



ALBAQUA

Biotechnological effluent treatment

AquaFUELS project Final Conference June 30th, 2011

Combined ALgal and BActerial waste water treatment for high
environmental QUALity effluents

CORNET-Projekt 23 EN „**ALBAQUA**“

Duration: 01.09.2009 – 31.12.2011

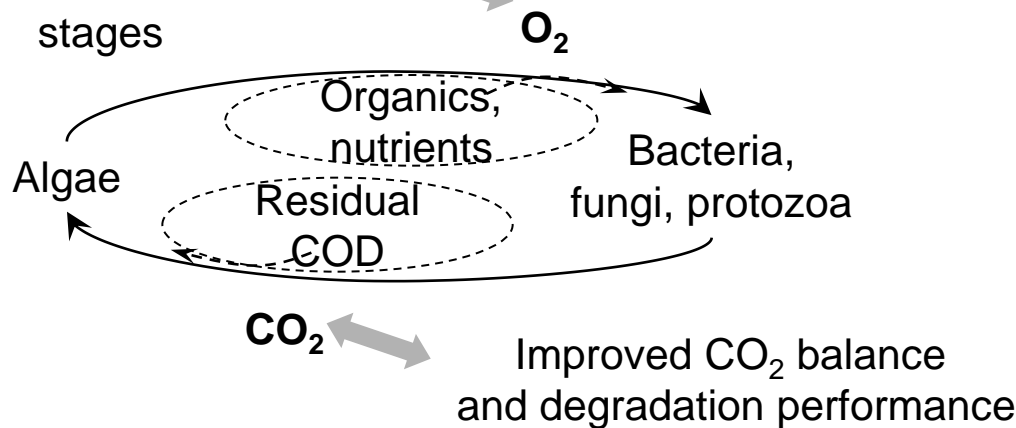
G. Weinberger, S. Bierbaum, C. Hentschke

- 1. Overview of project structure, partners, objectives and execution**
- 2. Materials and Trials**
- 3. Results so far**
 - **Cultivation**
 - **Degradation performance**
 - **Biomass characteristics**
- 4. Summary**



Algae in effluent treatment

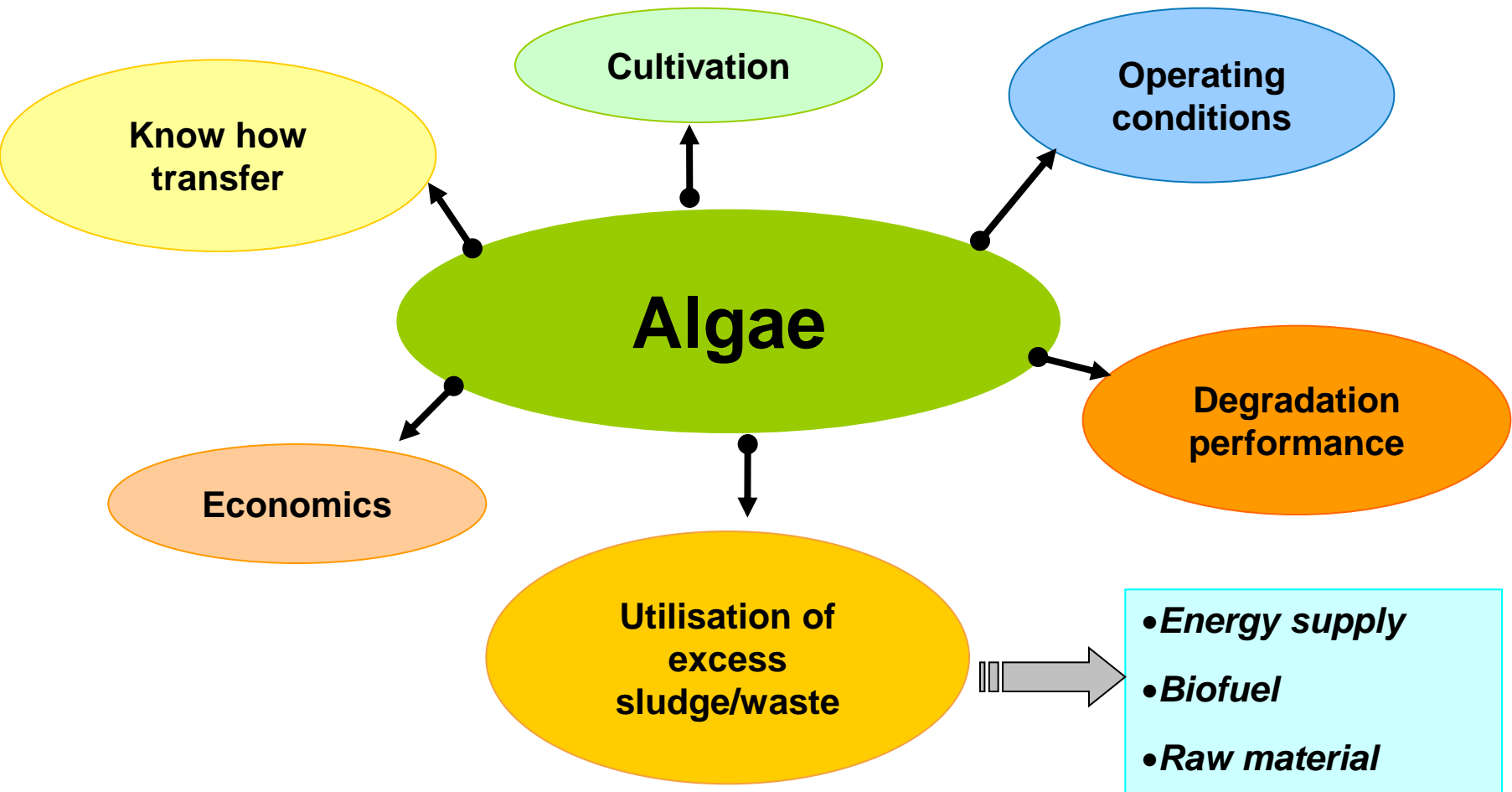
Reduced energy demand for O_2 supply to aerobic treatment stages



Possible application for paper industry?

Algae are autotrophic organisms – they may provide

- Increased degradation performance, due to specific algal degradation ability
- Improved CO_2 balance due to metabolic processes consuming CO_2
- Photosynthesis supplying oxygen to heterotrophic microorganisms, thus lowering the energy demand for oxygen supply in aerobic treatment stages.



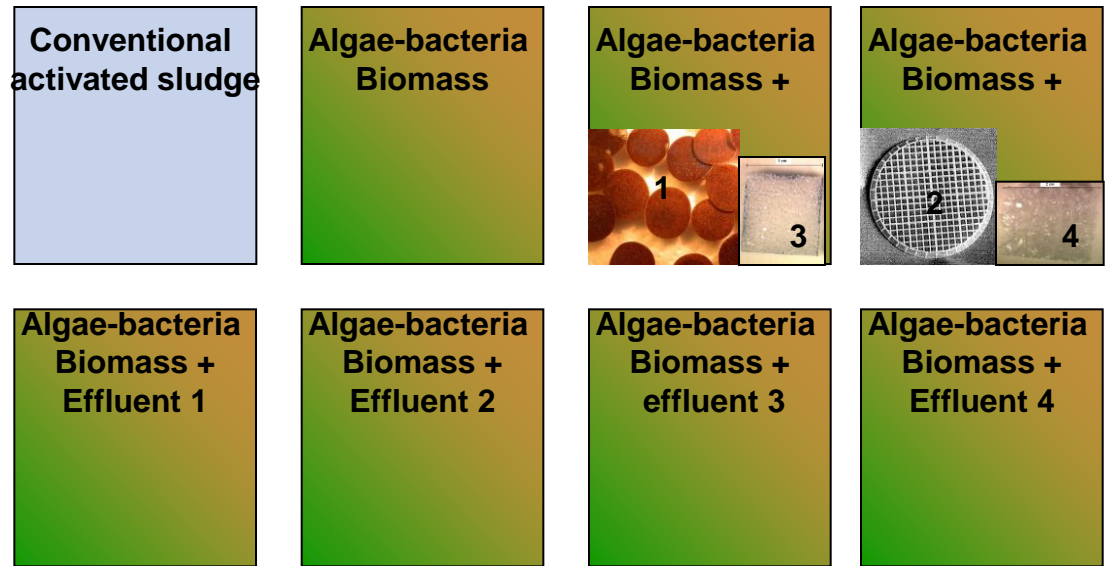
WP 1	Cultivation of suitable algae species
WP 2	Algae fixation techniques
WP 3	Operation of single algae-bioreactor
WP 4	Design of pilot system
WP 5	Degradation performance
WP 6	Utilisation of excess biomass
WP 7	Pilot plant trial
WP 8	Evaluation of benefits of effluent treatment by algae
WP 9	Evaluation of Economics

Currently all trials with *Chlorella vulgaris*

Parallel testing

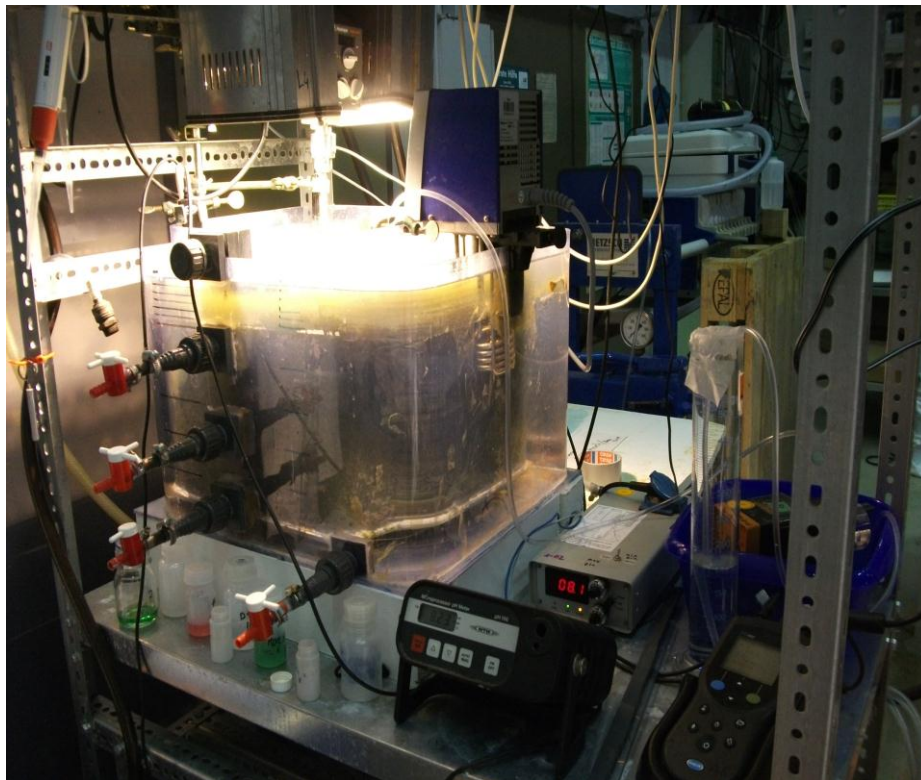
Algae fixation trials

Degradation performance of various effluents from paper industry



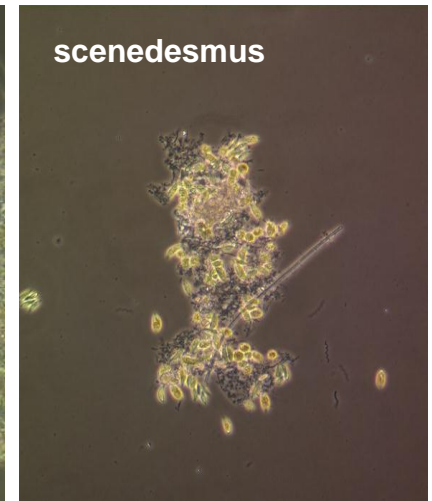
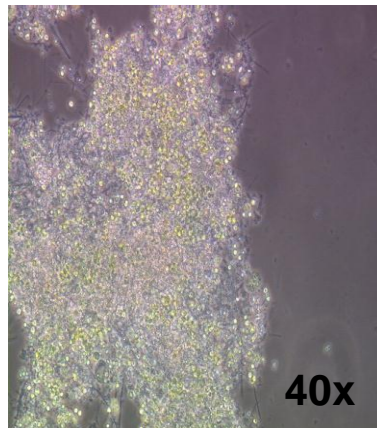
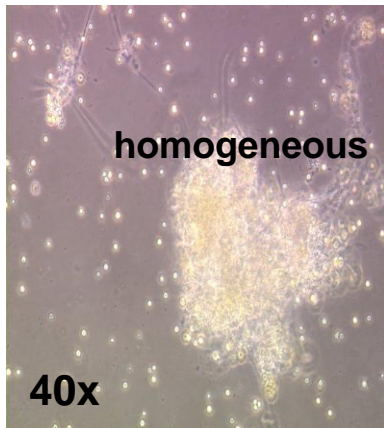
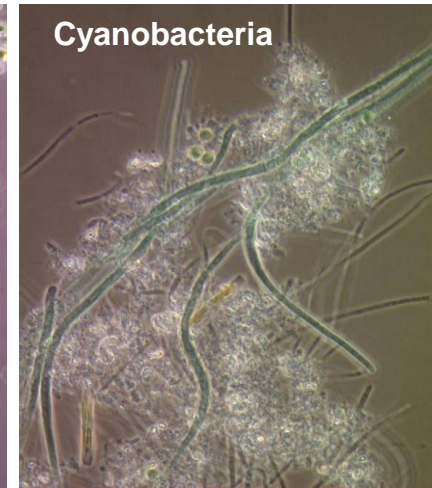
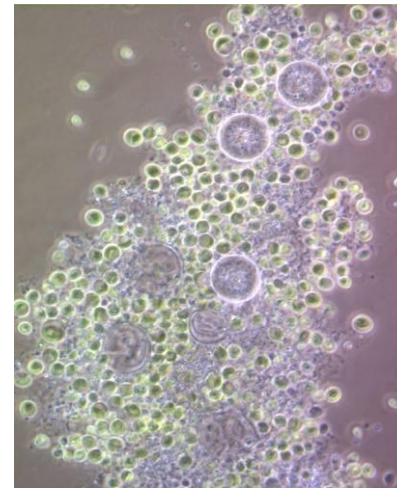
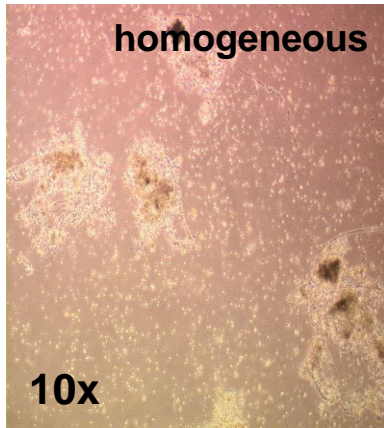
Nearly similar operating conditions in all bioreactors!

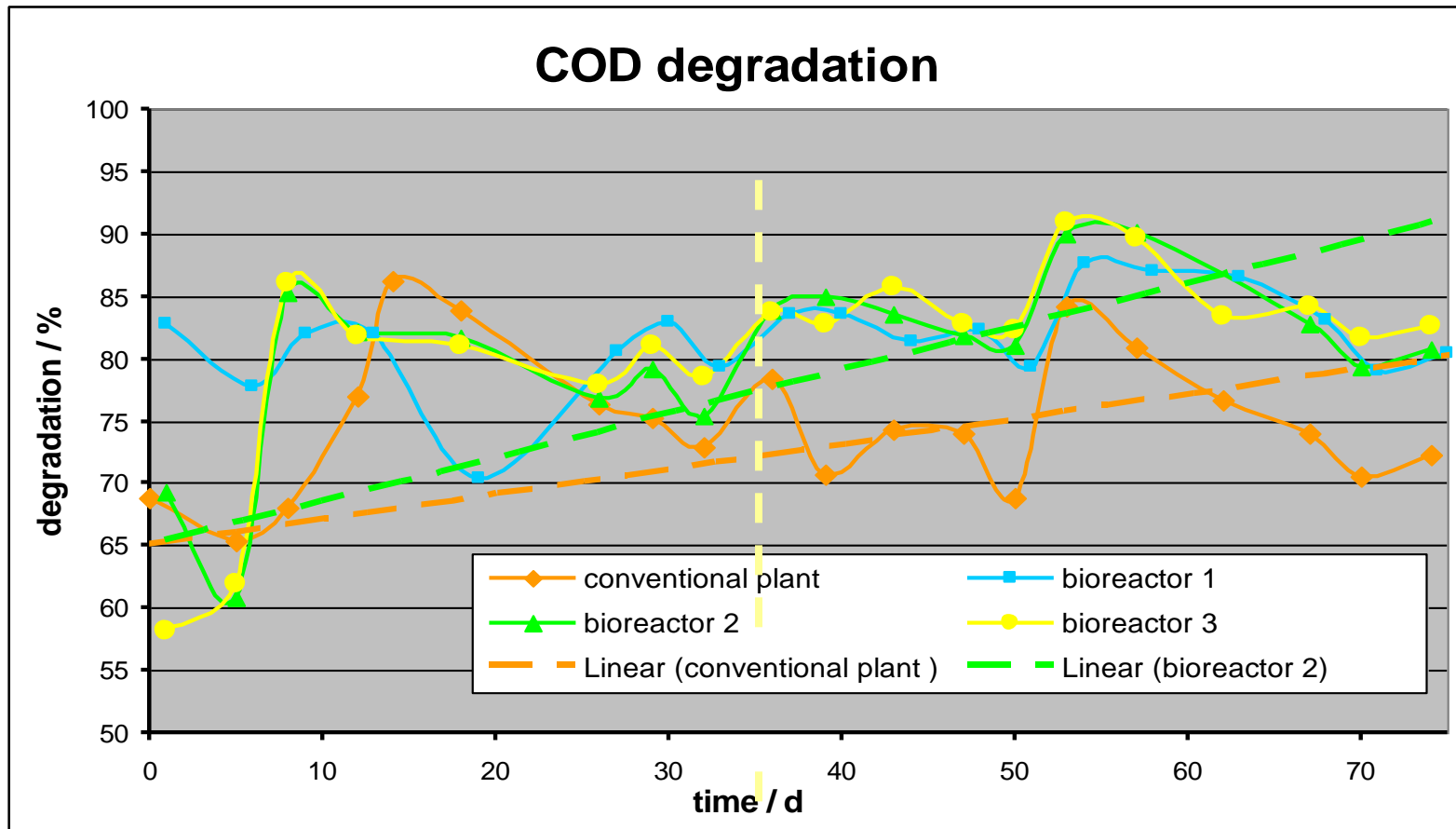
Trials – lab plants



Results - microscopic investigation

directly after addition





Results – effluents degradation

No. paper mill	Raw material	Products	Settle-ability	Degradation performance	Aeration	Algae content	Bluegreen algae (pH)
1	mechanical pulp, waste paper	printing papers in reels	☺	☺	☹	☹	☹
2	Groundwood pulp, pulp, waste paper	wood containing coated printing paper	☺	☺	☹	☹	☹
3	waste paper	board	☺	☺	☺	☺	☺
4	pulp	Woodfree graphic paper	☺	☺	☺	☺	☺

- good settling conditions in all reactors
- good degradation results for all reactors (COD > 70 %)
improved degradation results for all algae-bacteria test trials
(predominantly COD > 80 %), **but:** partly without stable algae content
- no aeration necessary in algae-bacteria-bioreactors
- extrusion/devour of algae by excess bacterial biomass growth under
operating conditions of
 $B_{TS} > 0,15 \text{ kg BSB}_5 / (\text{kg TS d})$, $\text{HRT} < 72 \text{ h}$, $\text{DSM}_{\text{total}} > 3 \text{ g/l}$
- unsatisfactory settling of algae on carriers/extrusion of algae by
bacterial biomass

Biomass characteristics

Sludge	ash %	C org. %	N tot. %	P tot. %	Sugars %	Algae %
TUHH	10,7	46,7	8,8	3,2	22,7	34
PTS 1	51,9	25,1	2,9	2,7	5,5	2,2
PTS 2	47,9	24,4	3,2	2,7	7,2	1,8
PTS 3	54,8	21,8	2,9	2,8	5,5	2,0
PTS I	38,7	31,2	4,4	2,0	18,5	4,0
PTS II	35,6	31,7	4,2	2,8	16,2	5,1
Typical a.s.	44,0	36,6	4,4	2,2	19,1	/



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Thank you for your kind attention!

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