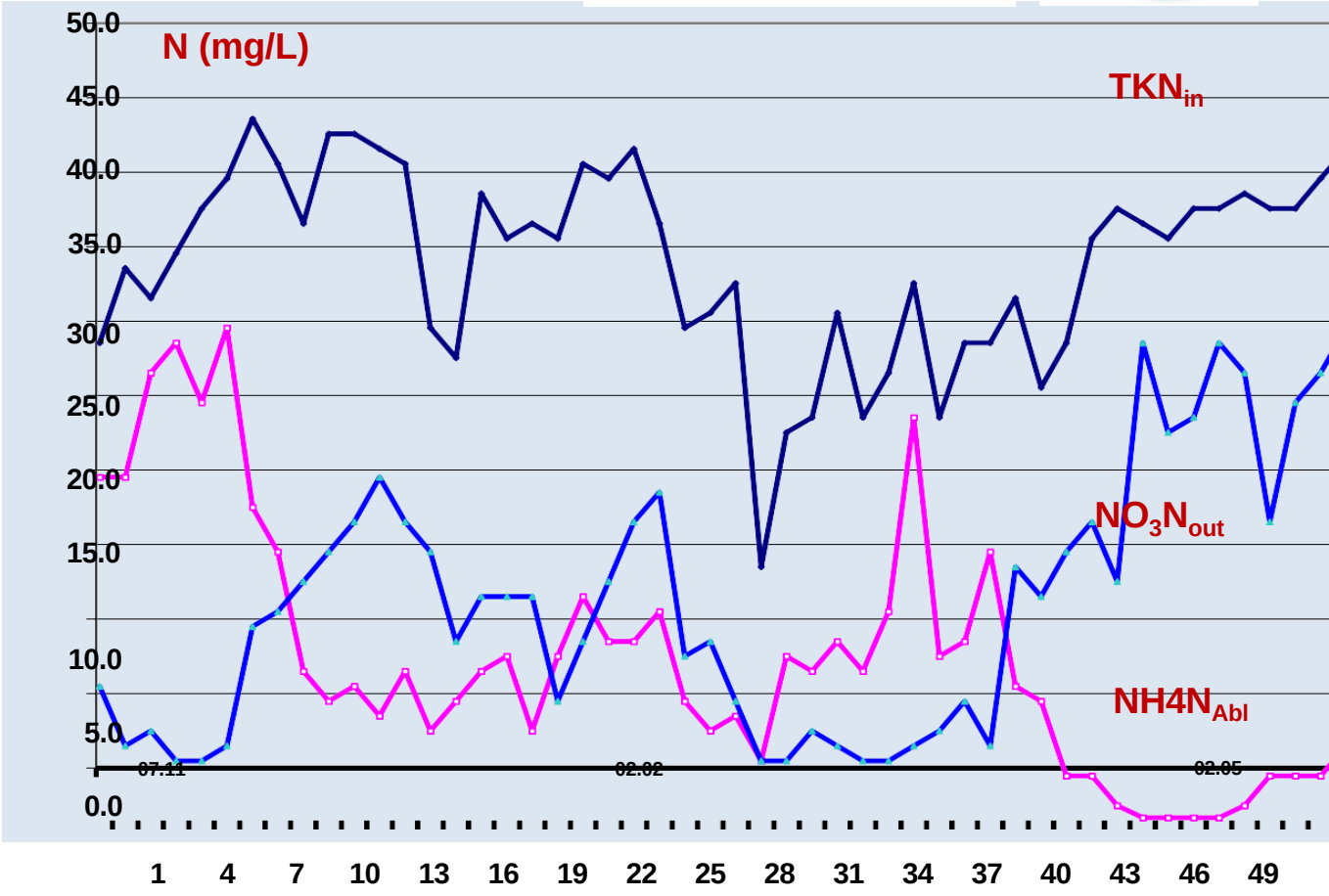
Nitrogen Concentrations after the addition of 12% Levapor at 10° to 17° C.

After 3 to 4 weeks a stable nitrification has been established.



Addition of 12 vol.% LEVAPOR carrier into the aerated basin of existing municipal plant in Espoo

RESULTS:

- efficient nitrification within 3 weeks, remaining stable over 4 years !

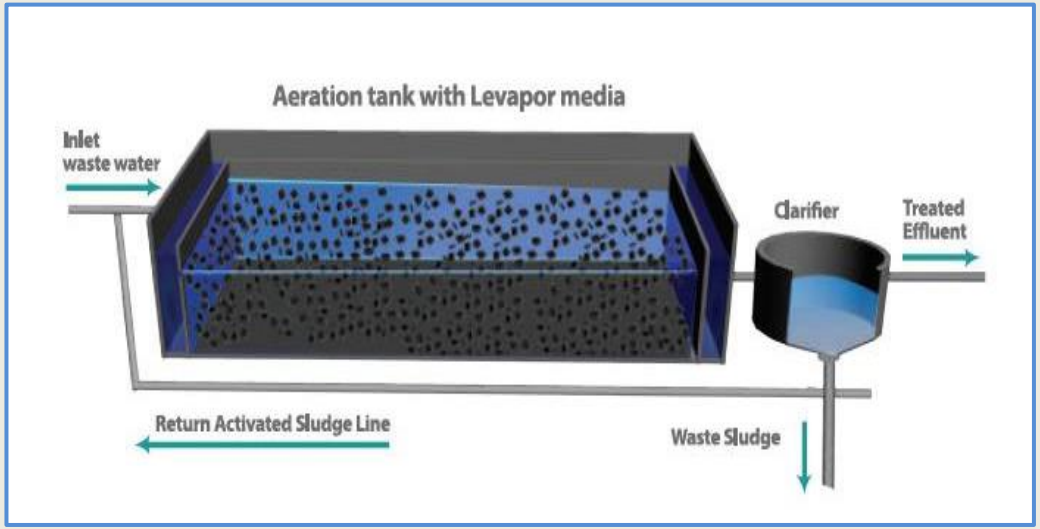
BENEFIT FOR CUSTOMER :

- lower cost of biocarrier
- 15- 25 % less sludge

LEVAPOR IFAS Upgrade to BNR

Simplified Upgrade

- Add Levapor 10-15%
- Add retention screen
- Add clarifier if required
- Upgrade Aeration System for higher OTR capacity



Benefits of LEVAPOR IFAS Upgrade

- No additional capital expenditure, saving space
- No additional land requirement
- Lower CAPEX and OPEX
- Simultaneous nitrification and denitrification reducing Nitrate recycle costs
- Better Quality of treated effluent for reuse and recycle
- Lower and well settled sludge production reducing sludge management costs
- Simple operation and maintenance

Ningan: Nitrification in winter

NINGAN SEWAGE TREATMENT PLANT - MUDANJIANG , CHINA

Sewage: 22,000 m³/day
Reactors: 4* 800 m³ = 3200 m³

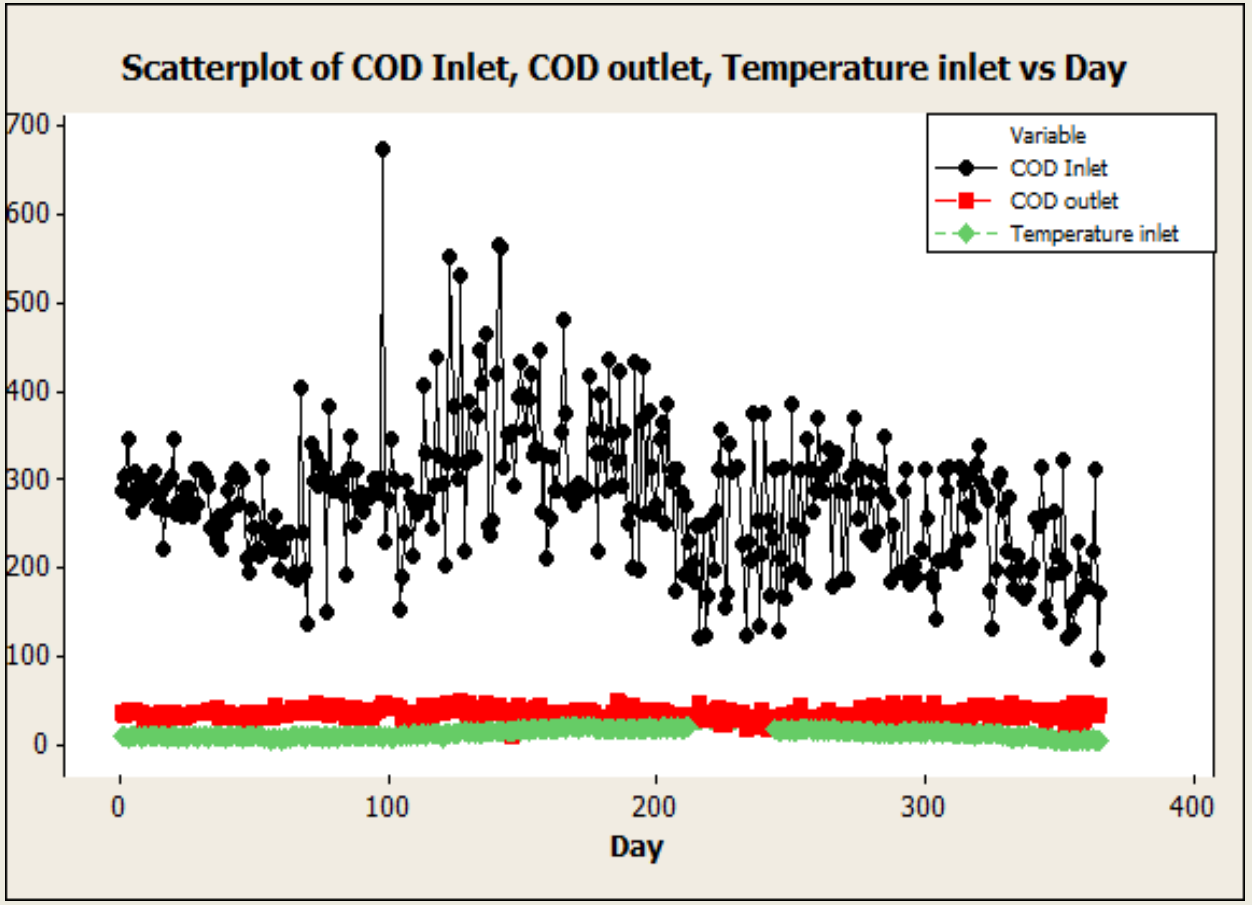
12.5 vol.% LEVAPOR Biocarrier
Retention time: 3.5 – 3.8 hours
Startup : October 1 , 2010

<u>Problem: COD removal in winter</u>

- **Winter begins in October**
- **Plant is only 250 km to Vladivostok**

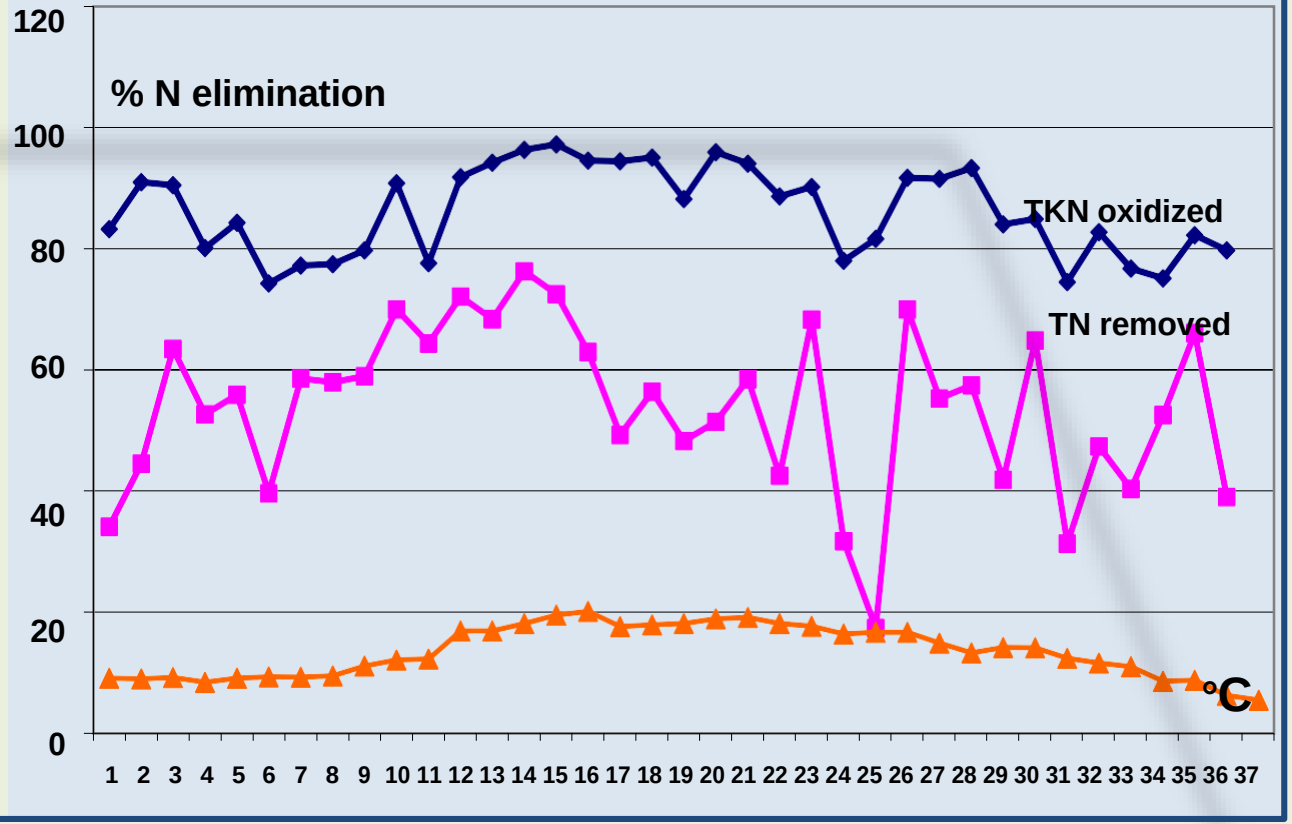
2013 Performance Summary

- Wider Fluctuations in inlet COD (96 - 670 ppm)
- Lower Temperatures
- (5.1 - 21 Degree C)
- Outlet COD (9 - 49.6 mg/litre)
- 86.3 % Mean COD reduction (61.9 -97.4%)
- 285 days COD < 39 mg/lit



Ningan STP: Nitrification in winter

TKN-oxidation and Total-N removal during different phases in 2013



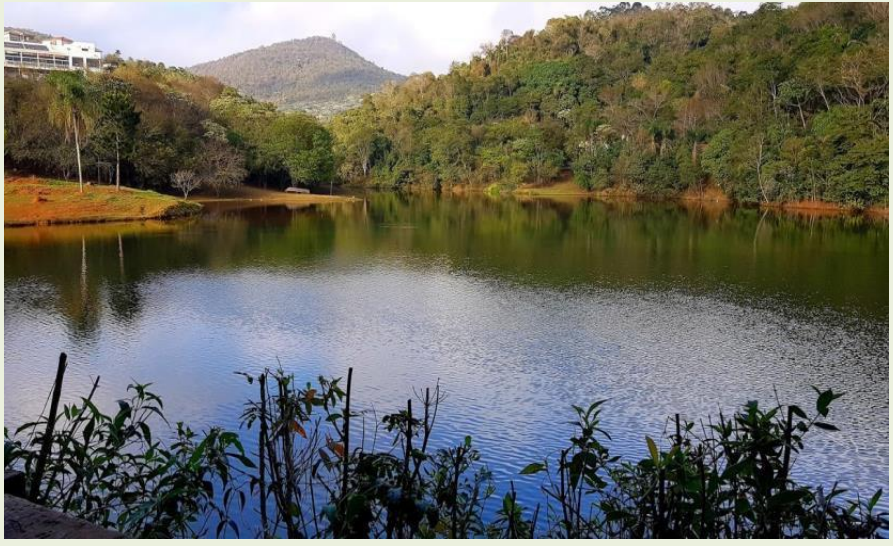
NINGAN, CHINA

- 88-90 % COD and 91-93% NH4.N reduction despite decreasing temperature and shorter HRTs
- Remarkable process stability against temp, COD, TKN variations
- Lower level of nitrate confirming denitrification
- Lower capital and operational cost

Genesis WWTP –
Sao Palo Brazil results:

1) Before LEVAPOR – no nitrification

2) 5 days after LEVAPOR addition –
18.4 % nitrification



WWTP Gênesis SABESP

Average SABESP last 12 months	IN	OUT	Efficiency
BOD	193	21	89,1%
COD	410	70	82,9%
N (mg/L)	51,0	46,0	9,8%

19/08/2018 — Application of Monera Levapor

Collect 24/08/2018	IN	OUT	Efficiency
BOD	317	32	89,9%
COD	790	115	85,4%
Ammonia Nitrogen	54,7	18,4	66,4%

Collect 31/08/2018	IN	OUT	Efficiency
BOD	550	24	95,6%
COD	1.207	70	94,2%
Ammonia Nitrogen	62,5	15,3	75,5%

Collect (with rain) 26/10/2018	IN	OUT	Efficiency
BOD	224	10	95,5%
COD	525	69	86,9%
Ammonia Nitrogen	43,9	3,2	92,7%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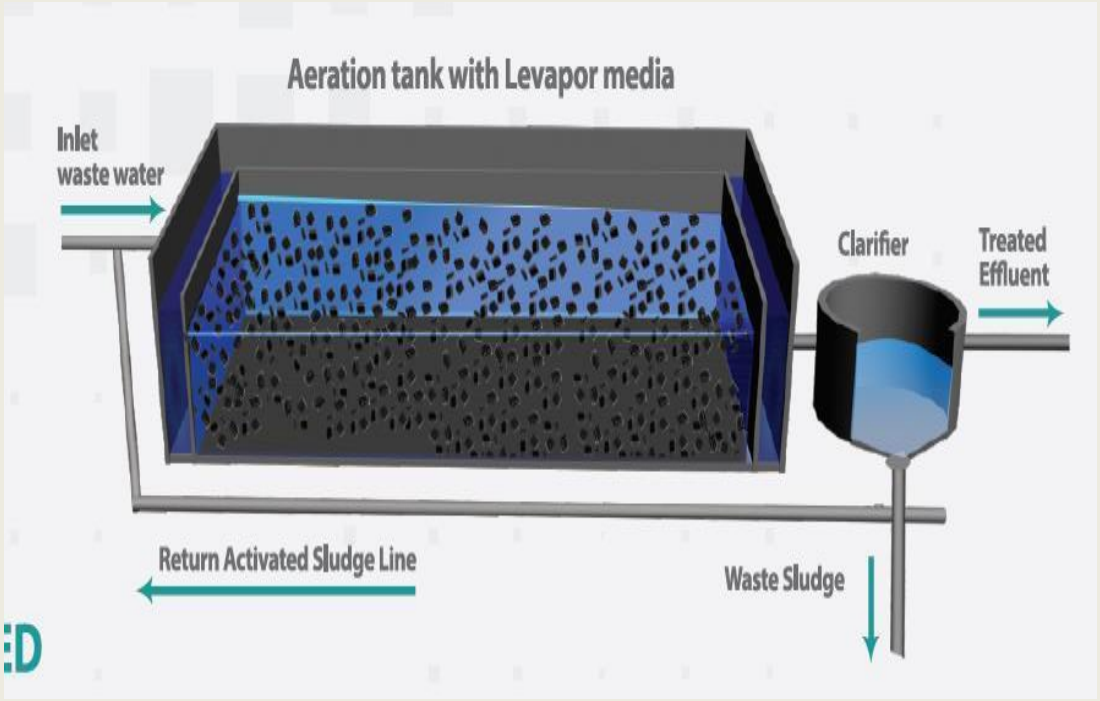
Compact MBBR plant for the treatment of municipal sewage

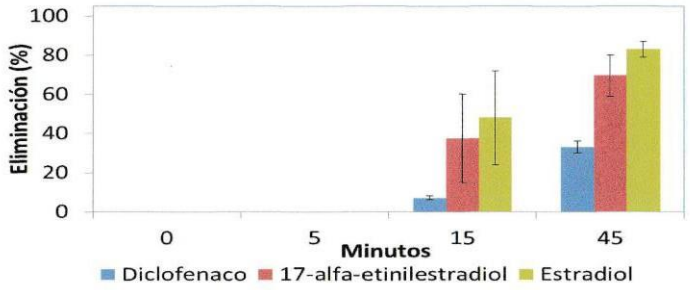
LEVAPOR: IFAS

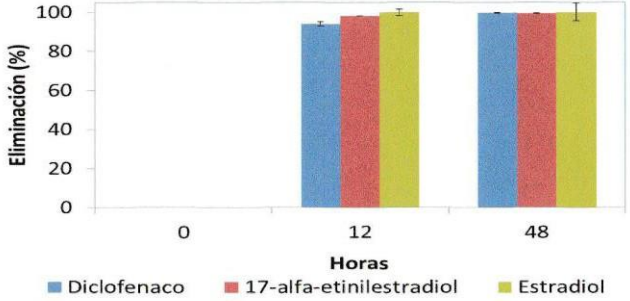


- Single Basin Construction
- 12 to 15 % Filling
- Loading Rates 2.5 to 4 Kg. COD/m3.day
- 6-8 mm retention screens
- Lower mixing energy requirement :
- 2-3 mg/lit Bulk DO
- 4-7 Nm3/m2.hr mixing air
- Up to 35% reactor volume saving compared to plastic media

Levapor post-treatment

- LEVAPOR: Plastic foam carrier with activated carbon on its surface





- In the first 45min, removal rates ranges from 33% and 83% depending on the compound
- After 12h, biodegradation occurred and removal rates >90% for all compounds

I+D+i

Removal of pharmaceuticals from municipal sewage by LEVAPOR biofilms

Two-step biotrickling filter (BTF) for the treatment of air, polluted with various complex pollutants

BENEFITS of LEVAPOR Biofilm Technologies

- higher plant performance
- higher process stability
- adsorbent surface
- 15 % to 50% less sludge
- better process economy
- easy upgrade of existing plants
- fast and simple realization
- widespread, several references (> 70 plants)

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