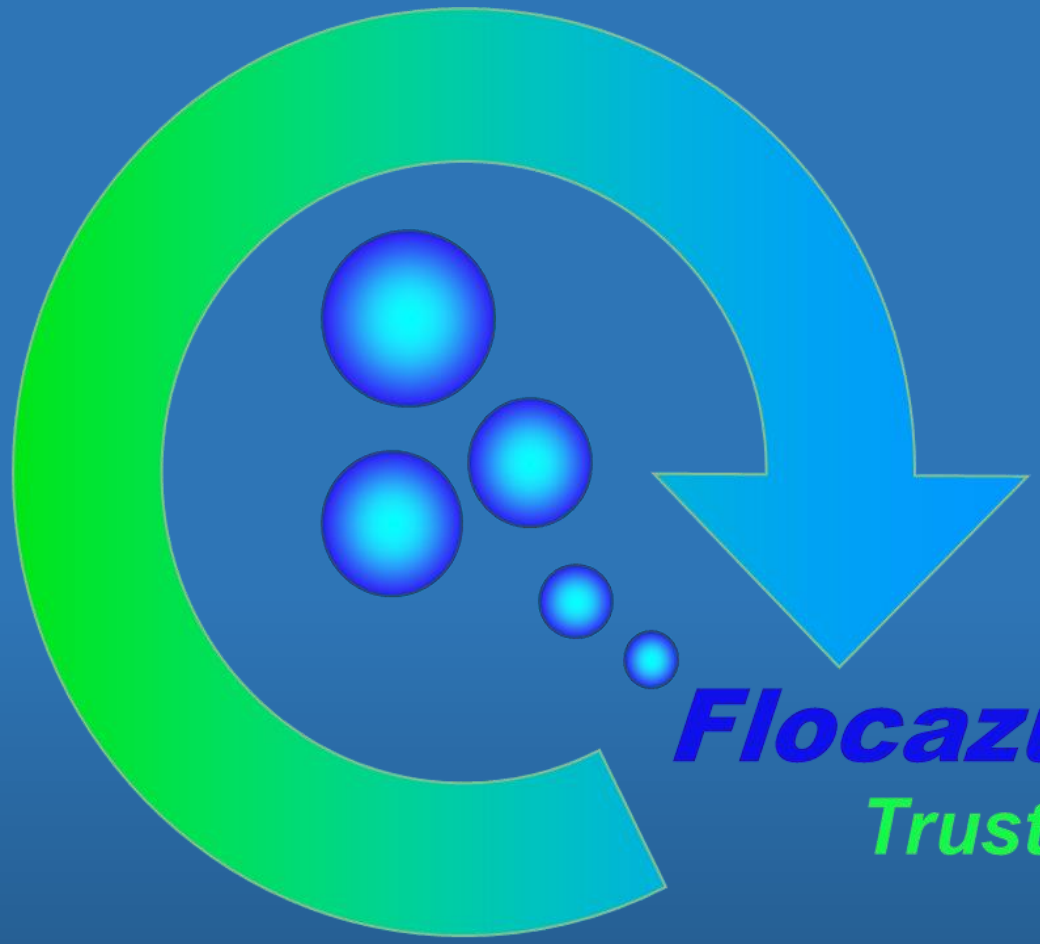


Flocazur AB

Trust Nature

Team

Ninni Petersson - CEO - Chairman of the Board

Marine biologist, Innovator, Entrepreneur and Project Manager with extensive experience in environmental assignments and project manager for a number of major projects.

Lena Nyström - R&D - Board member

Biomedical analysts with extensive experience in basic research in pharmacology at the University of Gothenburg, has been involved in the building of the Innovation and Entrepreneurship as Learning and Research at the Sahlgrenska Academy at Gothenburg University and has extensive experience of innovation and entrepreneurship outside the academy - to work early inventions / innovations and develop them into products

Luc Antelme - CTO – Board member

Water chemist, Process engineer, Entrepreneur and Innovator with extensive professional experience in water / drinking water production from France, where he worked for Lyonnaise des Eaux, a global company. Luc won eight times Lyonnaise des Eaux internal innovation contest.

Partners


VÄSTRA
GÖTALANDSREGIONEN


zacco


GUF
GÖTEBORGS
UPPFINNAREFÖRENING


CIT
Chalmers
Industriteknik


RI.
SE
Research Institutes
of Sweden


Jordbruks
verket
Swedish Board
of Agriculture

Patents

Sweden: *Approved*

USA: *Approved*

South Africa: *Approved*

Australia: *Approved*

China: *Approved*

Brazil: *Approved*

India: *patent pending*

EPO: *Approved*

Russia : *Approved*

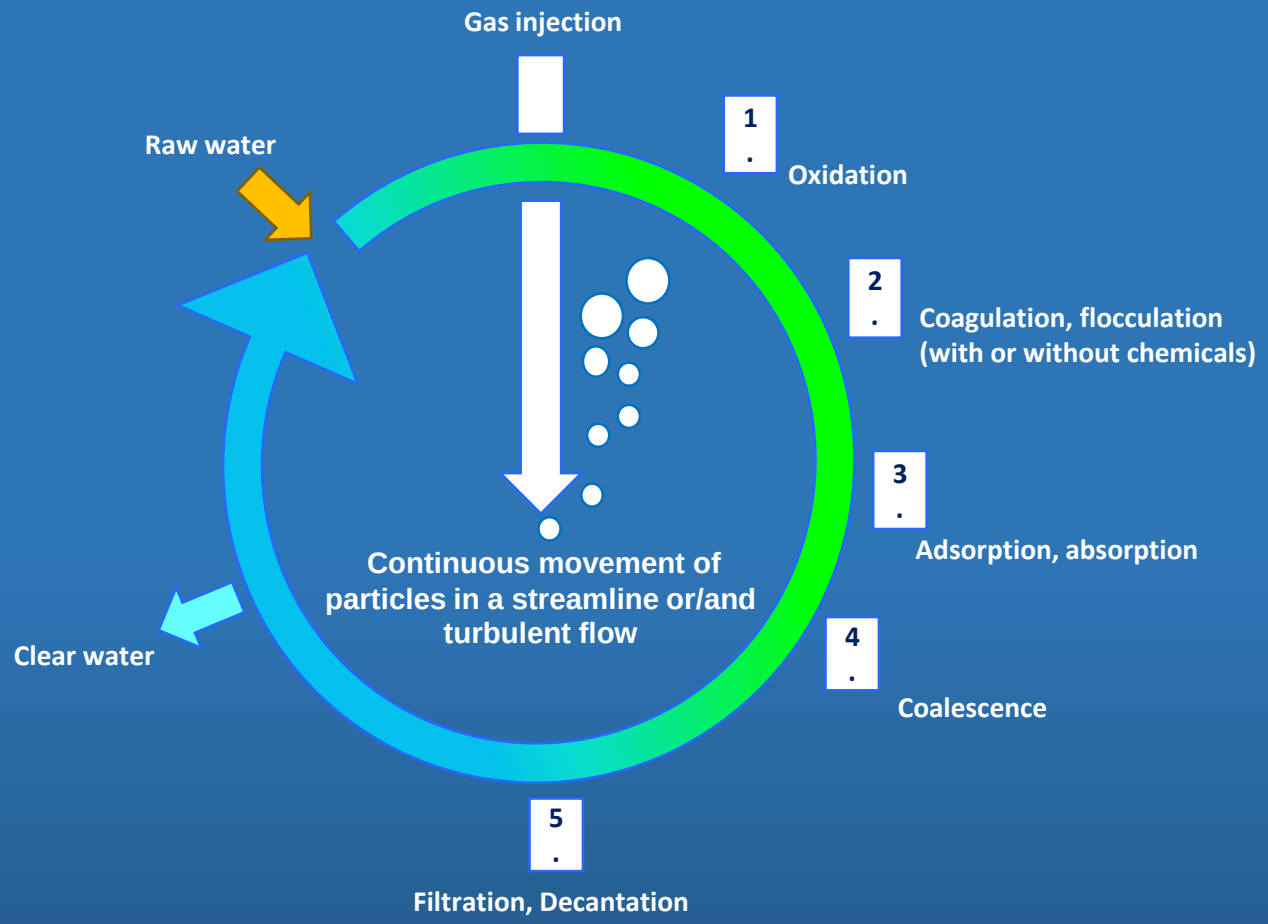
Unique technology

- Our new, patented, Flocazur is a separation technique that only consist of one step – five different reactions in one reactor a new and unique design.
- The technology functions as a super charging particle system with e. g. zeolite, bentonite, sepiolite, activated charcoal etc.
- The Flocazur technology is very flexible, could be scaled into different sizes and could constitute a whole treatment installation or be a part of an already existing treatment plant.
- The technology has a big market potential when it could be used for aquaculture, wastewater, drinking water, storm water, process industries, beverage industries and households.

Using natural forces

The main principals are: high kinetic energy, covalent bonds, hydrogen bonds, polar and through van der Waals-London bonds . Together, these forces cause ionic and molecular destabilization, which leads to precipitation that in turn causes coagulation and flocculation (formation of micro flocs to macro flocs). These reactions make a coalescence, a homogeneous suspension and sludge formation with efficient filtration effect.

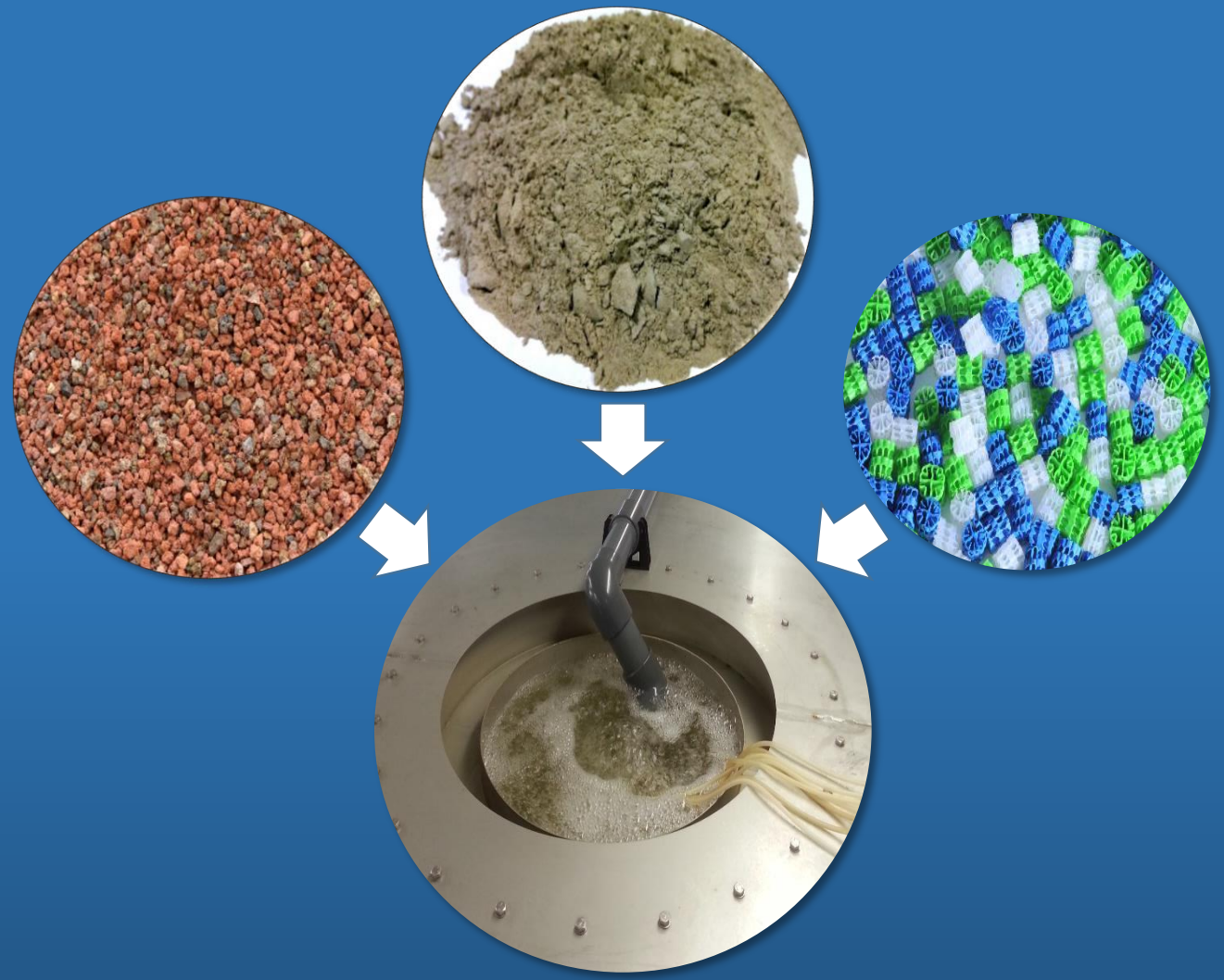
The Flocazur reactor is designed to make maximum use of this coalescence and thus achieve a fast and efficient sludge formation, with the right physical - chemical characteristic for separation. The increasing number of collisions between the particles and the macro flocks, which takes place in the reactor, enables the neutralization and separation of various substances fast and efficiently. In this way one can entirely avoid or drastically reduce the use of additional or complicated process steps and hazardous binding material such as metal salts or polymers.



Using natural forces

Besides flocculation, there is also an effective flotation or protein separation in the reactor's central upper part, where the hydrophobic substances, for example fats and hydrocarbons are separated. Different types of gases can be used for different reactions and the technology works as a liquid filter, which in turn avoids the operational problems, caused by filter replacements.

Flocazur is also an effective technology for biological transformation in various technical fields such as activated sludge process (bacterial oxidation), MBR (Moving Bed Reactor), MBBR (Moving Bed Biofilm Reactor) GSBR (Granular Sequencing Batch Reactor) and GSBBR (Granular Sequencing Biofilm Batch Reactor) especially the nitrification, denitrification and mineralization of organic substances.

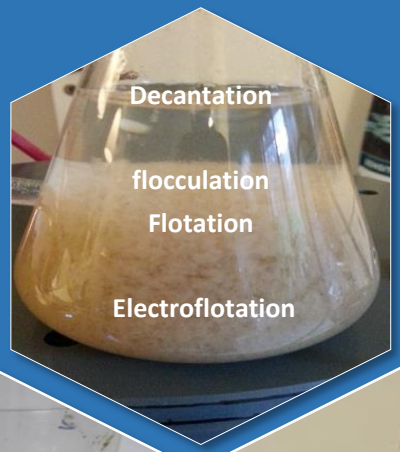


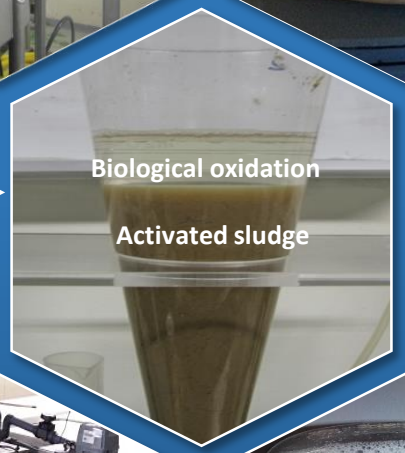
Flocazur technical fields

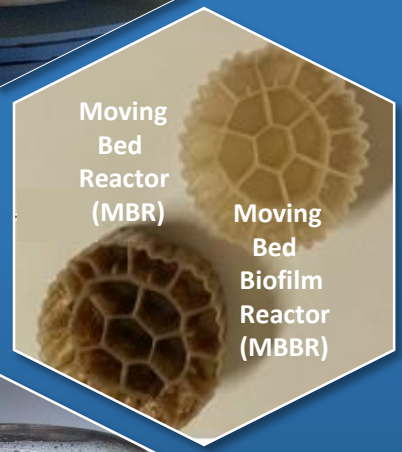
Primary

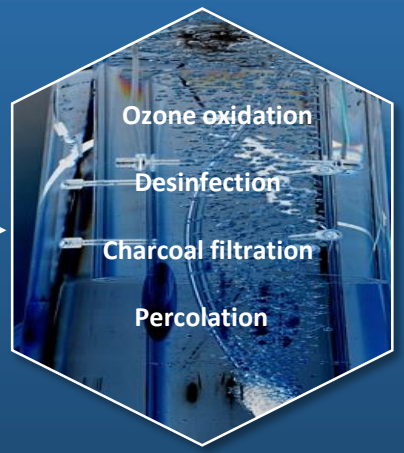
Secondary

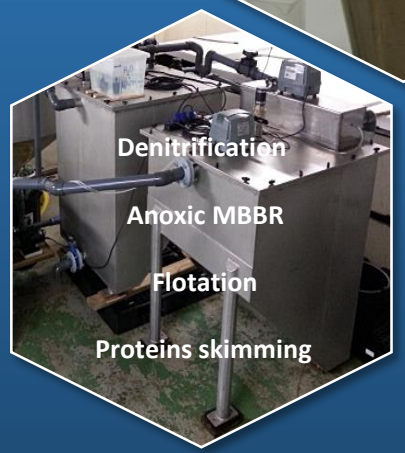
Tertiary

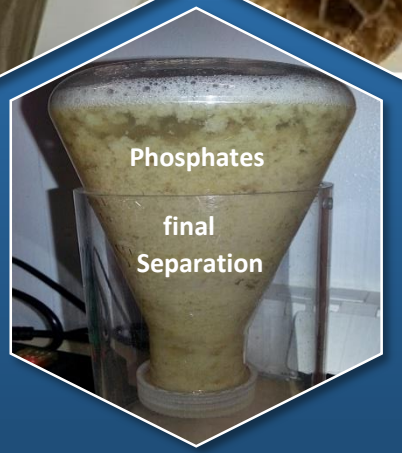












Technological advantages

- Works over a wide range of temperatures
- Works on many liquids over wide ranges of densities and viscosities
- Optimizes pH and alkalinity management
- Increases oxygen level and redox potential
- Optimizes the reaction time for adsorption, absorption, coagulation and flocculation
- Works with particles of different volumes and mass
- Effectively reduces suspended solids, hydrocarbons, nitrogen and phosphor
- Optimizes sludge thickening and coalescence
- Optimizes the production of sludge, both in quality and quantity
- Effectively reduces chemical oxygen demand (COD), biological oxygen demand (BOD) and total organic carbon (TOC)
- Optimizes biological capacity for nitrification and denitrification
- Efficient skimming of seawater
- Reduces energy consumption
- Reduces the use of chemicals
- Is scalable and can be included in another clarification process or perform on its own

By means of

- New innovative reactor design
- New innovative blending technique
- Optimization of chemical reactivity
- Effective stripping of harmful gases
- Effective dispersion of hydraulic energy in the reactor between processes
- Optimization of oxidation by a more efficient diffusion technique of air or ozone
- Optimization of the particle interaction rate in the reactor / coagulation
- Optimization of flocculation by efficient energy transfer after coagulation
- Optimization of growth and bacteriological reactivity with or without natural carriers
- Perfectly suited for MBR, MBBR, GSBR and GSBBR bed systems
- Longer Hydraulic Retention Time (HRT) in the reactor
- Simultaneous management of flotation and settling

Tests

Chalmers University Gothenburg

% reduction clear phase (process water SCA)

Ref	Mg 2+	N-TOT	P-TOT	TOC
mg/l	9.73	21.7	3.43	2038
1:15´	4.28	11.8	1.96	1130.5
%	56	46	43	45

MITT Sundsvall University

% reduction clear phase (process water SCA)

Ref	TC		TOC	TOC red
ppm	1342	IC 1.3	1340.7	%
15´	945	3.7	941.3	30

Spendrups brewery

% reduction clear phase (marc liquid 60°C)

Ref mg/l TSS	9800 mg/l
Skum TSS	30 000 mg/l
15´	1900 / 81%

Separation tests for brewing liquid - Spendrups Grängesberg 2012 (Sweden)

PS	T°C	Q	Ref	Red 60´	Red %
> 5	30	160,0	85909	22377	74,0
> 15	30	160,0	17315	764	95,0
> 30	30	160,0	4600	66	98,5
> 50	30	160,0	1393	11	99,2
> 100	30	160,0	192	7	96,3
> 150	30	160,0	31	4	87,0
> 200	30	160,0	18	0	100
> 400	30	160,0	0	0	100
> 500	30	160,0	0	0	100
> 1500	30	160,0	0	0	100

Analyzes by SWEREA and IVF laboratories

PS: Particle sizes (µm)
T°: Temperature (degree Celsius)
Q: Flow of the liquid (l/h)
Ref: Number of particles in the liquid
Red 60´: Separation of particles after 60´
Red %: Global particles reduction

Test of the Flocazur Recirculating Aquaculture System (RAS) - Zoologen Gothenburg University

*MBR: Moving Bed Reactor
* GBR: Granular Bed Reactor

Conditions of the experiment

Objectives of the experiment: control of the pH level, reduction of Ammonia NH4+, Nitrites NO2-, Nitrates NO3- and total Phosphorus P-Tot.

pH >7,0
NH4+ < 1mg/l
NO2- < 1mg/l
NO3- < 50mg/l
P-Tot < 1 mg/l

Water: Freshwater
Fish: *Oncorhynchus Mykiss*
Weight per fish: 80,0 g
Total Biomass: 2x1,6 kg
Fish tanks: 2x70 L
Flow rate/tank: 30 L/H
Flow in the Flocazur reactor: 90 L/H
Flow in the denitrification reactor: 0,2 l/minute
Food distributed: 2x15 g/day
Pellets - Proteins level: 45%
Duration of the test: 23 days
No water change

Zoologen RAS system:
*MBR volume: 2x200 l (kaldnes)
Sand filters: 2x3m3
Maturity of the system: several years

Flocazur RAS system:
*GBR volume: 0,5 l
Volume of the reactor: 12 l
Denitrification reactor: 3,0 l
*Maturity of the
Flocazur GBR system: 23 days

Test results

1/ **Zoologen RAS system** (MBR and sand filters):
pH: 6,8
NH4 +: 0,00 mg/l
NO2-: 0,05 mg/l
NO3-: 58,0 mg/l
P-Tot: 1,88 mg/l

2/ **Flocazur RAS system** (GBR and denitrifcation)
pH: 7,3
NH4 +: 0,00 mg/l
NO2-: 0,30 mg/l* (but not critical)
NO3-: 49,0 mg/l
NO3- after denitrification: 4,70 mg/l
P-Tot: 0, 51 mg/l

Flocazur RAS industrial scale

Recirculating Aquaculture System (RAS)

Three years validation project funded by

European fisheries fund

and

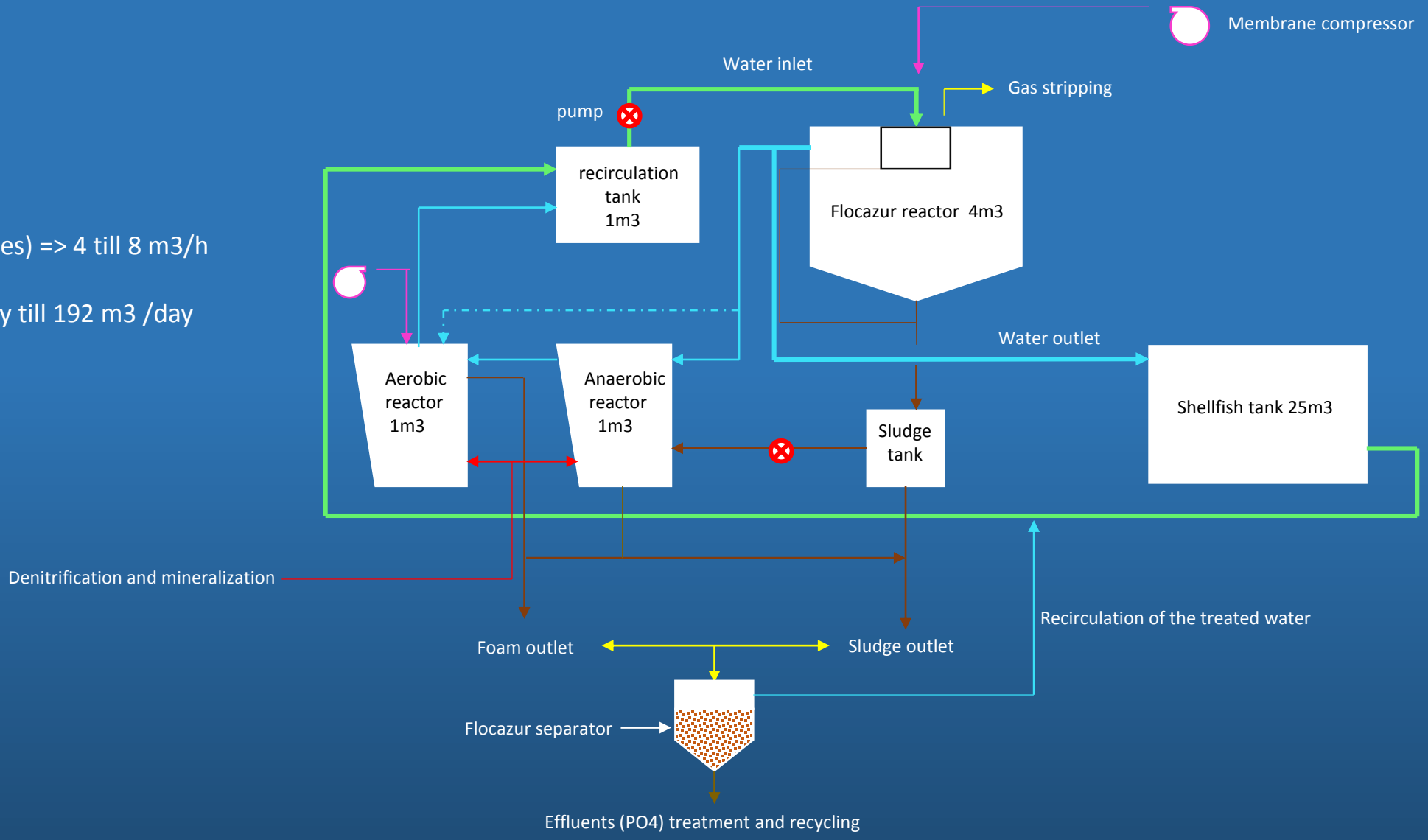
Havsmiljöfonden - Swedish government

EUROPEISKA UNIONEN
Europeiska fiskerifonden
- En satsning på hållbart fiske -

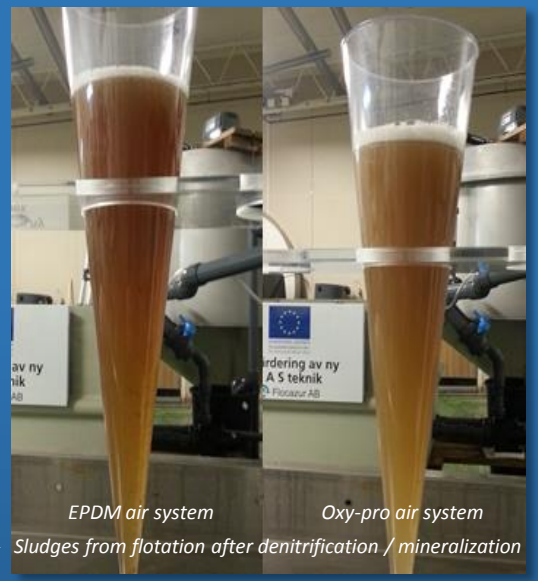
Flocazur pilot *Kvalitetskräftan Fjällbacka HB* - Sweden

Q (flow rates) => 4 till 8 m3/h

96 m3 /day till 192 m3 /day



Sludge produced by Flocazur RAS system

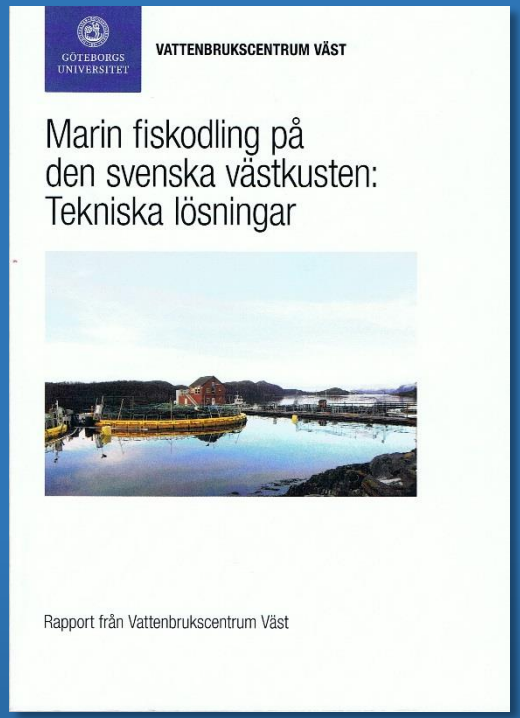


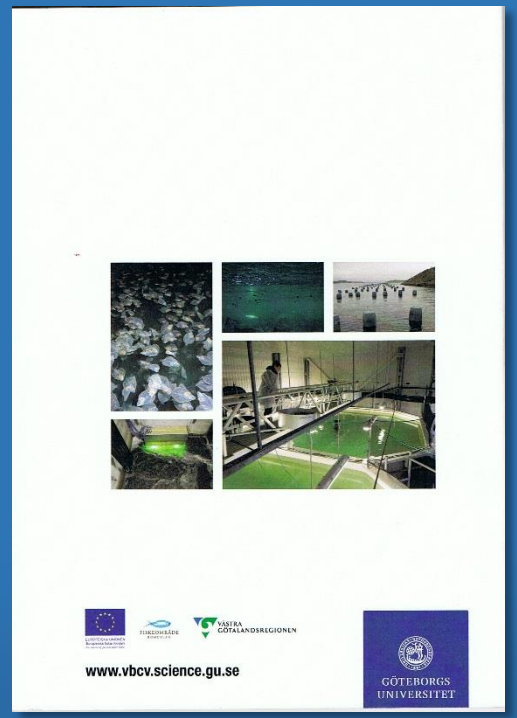
Recirculation of treated water

Results after one year operation without exchange of water

Parameter	Ref	Res
Temperature:	**< 8° C**	**9.9**
Oxygen (O2):	> 50 %	97.0
pH:	7.5 till 8.5	7.66
Ammonium (NH4+):	< 1.0 mg/l	0.00
Nitrite (NO2-):	< 1.0 mg/l	0.33
Nitrate (NO3-):	< 50.0 mg/l	9.70
Tot-P (phosphorus):	< 1.0 mg/l	0.16
Flow (Q):	2 till 7m3/h	3.20
Salinity:	30-32 ‰	32.0
Total biomass treated:	Kg	10 000
Total water volume:	m3	31.0

References *(swedish)*





Final report of Evaluation of Flocazur water treatment technology for pisciculture – Validation of new water treatment technology for land based aquaculture, Board of agriculture Dnr: 31-3837-10, Board of agriculture Journal nr: 2012-712, Kund nr O 168 34, County Government Dnr: 622-539-2011.

Vattenbrukscentrum väst, Göteborgs universitet (Aquaculture Centre West, University of Gothenburg) Marin fiskodling på den svenska västkusten: Tekniksa lösningar (Marine fish farming on the Swedish west coast: Technical solutions) report nr 4, ISBN: 978-91-982551-0-2

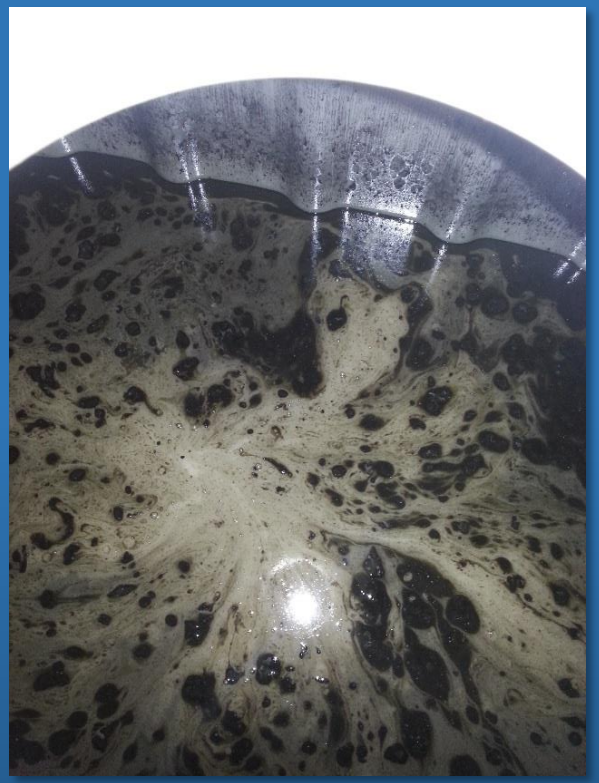
Test liquids from Germany (15.12. 2014)

-

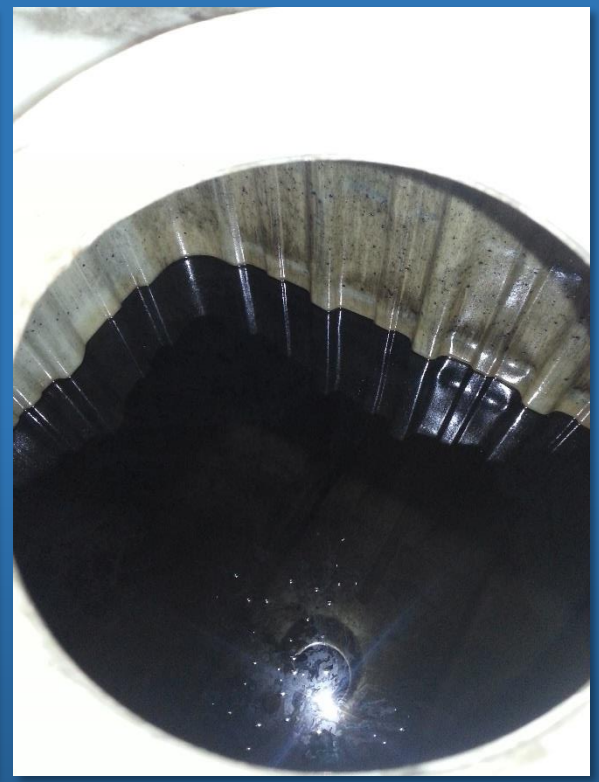
Liquid: Emulsion from metal industry

Liquid: Floor Scrubber Unit

Content: Oils
Surfactants
Heavy metals
Aliphatic hydrocarbons
Aromatic (polycyclic) hydrocarbons
COD (Chemical Oxygen Demand)



Emulsion from metal industry



Floor scrubber unit

Emulsion from metal industry

Parameter/units Emulsion	Before Treatment	After Treatment	% Reduction	After activated carbon filtration	% Reduction
pH-value	8,40	5,60	.	6,70	.
Conductivity µS/cm	262	867*	+ 70.0*	815*	+ 67.8*
COD mg/l	62 000	50 000	20.0	30 000	52.0
Lead µg/l	220	3.30	98.5	1.10	99.5
Cadmium µg/l	0.26	0.09	65.0	< 0.02	92.3
Copper µg/l	650	49.0	92.5	34.0	95.0
Zinc µg/l	8200	580	93.0	130	98.4
Aliphatics					
C5-C8 mg/l	0.11	0.021	81.0	<0.01	91.0
C8- C10 mg/l	4.00	2.50	38.0	0.22	95.0
C10 – C12 mg/l	6.70	32.0*	+ 79.0*	0.70	90.0
C12 – C16 mg/l	73.0	1.10	98.5	0.14	99.8
C16 – C35 mg/l	470	21.0	96.0	6.70	98.6
Aromatics					
C8 – C10 mg/l	0.051	<0.01	80.4	< 0.01	80.4
C10 – C16 mg/l	0.14	<0.01	92.8	< 0.01	92.8
C16 – C35 mg/l	0.019	<0.002	89.5	< 0.002	89.5

Comments:

Conductivity => Poly-Aluminium Chloride and Sodium hydrogen Sulphate is used

C10 – C12 => Chemical reactions with low pH . Activated carbon filtration is used

Floor Scrubber Unit

Parameter/units Floor scrubber Unit		Before Treatment	After Treatment	% Reduction	After activated carbon filtration	% Reduction
pH-value		7.40	4.70	.	7.00	.
Conductivity µS/cm		166	265*	+37.3*	266*	+ 37.5*
COD	mg/l	67 000	5700	92.0	91.0	99.0
Lead	µg/l	2400	1.00	99.9	0.24	99.9
Cadmium	µg/l	20.0	0.03	99.9	0.055	99.7
Copper	µg/l	3100	1.40	99.9	<0.50	99.9
Zinc	µg/l	130 000	4800	96.0	640	99.5
Aliphatics						
C5-C8	mg/l	0.10	0.024	76.0	<0.01	90.0
C8- C10	mg/l	1.30	0.047	96.4	<0.01	99.2
C10 – C12	mg/l	0.00	5.30*	+100*	0.014	99.7
C12 – C16	mg/l	0.00	0.24*	+100*	< 0.01	96.0
C16 – C35	mg/l	0.00	6.40*	+100*	0.49	92.3
Aromatics						
C8 – C10	mg/l	0.00	<0.01	.	<0.01	.
C10 – C16	mg/l	0.00	<0.01	.	<0.01	.
C16 – C35	mg/l	0.00	<0.002	.	<0.002	.

Comments:

Conductivity => Poly-Aluminium chloride and sodium hydrogen sulphate is used.

C10 – C35 => Chemical reactions with low pH. Activated carbon filtration is used

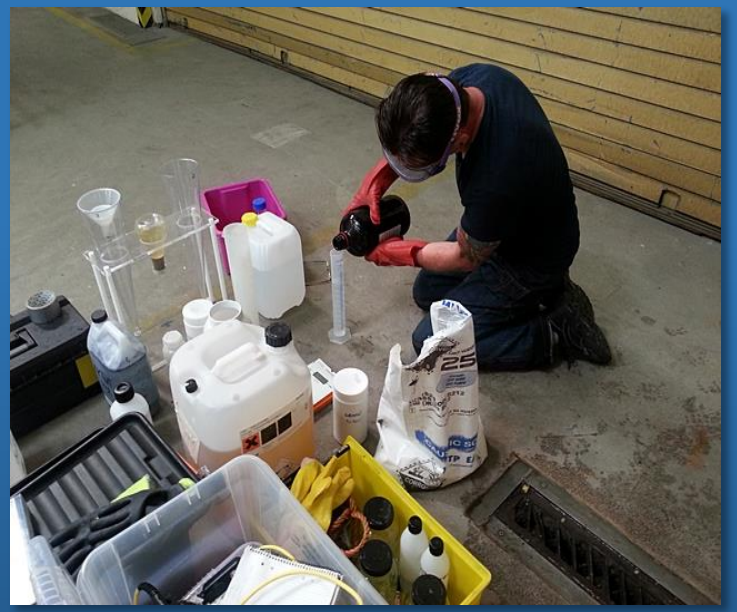
Aromatics => No measurable aromatic compounds

Visual results

Emulsion from metal industry

Liquid from floor scrubber unit

Technical validation of the Flocazur technology for a international german company 03.07 – 07.07.2015



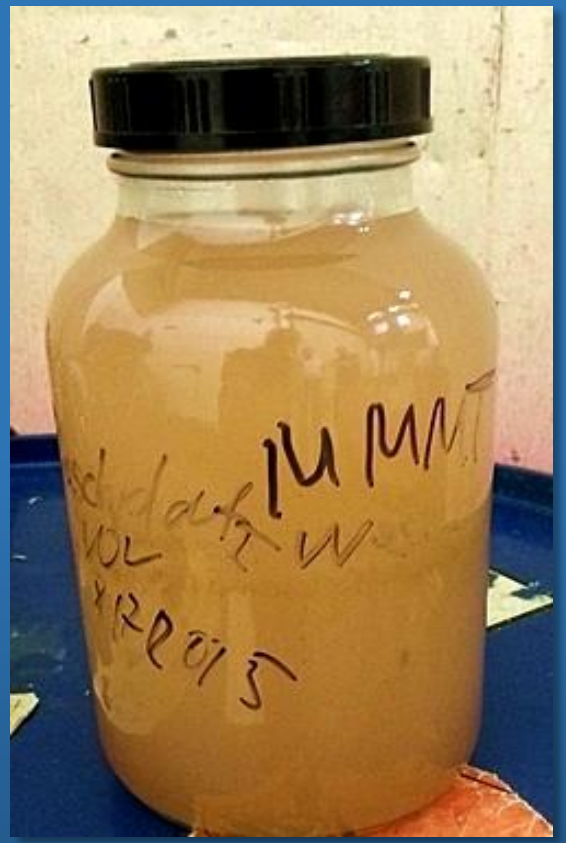
Flocazur: test *no. 1*

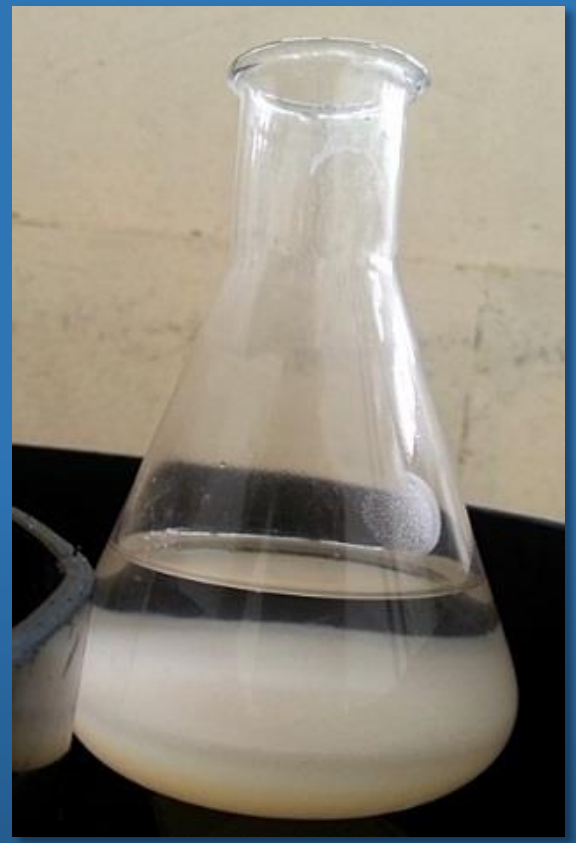
Flocazur: result *no. 1*

Parameter/units		Before Treatment	After Treatment	% Reduction
pH-value		9.3	6.1	.
Conductivity	µS/cm	2900	7400*	+ 61.0*
COD	mg/l	110 000	74 000	33.0
Hydrocarbons	mg/l	400	< 0.5	99.9
Lead	mg/l	0.017	0.006	65.0
Cadmium	mg/l	< 0.005	<0.005	0.00
Copper	mg/l	0.76	2.3*	+ 67.0*
Zinc	mg/l	2.2	1.8	18.0

*Cause: Poor decantation with PAC => high temperature (57°C)

Flocazur: test *no. 2*



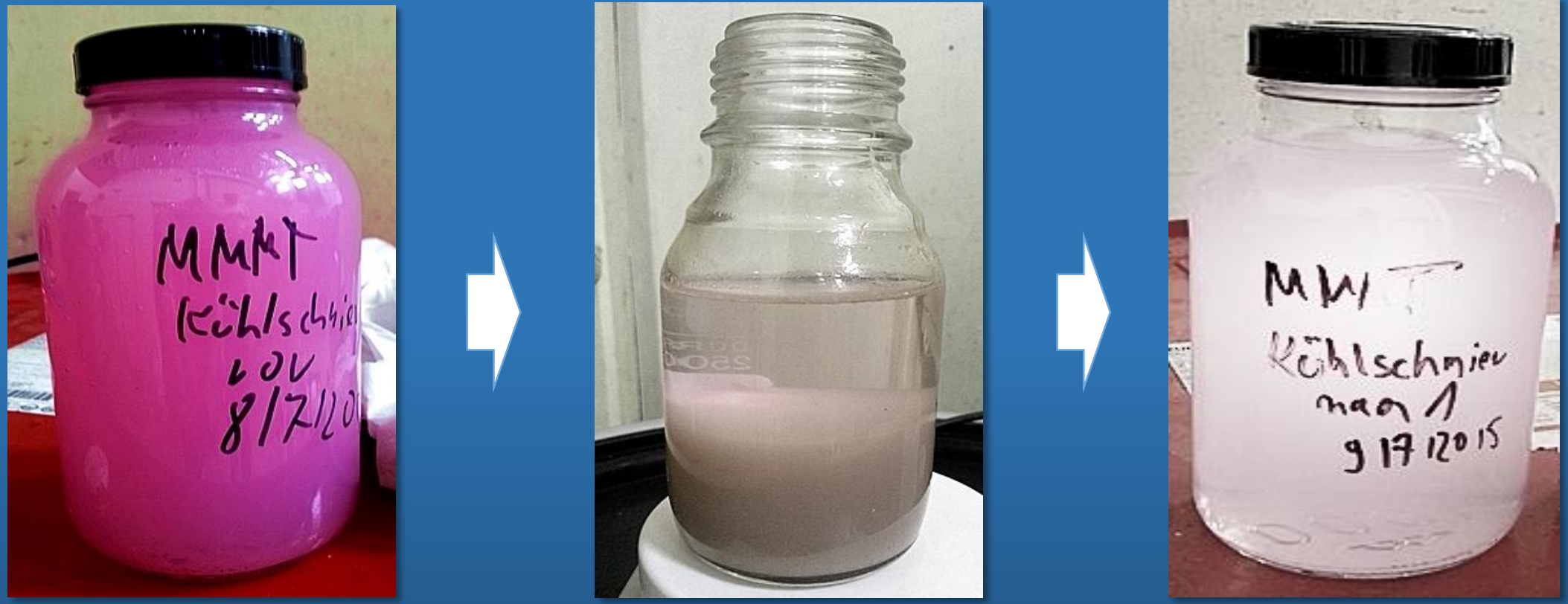


Flocazur: result *no. 2*

Parameter/units		Before Treatment	After Treatment	% Reduction
pH-value		8.30	11,8	.
Conductivity	µS/cm	390	1800*	+ 78.0*
COD	mg/l	2800	620	78.0
Hydrocarbons	mg/l	300	23.0	92.3
Lead	mg/l	0.17	0.007	96.0
Cadmium	mg/l	< 0.005	<0.005	0.00
Copper	mg/l	0.32	0.04	87.5
Zinc	mg/l	0.59	0.04	93.2

*Cause: Unrefined media (raw bentonite) and sodium hydroxide

Flocazur: test *no. 3*

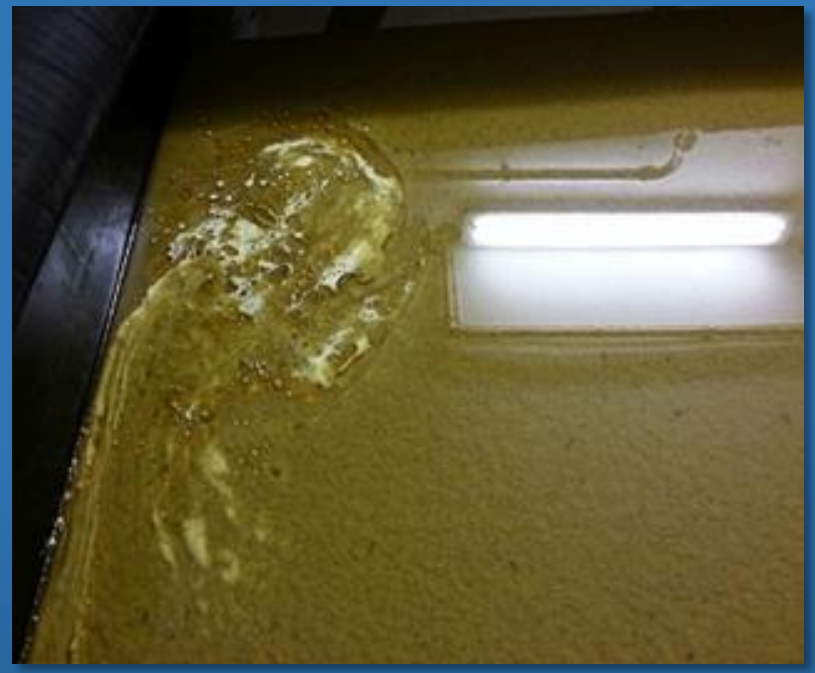


Flocazur: result *no. 3*

Parameter/units		Before Treatment	After Treatment	% Reduction
pH-value		6.70	12,6	.
Conductivity	µS/cm	290	7800*	+ 96.0*
COD	mg/l	350	55.0	84.3
Hydrocarbons	mg/l	6.50	< 0.5	92.3
Lead	mg/l	0.27	0.005	98.0
Cadmium	mg/l	< 0.005	<0.005	0.00
Copper	mg/l	0.50	0.09	82.0
Zinc	mg/l	0.51	0.01	98.0

*Cause: Unrefined media (raw bentonite) and sodium hydroxide

Flocazur test *no. 4*



Washing
of
emulsion

separation
of
Oil

flocculation
of
emulsion

Flocazur: result *no. 4*

Parameter/units		Before Treatment	After Treatment	% Reduction
pH-value		7,80	3,80	.
Conductivity	µS/cm	2300	44000*	+ 95.0*
COD	mg/l	74000	25000	66.0
Hydrocarbons	mg/l	130 000	5500	96.0
Lead	mg/l	1200	690	42.5
Cadmium	mg/l	< 0.021	<0.011	48.0
Copper	mg/l	48.0	8.70	82.0
Zinc	mg/l	65.0	34.0	48.0

*Test performed with sodium chloride and sulfuric acid

Core values

- Works without, or very low, amounts of chemicals
- Works in fresh- and saltwater
- Free of mechanical parts
- Time effective process
- Reliable
- Flexible constructions, applications
- Energy saving
- Low maintenance
- Longevity
- Cost effective technology

Potential Markets

- Seawater
- Storm water
- Wastewater
- Drinking water
- Aquaculture
- Beverage
- Household

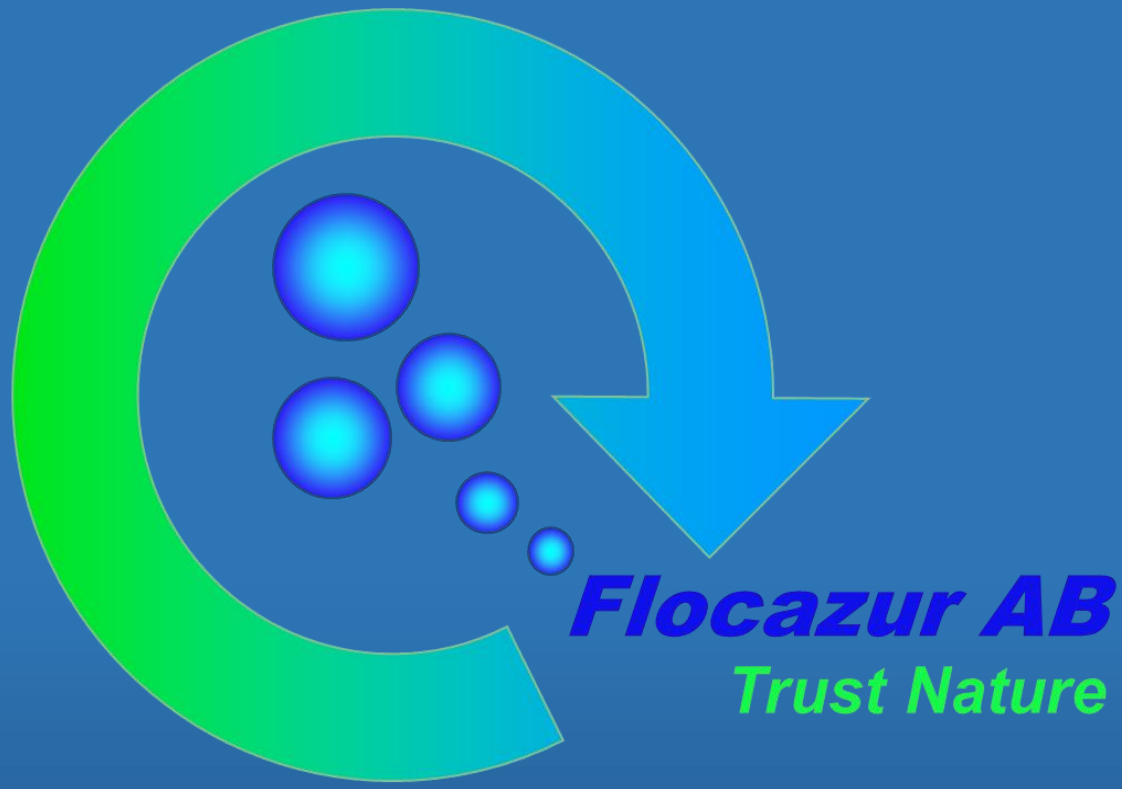
Improvement of water quality

Chemical controls

Sludge production

Biogas / Energy

Recycling industry



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