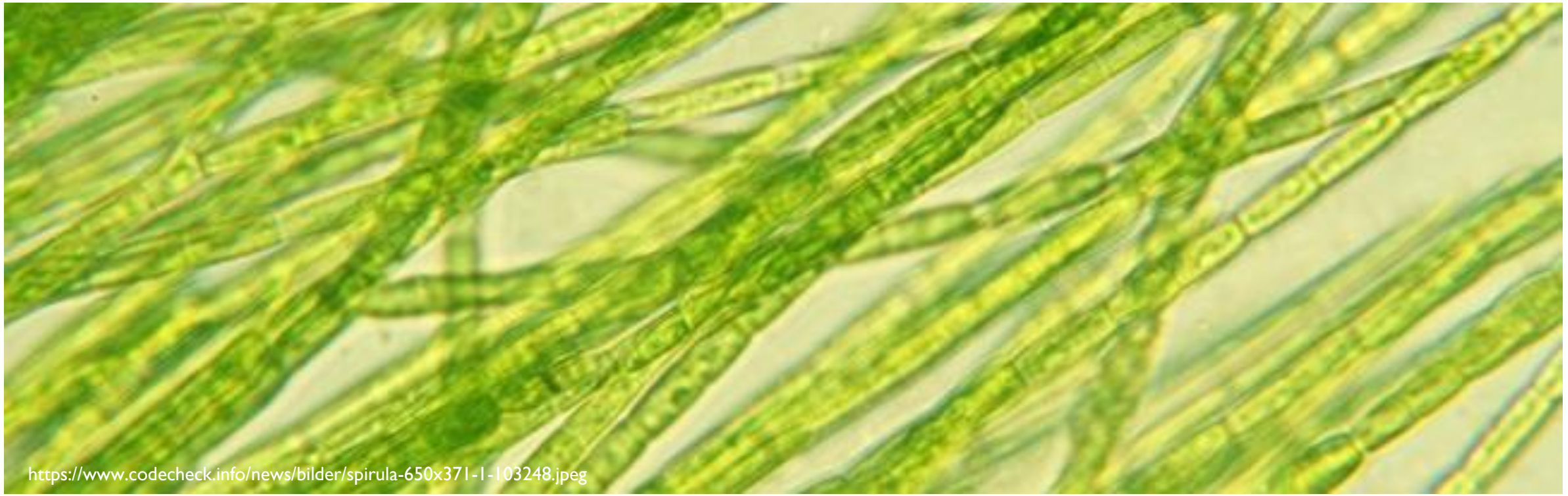

https://www.codecheck.info/news/bilder/spirula-650x371-1-103248.jpeg

BIOFUEL AND LIPIDACCUMULATION IN MICROALGAE

A PROJECT BY LIV ZANDER AND CARLA VERMÖHLEN

SUMMARY

- Topic of the project
- Problem
- Intentions and goals
- Planned cultivation and experiments
- Lipidaccumulation in algae
- Results from literature research
- Biofuel from rape and algae
- Conclusion

TOPIC OF THE PROJECT

https://www.myfairtrade.com/media/image/e6/3e/6a/2924_amazon_d.jpg

FOCUS OF OUR PROJECT CLASS

- Shaping of structural change in the rhine area
- Recultivation of artificial mining lakes
- Sustainibility through algae

What about energy production through algae?

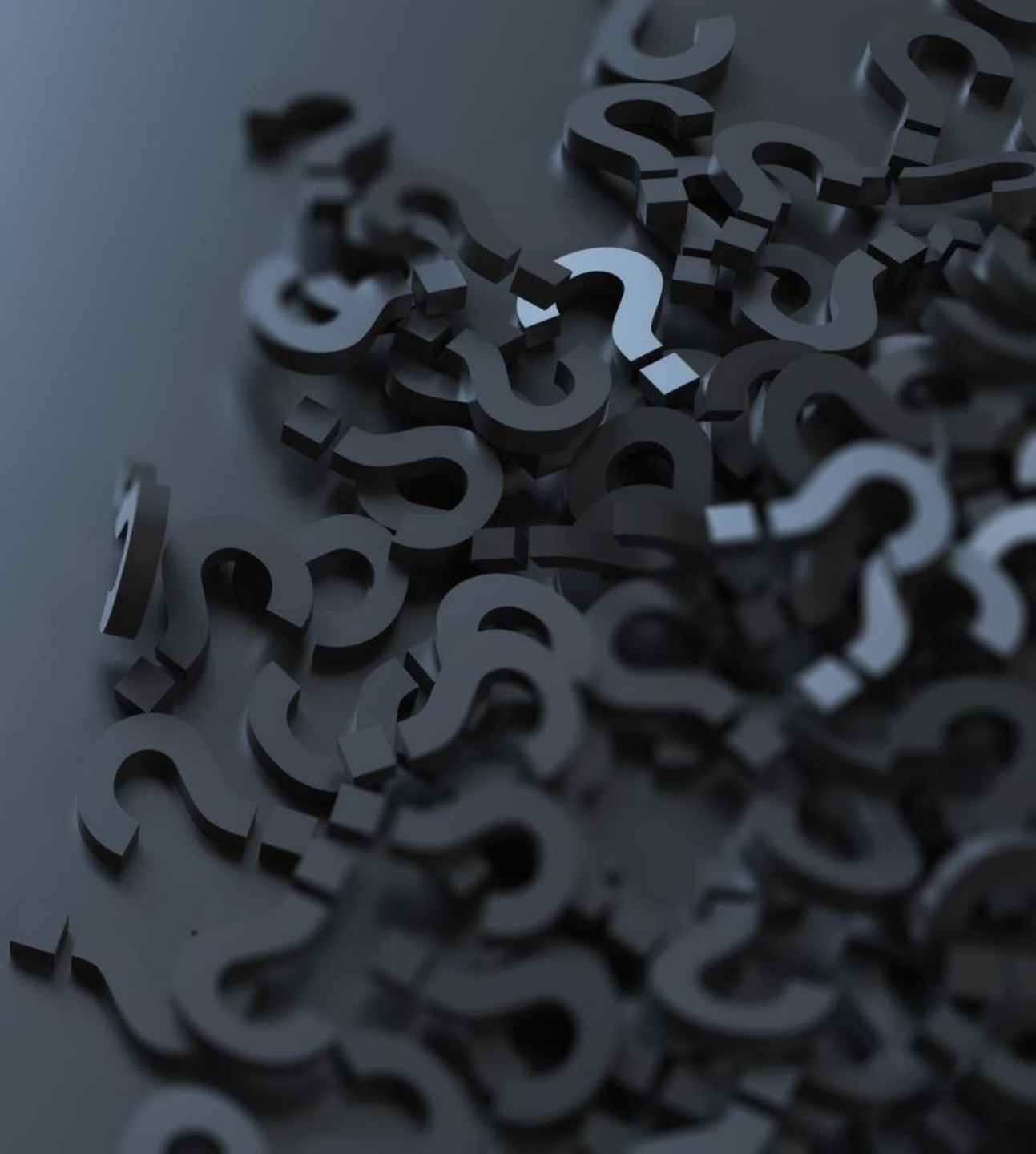
https://cdn.shopify.com/s/files/1/2391/5863/articles/shutterstock_448581889-min_1500x.jpg?v=1521228561

HOW DID WE CHOOSE A TOPIC?

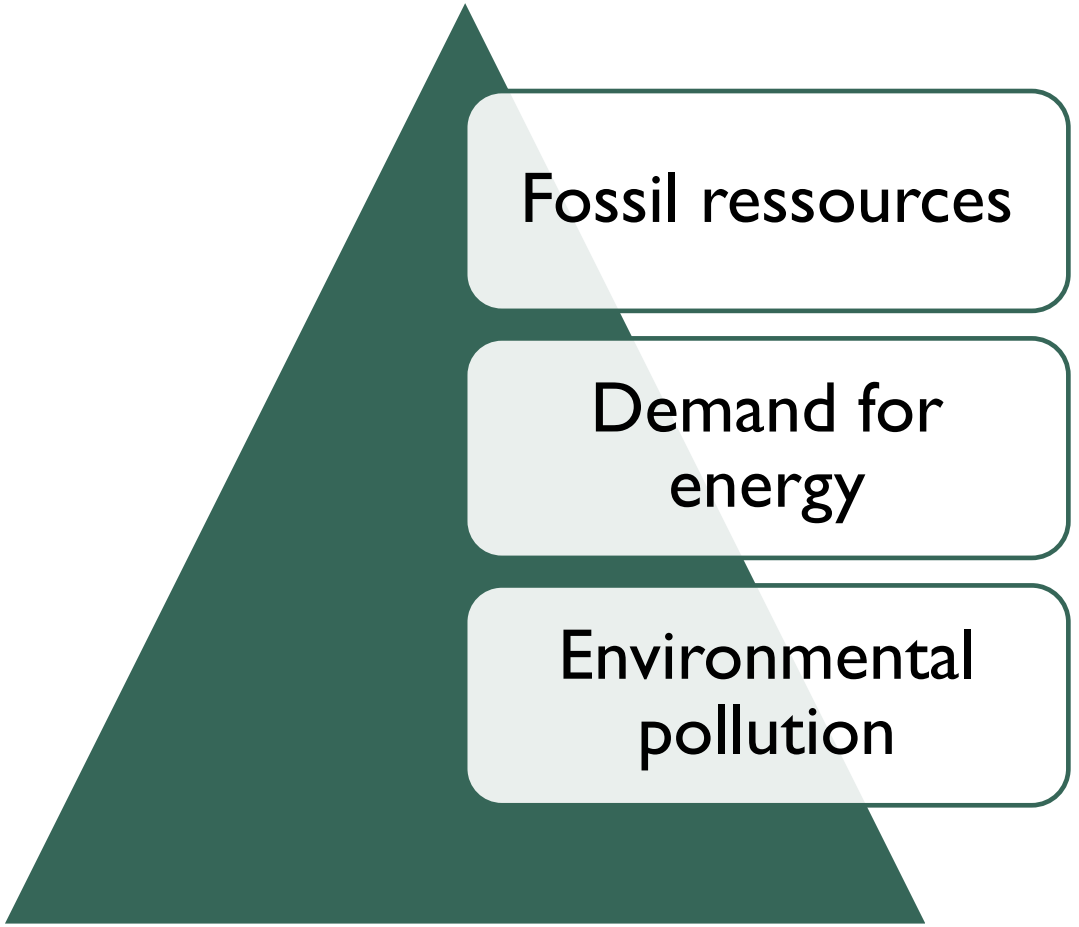
- Personal interest in transition of energy production
- Interesting research opportunities
- Low water consumption
- No competition to food crops => Independency from fertile soil
- Diverse possible application

Forschungszentrum Jülich

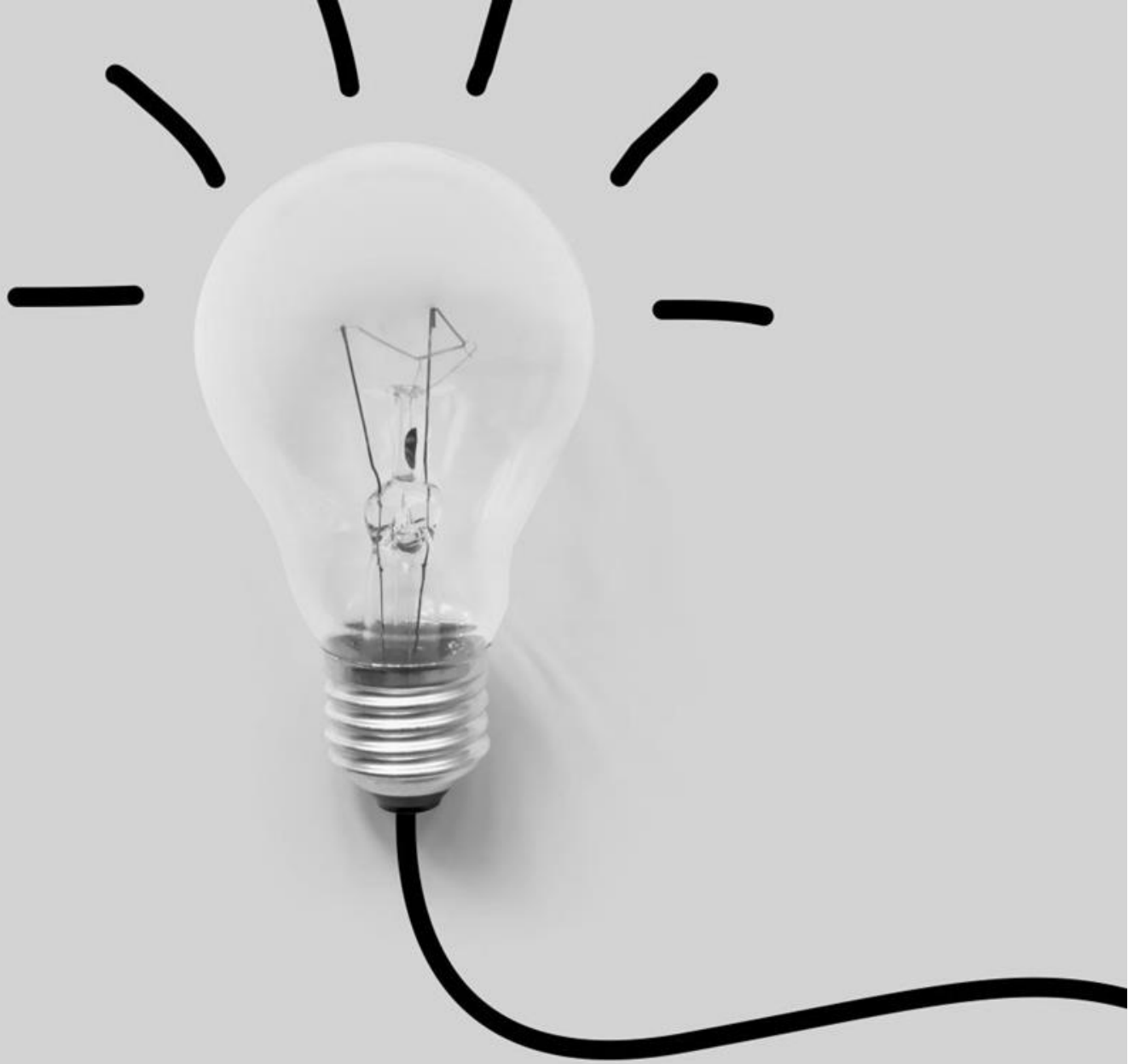
PROBLEM



PROBLEM


Fossil ressources
Demand for energy
Environmental pollution

INTENTIONS AND GOALS



INTENTIONS AND GOALS

01

Cultivation of algae under different circumstances to achieve lipidaccumulation

02

Comparision of different biofuels

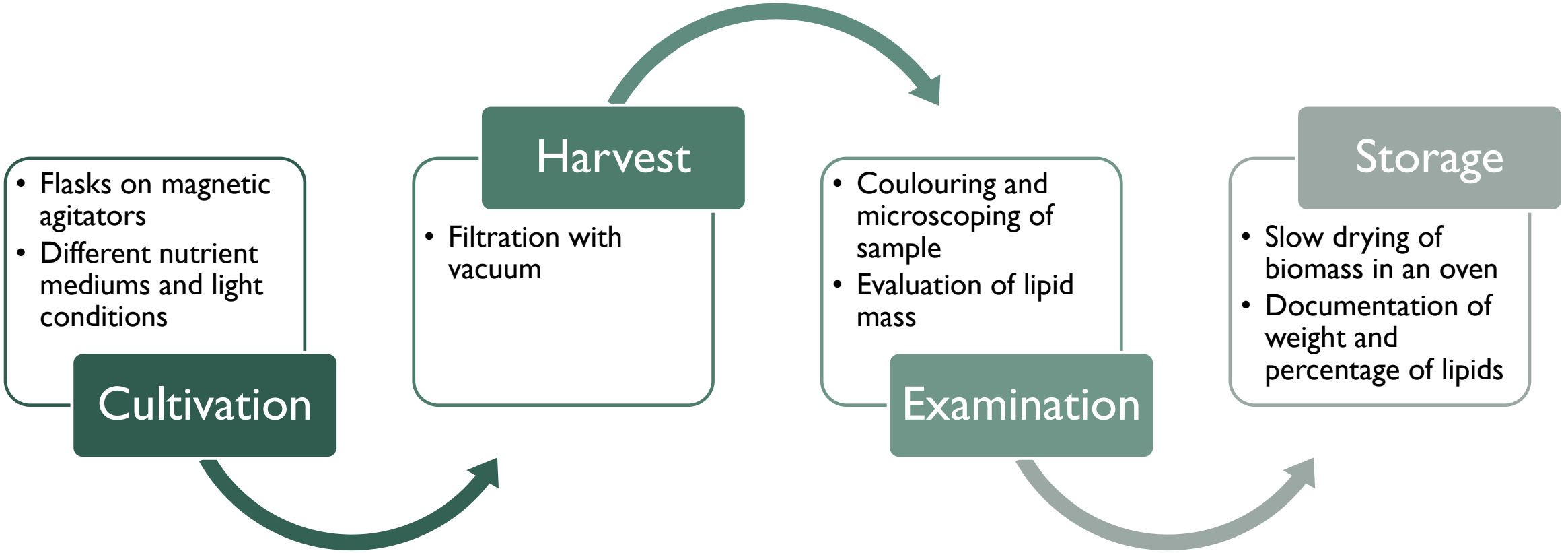
03

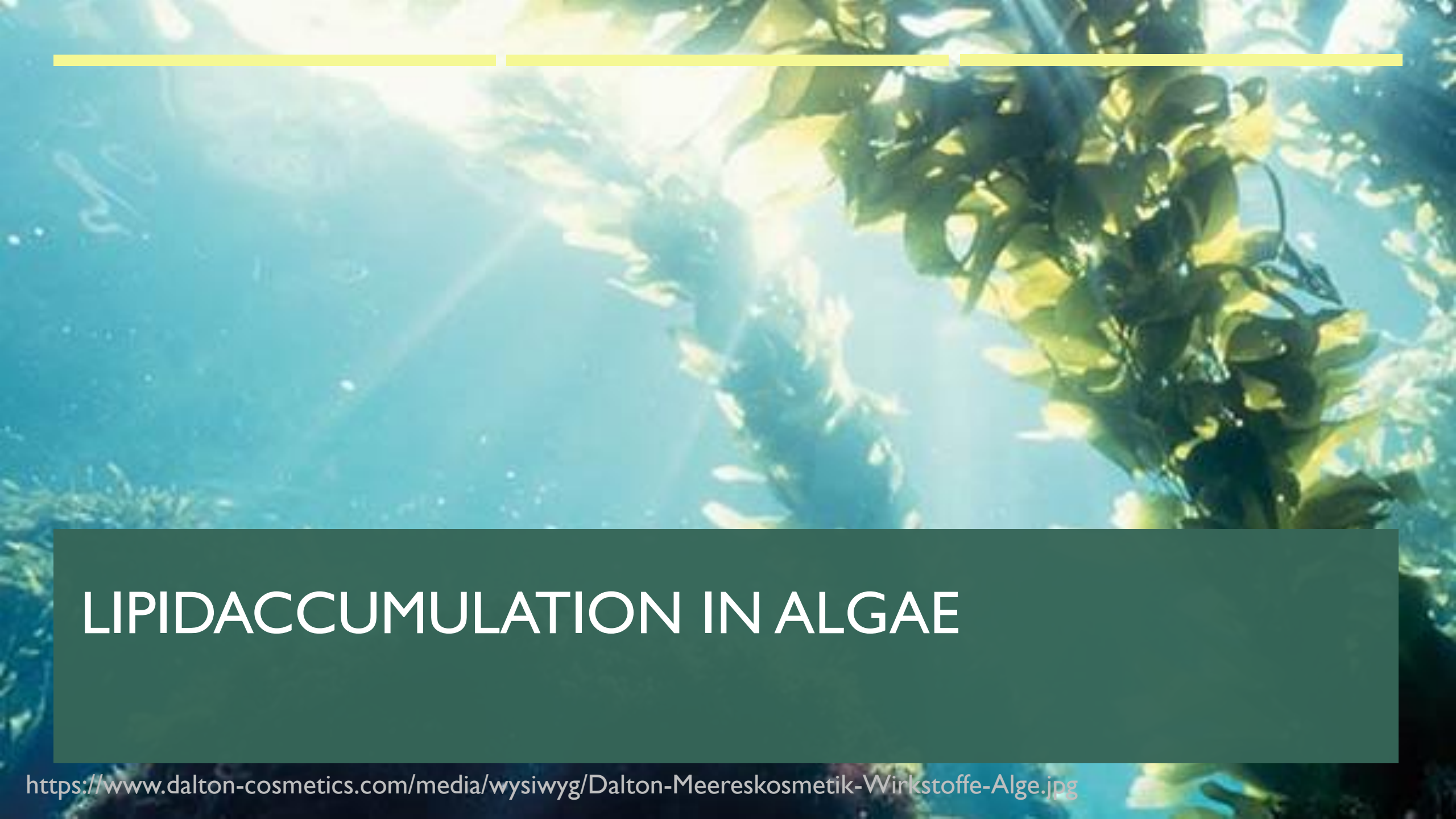
Conclusion for daily usage and possible applications

PLANNED CULTIVATION AND EXPERIMENTS

https://www.golem.de/2011/152406-250310-250309_rc.jpg

PLANNED CULTIVATION AND EXPERIMENTS





LIPIDACCUMULATION IN ALGAE

https://www.dalton-cosmetics.com/media/wysiwyg/Dalton-Meereskosmetik-Wirkstoffe-Alge.jpg

LIPIDACCUMULATION IN ALGAE

- Plant is forced to prioritise under ressource limitation => Allocation
- Nitrogen limitation: Lipids are no longer used for cell formation; they are stored in other cells
- Extraction for biofuel production

RESULTS FROM LITERATURE RESEARCH

FIRST STUDY

INTRODUCTION TO THE DISSERTATION

- PhD thesis by Robert Dillschneider (Karlsruher Institut für Technologie KIT) published in 2014
- Link: https://publikationen.bibliothek.kit.edu/1000042024/3158745
- Topic: Efficiency of microalgae cultivation for biofuel production
- Focus of evaluation: Lipidaccumulation during cultivation

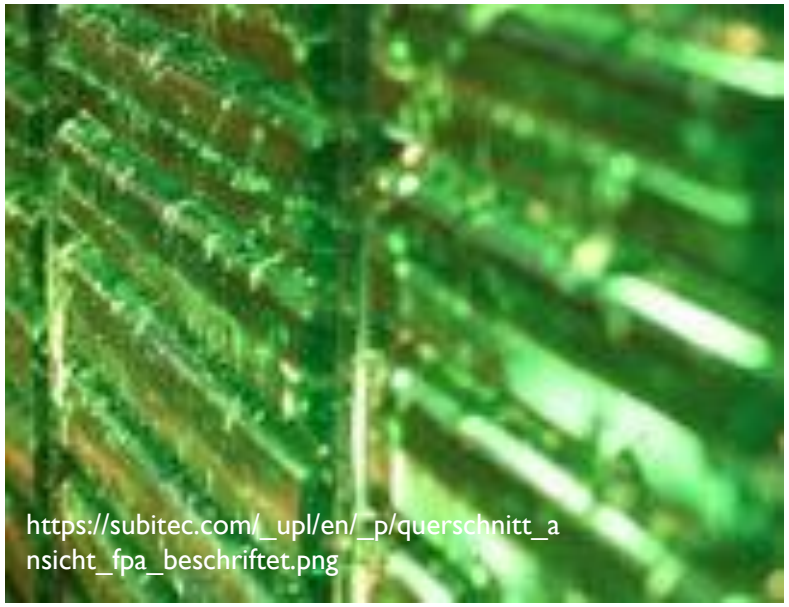
https://images-na.ssl-images-amazon.com/images/I/41Qm9C+xZuL._SX339_BO1,204,203,200_.jpg

CULTIVATION

- Examination of three different algae: Phaeodactylum tricornutum, Nannochloropsis salina, Chlorella vulgaris
- Interessant aufgrund der Fähigkeit der Lipidanreicherung und dem großen Anteil an Fettsäuren (relevant for biofuel research)
- Precultures were grown in flasks and mixed by rotary shakers
- Temperature and other outside influences were controlled by incubators
- Different reactors were used

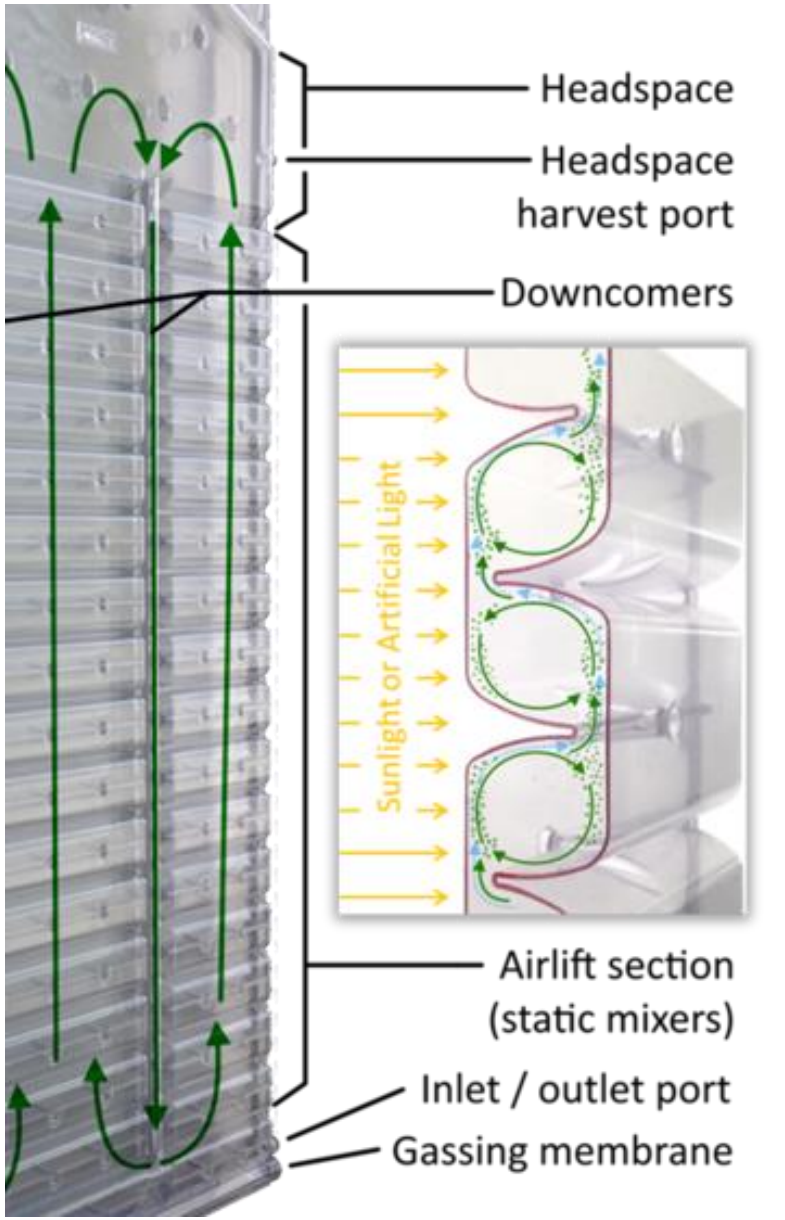
https://www.supersmart.com/data/images/blog/algues.jpg

FAP-REACTOR



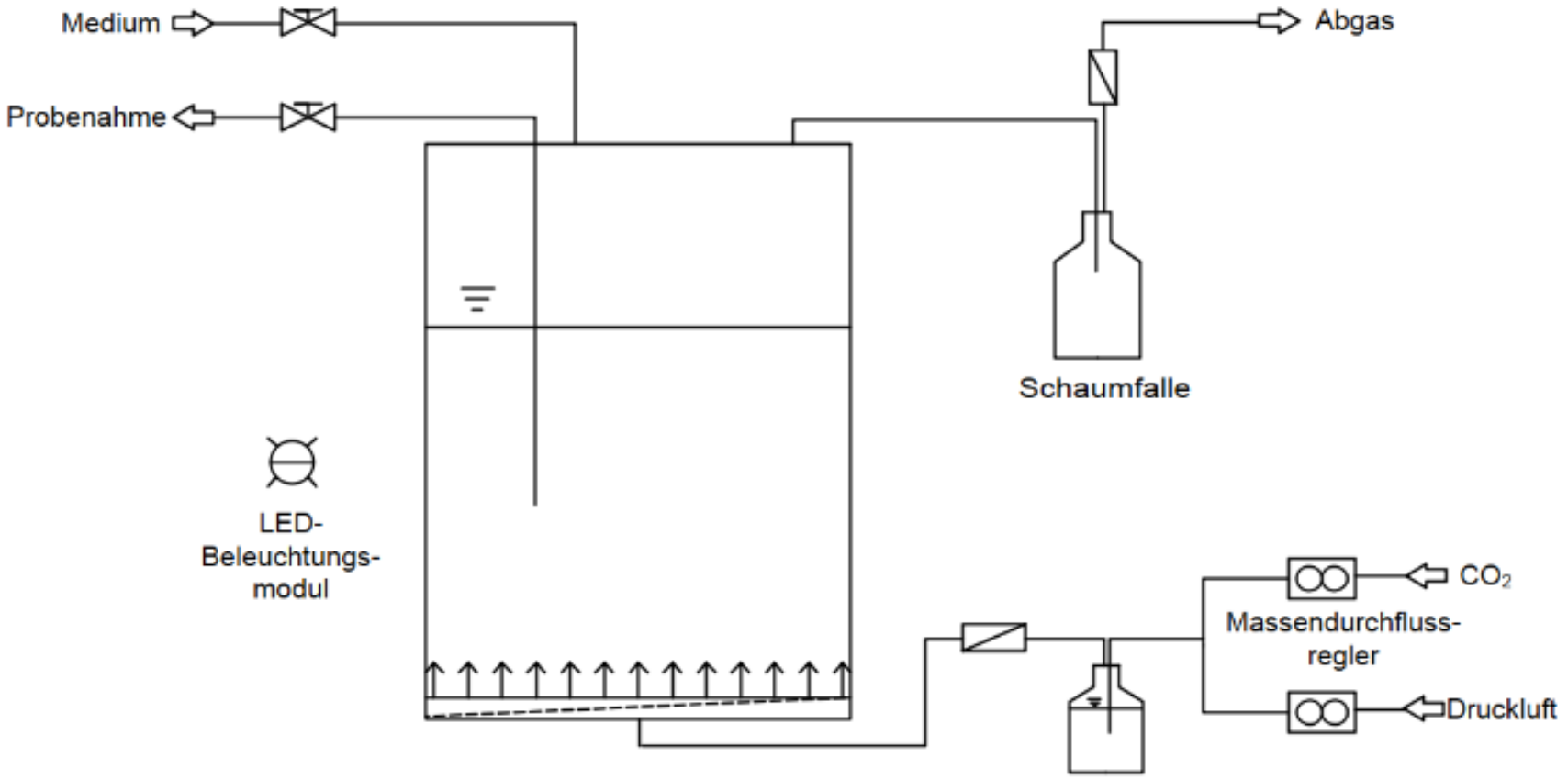
https://subitec.com/_upl/en/_p/querschnitt_ansicht_fpa_beschriftet.png

https://www.gesundheitsindustrie-bw.de/application/files/4114/3518/9606/13862_de.JPG



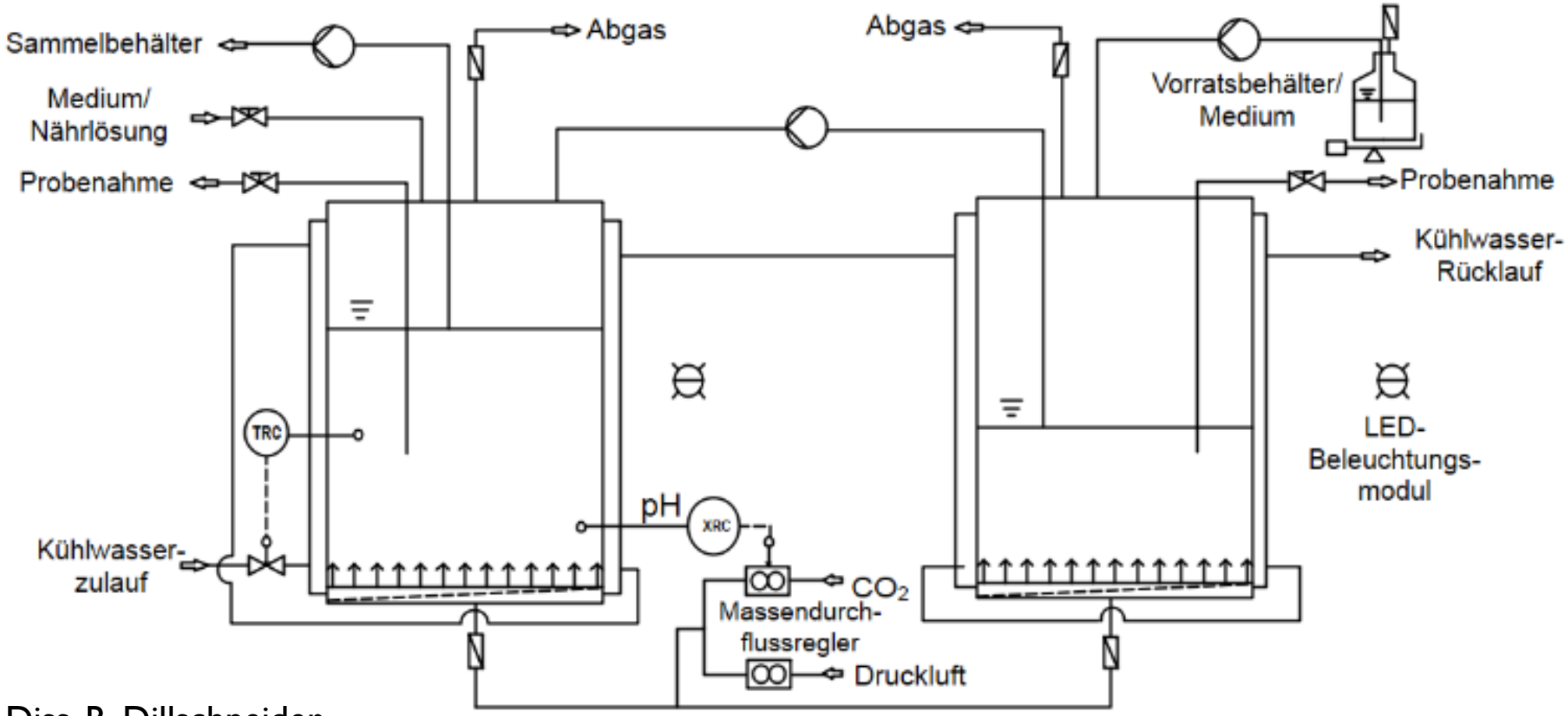
https://www.gesundheitsindustrie-bw.de/application/files/4114/3518/9606/13862_de.JPG

REACTOR DIAGRAM



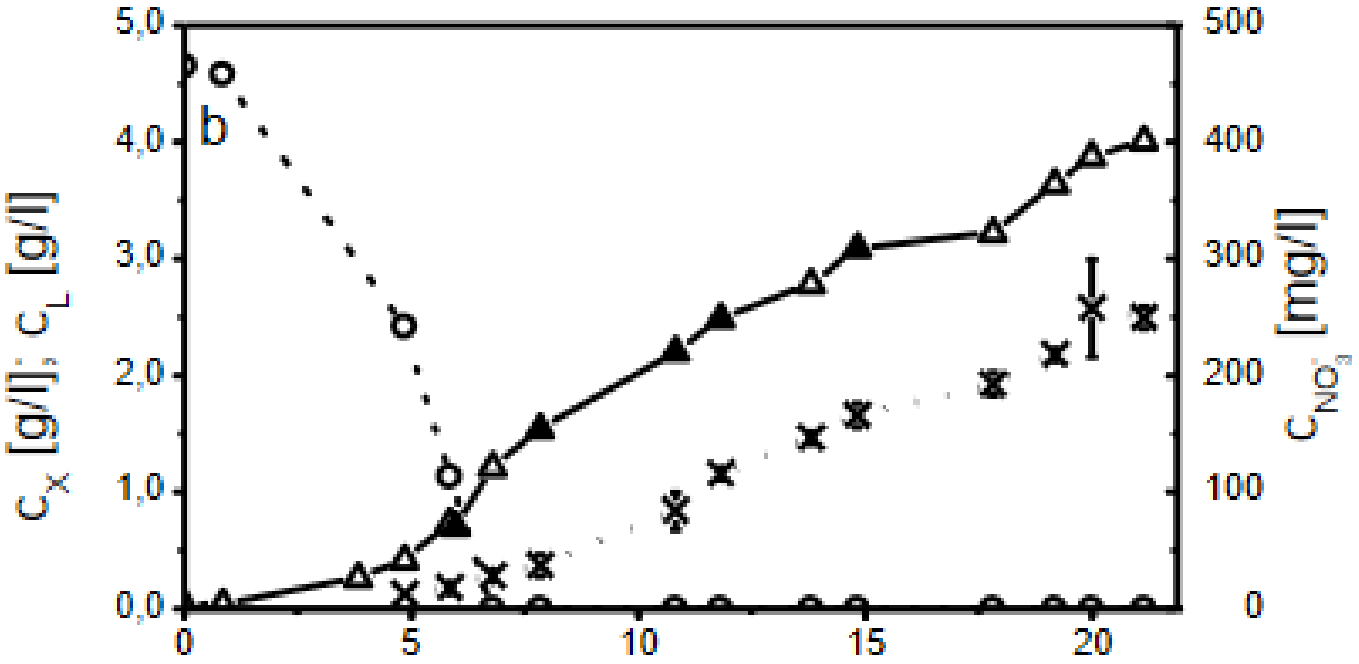
Diss. R. Dillschneider

COMPOSITION FOR LIPIDACCUMULATION



Diss. R. Dillschneider

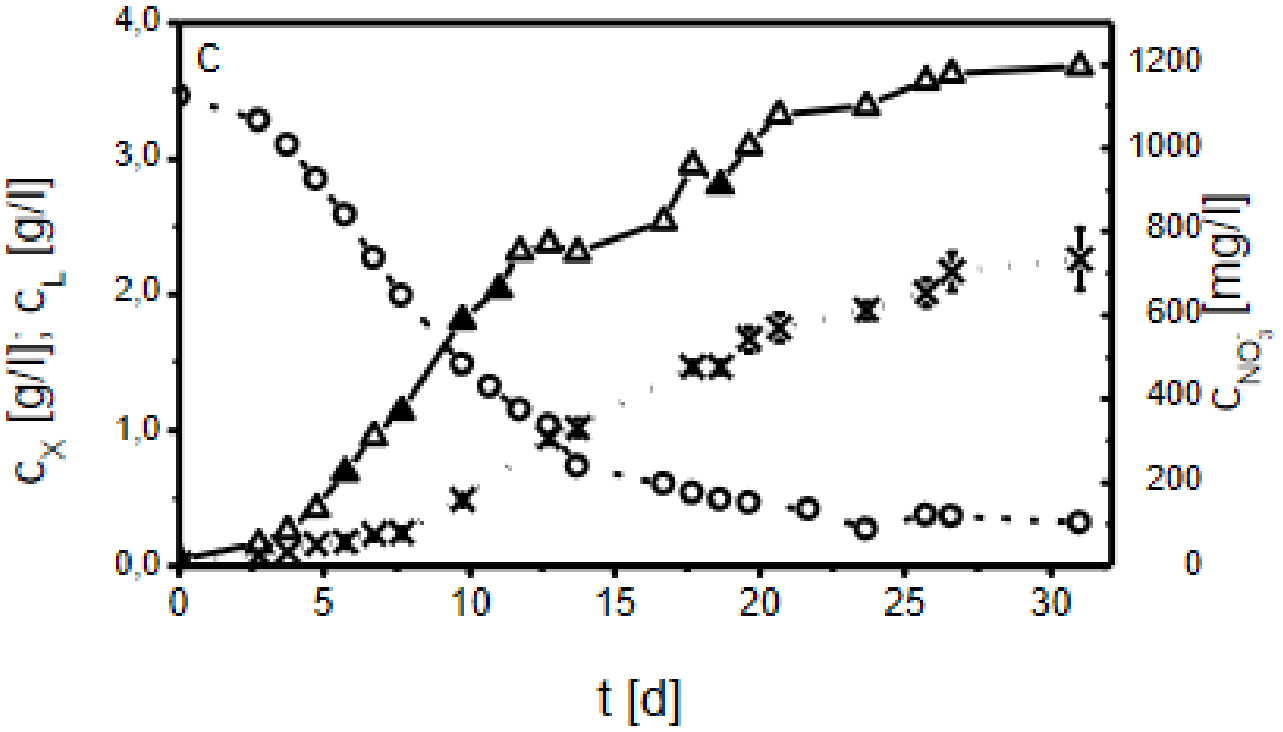
NITROGEN LIMITATION



Δ: Biomass concentration;
×: Lipidconcentration;
○: Nitrogenconcentration

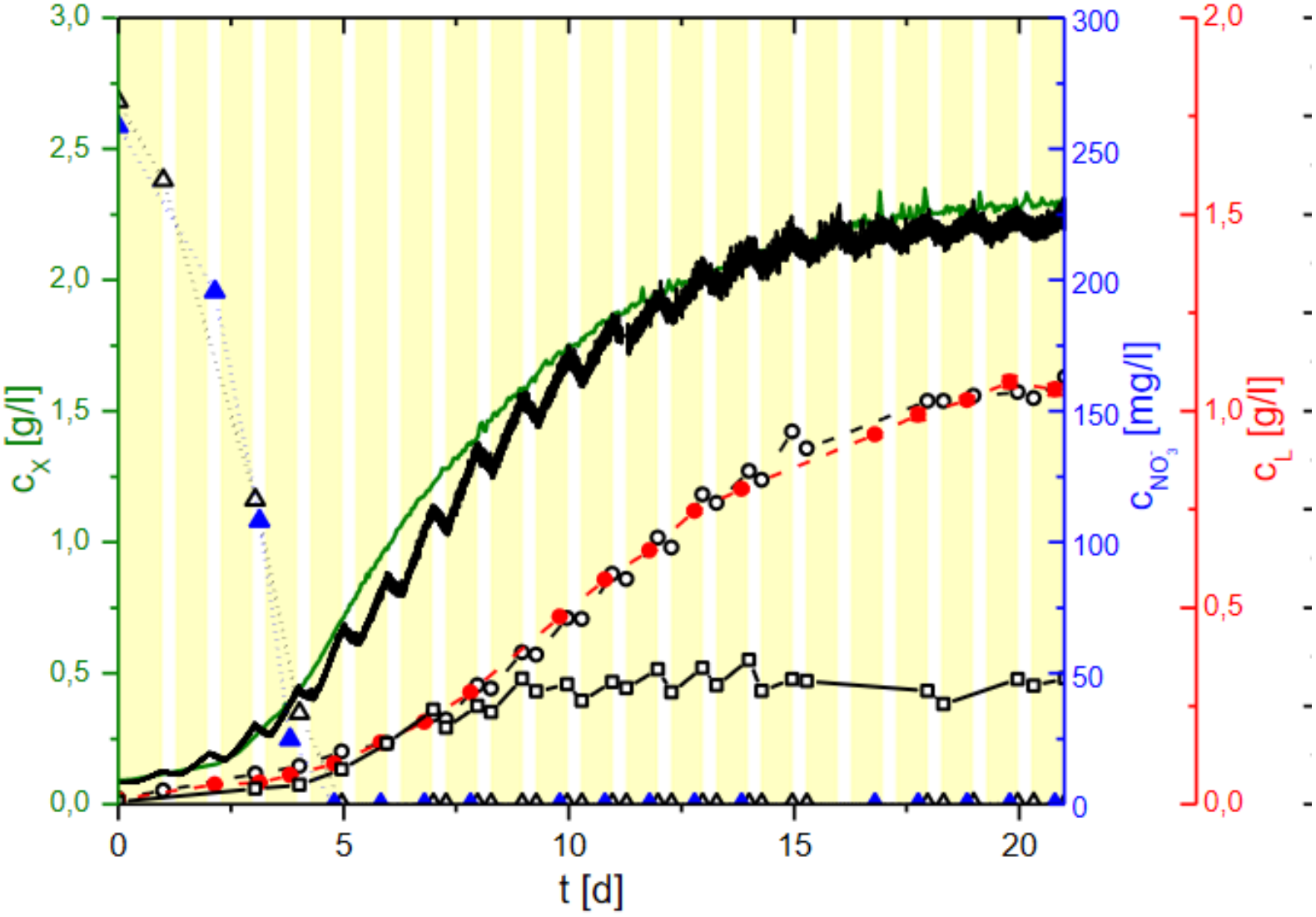
Diss. R. Dillschneider

PHOSPHORUS LIMITATION



Diss. R. Dillschneider

Δ: Biomass concentration;
×: Lipidconcentration;
○: Nitrogenconcentration



Diss. R. Dillschneider

DAYLIGHT CYCLE IMITATION

CONCLUSION

- Two phase cultivation offers higher percentage of lipidss and more effective production of biomass as well as lipids
- Energy loss can be compensated by putting multiple vertical reactors behind each other
- Cultivation with sunlight promises same results =>cheap and sustainable energy source
- More efficient growth under red light
- Monochromatic light showed influence on pigmentation

https://www.ab-in-den-urlaub.de/magazin/wp-content/uploads/2014/08/1544448038_Algen-unter-Wasser-Teaser.jpeg

RESULTS FROM OTHER STUDIES

RESULTS

- For P. Tricornutum a light intensity between 50 and 150 µmol /m*m*s is optimal
- Certain precautionary measures ought to be taken for a high light intensity (Prevention of photoinhibition) e.g. increase of cell density in a culture

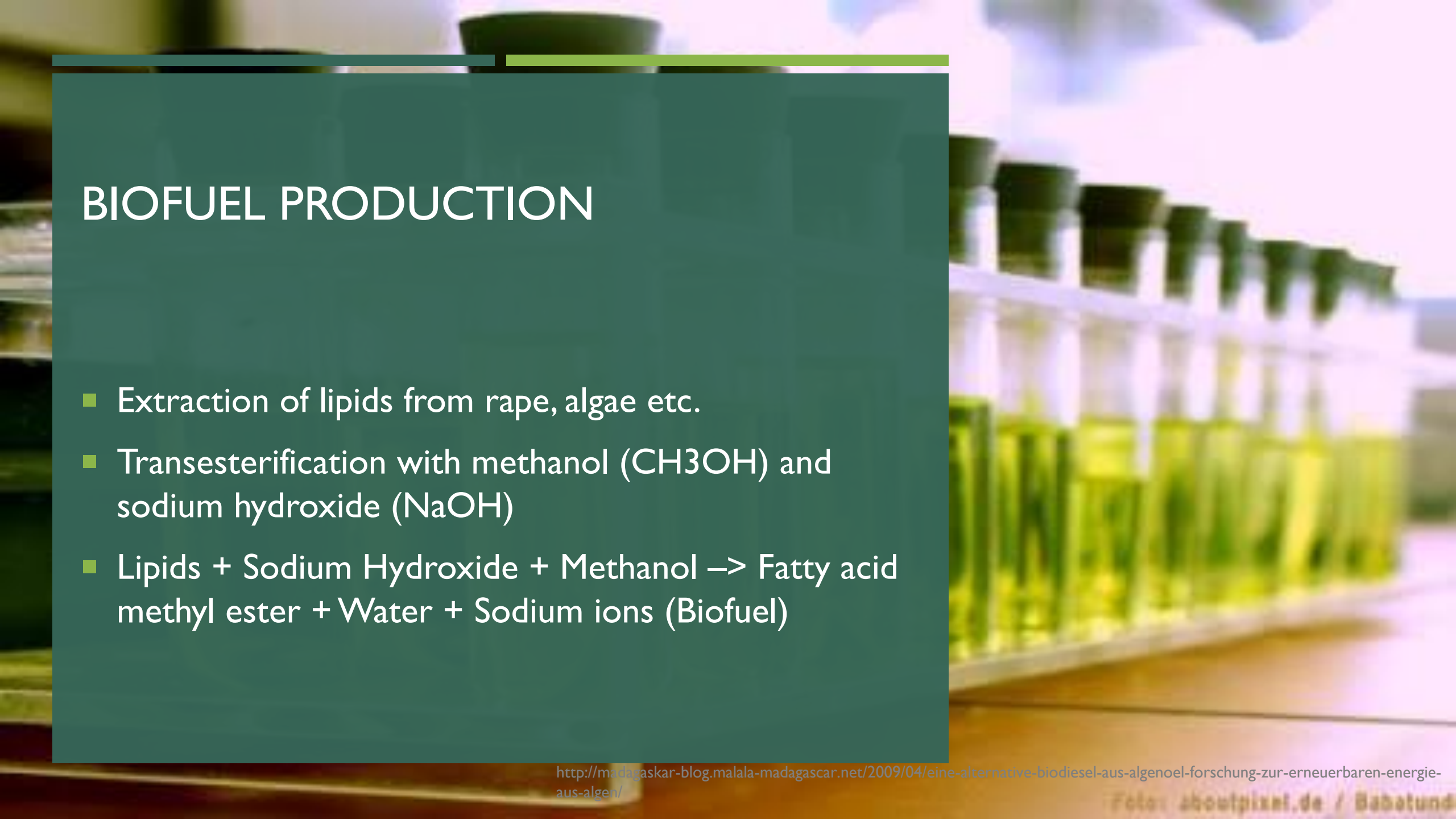
http://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC5389818&blobtype=pdf

https://www.foodspring.de/magazine/wp-content/uploads/2020/11/160620-Blog-Titelbild-%C2%A9istock-Sasha-Radosavljevic.png

BIOFUEL

BIOFUEL PRODUCTION

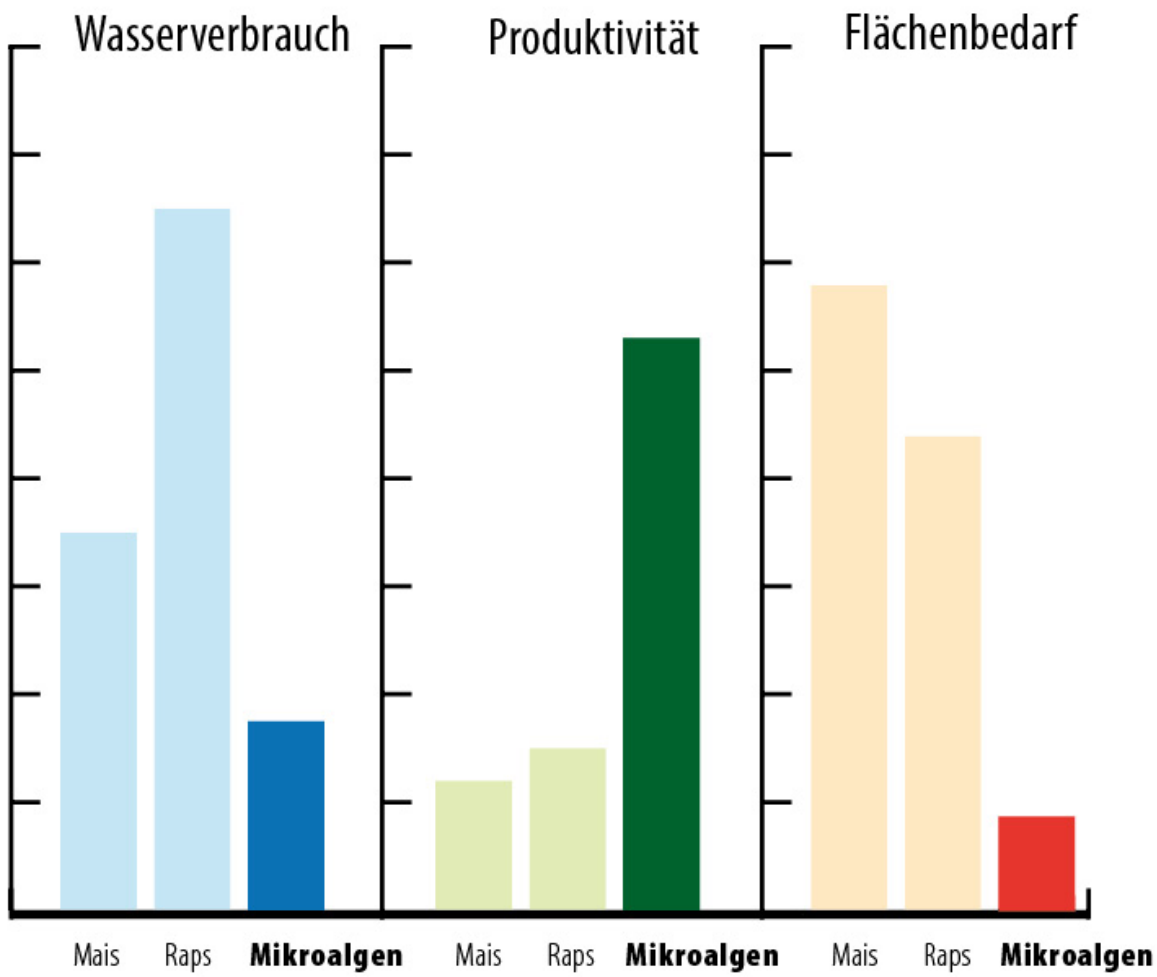
- Extraction of lipids from rape, algae etc.
- Transesterification with methanol (CH_3OH) and sodium hydroxide ($NaOH$)
- Lipids + Sodium Hydroxide + Methanol –> Fatty acid methyl ester + Water + Sodium ions (Biofuel)



http://madagaskar-blog.malala-madagascar.net/2009/04/eine-alternative-biodiesel-aus-algenoel-forschung-zur-erneuerbaren-energie-aus-algen/

ADVANTAGES AND DISADVANTAGES

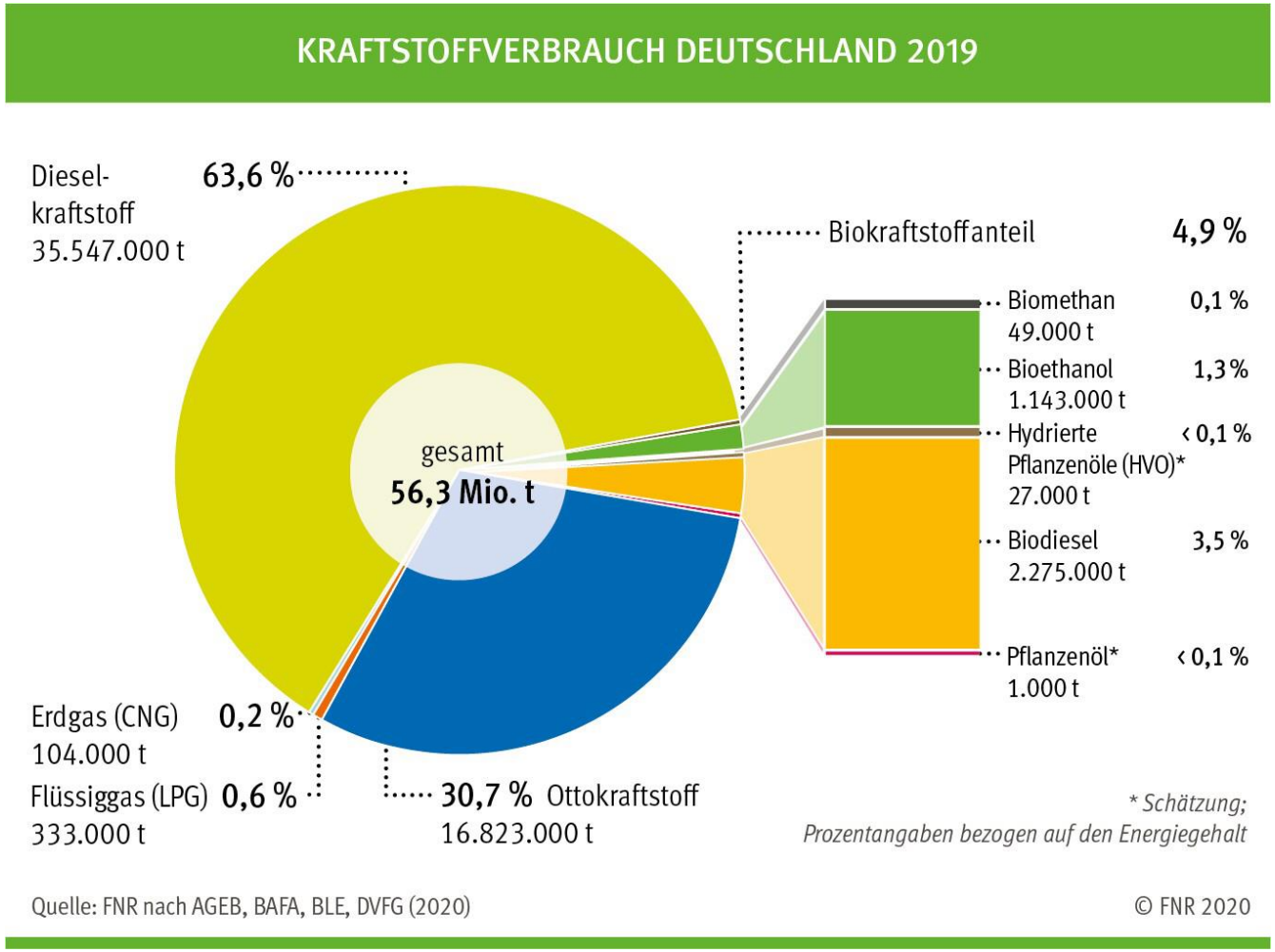
Advantages	Disadvantages
Edible oil waste does not stand in competition to nutrition	Not enough edible oil waste in circulation
Creation of sustainable jobs	Almost no gas stations for 100% bio fuel
Usable in already existing engines without a necessary upgrade	Huge amounts of glycerine
Highly effective	
CO2 neutral , every litre saves 2,7 kg CO2	
80% less greenhouse gasses	
Low soot emissions	



https://dresdner-transferbrief.de/mikroalgen-unerschlossenes-potenzial-fuer-innovative-neue-maerkte/algen-vergleich-grafik/

COMPARISON OF DIFFERENT BIOFUELS

BREAKDOWN OF FUEL USE

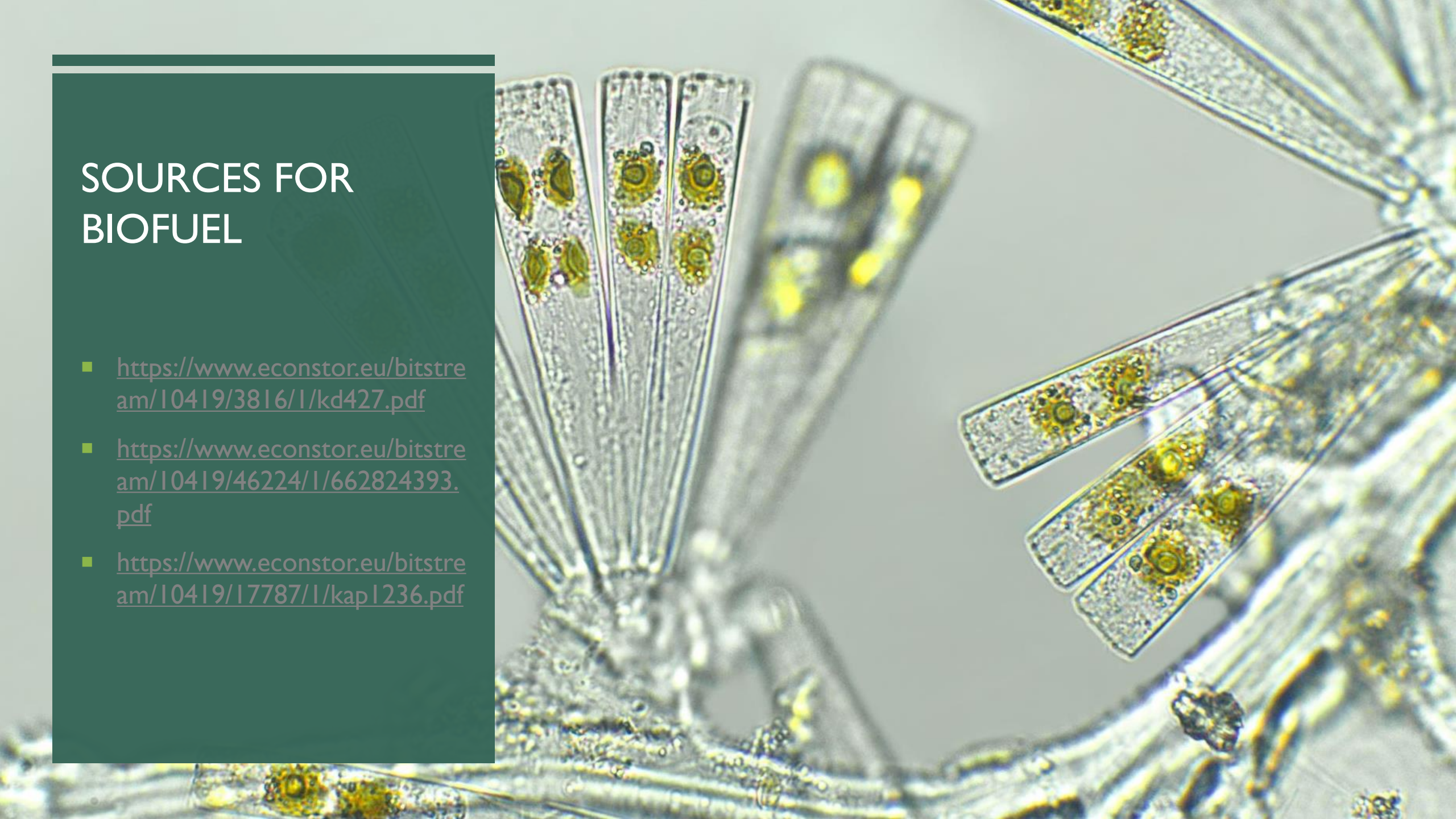


https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/biokraftstoffe/biokraftstoffe-in-deutschland.html

FOSSIL FUELS VS. BIOFUELS

	Fossile Kraftstoffe		Biokraftstoffe	
Euro pro Liter	Ottokraftstoff	Dieselkraftstoff	Biodiesel	Bioethanol
Verbraucherpreis	1,26	1,12	1,01	0,58
Energieäquivalenter Preis			1,11	0,89
Mineralölsteuer	0,655	0,47	0	0
Mehrwertsteuer 16 Prozent	0,174	0,154	0,14	0,08
Nettopreis (ohne Mineralöl- und Mehrwertsteuer)	0,431	0,496	0,87	0,50
Energieäquivalenter Nettopreis			0,96	0,77
Produktendpreis (ohne Kosten für Transport, Lagerhaltung, Bevorratung, Verwaltung, Vertrieb und Gewinn)	0,343	0,3774	ca. 0,81	ca. 0,47
Deckungsbeitrag und sonstige Kosten (Logistik, Verwaltung etc.)	0,088	0,119	ca. 0,03	0,03
Beimischungskosten			0,03	0,13[a]

SOURCES FOR BIOFUEL



- https://www.econstor.eu/bitstream/10419/3816/1/kd427.pdf
- https://www.econstor.eu/bitstream/10419/46224/1/662824393.pdf
- https://www.econstor.eu/bitstream/10419/17787/1/kap1236.pdf

CONCLUSION

CONCLUSION

- Biofuel offers an equal alternative to conventional fuels
- Algae are very suitable for biofuel production
- Fuel from algae ist superior to fuel from land plants e.g. rape
- Algae cultivation can be commercialised easily
- Algae fuel can be used especially for aircrafts (low freezing point)
- Production can finance itself through side products
- Everything is used in production => Sustainibility and bioeconomy

https://readersdigest.de/media/zoo/images/unterwasser-foto-mit-fischen-im-seetang-algen-wald_6d1f51e5d938716ecf8667cbc2c76dd7.jpg

THANK YOU FOR YOUR ATTENTION!

Do you have any questions?

https://memegenerator.net/img/instances/50139956/end-of-presentation-thank-you.jpg