MACROALGAE COLLECTION AND STORAGE TECHNOLOGIES ANALYSIS

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Aim of the Study

The study is aimed to summarize information on different technologies used worldwide (including Baltic Sea region) for collecting and storage of seaweed / macroalgae washed ashore. Besides, this study is intended to analyse various technologies' potential suitability for specific environmental conditions of Kurzeme coast (wide sandy beaches) as well as to identify the most economically advantageous macroalgae collecting technology.

The following tasks have been implemented in the framework of this study:

1. Literature review. Expert interviews in order to characterize current situation and define research objectives;
2. Literature analysis (including review on relevant research done so far) in order to develop methodology for evaluation of algae collecting and storage technologies;
3. Using secondary databases – evaluation of worldwide used technologies, implementation of relevant experience analysis, identification of algae gathering and storage knowledge in Baltic Sea region;
4. Critical evaluation of data followed by development of relevant arguments and proposals for algae collecting and storage technologies which would be most suitable for Kurzeme region;
5. Development of research report (in Latvian and English).

Amounts of seaweed washed ashore over summer & autumn 2018 (m^3 / 100m)

Nr.	Location	Amount in summer	Amount in autumn
1.	Jūrmalciems	0	0,88
2.	Liepāja	0.44	228.29
3.	Ziemupe	0	0

"Jūras aļģu sanesumu izvērtēšanas un apsaimniekošanas plāns Latvijas piekrastē" (Biedrība „Baltijas krasti")

Organized collection of algae in Liepaja and Ventspils:

- Ventspils (collected by utility company)
- Liepaja (collected by utility company)

Other municipalities does not organize or regulate the process of collecting algae.
Citizens are collecting algae by own machinery and transport for they own needs (for fertilization their fields and improvement of soil structure).

Today – fertilizer, tommorow – valuable raw material

- From being waste today it could turn to valuable resource in near future,
- Collection of algae could rapidly increase,
- Deregulated situation could create significant risks,
- Rational and balanced order, optimal for all parties is necessary,
- Planning further business all risks has to be accounted.

Collecting algae – methods and equipment

On Liepaja beach company «TRANZĪTS L» collecting algae using common communal machinery – front loaders and tipper trucks. The same machinery is used in Ventspils.

Photo: liepajniekiem.lv 28.06.2018.

Problem – large amounts of beach cast algae

Problem for processing plants – seasonality and uncertancy

Mechanized seaweed collection

Another widespread method to harvest piles of seaweed washed ashore is utilization of agricultural or utility machinery, front loaders, grabs, excavators and tractor trailers. Such an equipment has been used most often for macroalgae gathering in Latvia, Poland, Sweden, Australia, New Zealand.

- “Les algues vertes suspectées d'être la cause de plusieurs décès ces dernières années en Bretagne”. Viewed in 31.07.2019. Retrieved from https://france3-regions.francetvinfo.fr/bretagne/rappel-deces-causes-algues-vertes-ces- dernieres-annees-bretagne-1696968.html

Collection technologies are about the same as in Latvia

Experiments with harrows

Negative results

Swedish experience– Trelleborg

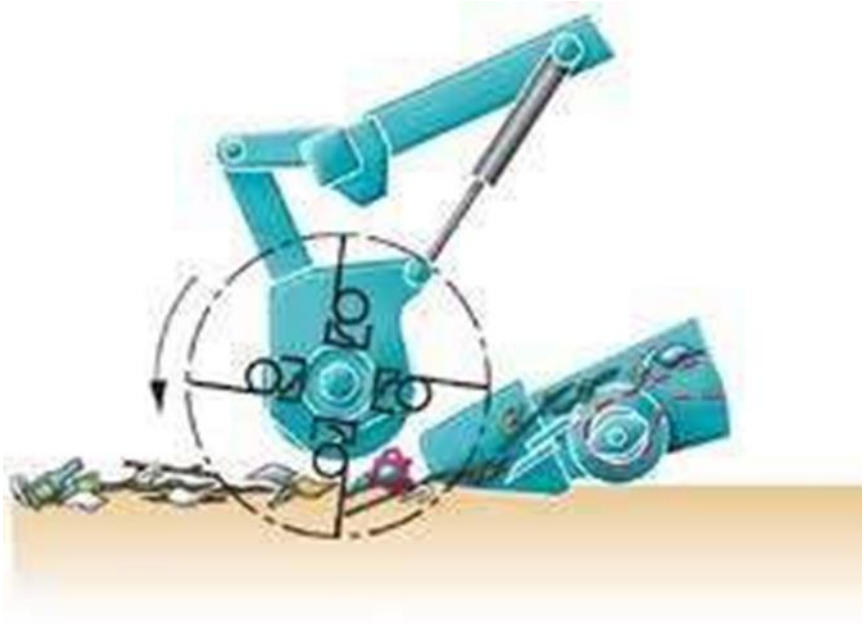
Study “Technological Solutions for the Collection and Removal of Algae from the Beach, Sea and Coastal Strip in Trelleborg Municipality”. Viewed in 31.07.2019. Retrieved from http://wabproject.pl/files/Technological%20solutions%20for%20the%20collection%20and%20removal%20of%20algae%20from%20the%20beach,%20sea%20and%20coastal%20strip%20in%20Trelleborg%20Municipality%20%20 ENGLISH.pdf

Experiments with beach cleaning machines

BeachBeachTech 2800 represents itself an example of such a cleaning machine. Its technical description reveals that volume of its garbage collection container comprises 2.8 m³. Such a volume is insufficient for serious algae harvesting projects since small size container must be unstuffed too often.

BeachTech Strandreiniger. Wegweisende Technik für saubere Strände". Viewed in 31.07.2019. Retrieved from https://www.beach-tech.com/fileadmin/content_beachtech/modul_8_download/Dateien/online-version- beachtech_broschuere-deutsch.pdf

BeachTech type of machines has the following unit for garbage pick-up: rotatory, flexible steel “fingers” which lift up garbage pieces from the sand and put them on the moving belt which serves also as a sieve for sand separation.



BeachTech Strandreiniger. Wegweisende Technik für saubere Strände”. Viewed in 31.07.2019. Retrieved from https://www.beach-tech.com/fileadmin/content_beachtech/modul_8_download/Dateien/online-version-beachtech_broschuere-deutsch.pdf

In order to ensure highly efficient sand removal from seaweed / garbage material additional appropriate active or passive elements should be attached to the transporter belt – they would interact with material gathered separating thus sand admixture.

Online Brochure Main Cherrington Model 5450 Booklet. Viewed in 31.07.2019. Retrieved from https://literature.puertoricosupplier.com/089/DW88630.pdf

Results for all machine complex usage

Collection with frontloader and beach cleaning machine:

Productivity: 45 cub.m./h, alltogether 225 cub.m.

Fuel compsunction -60 liters/5 h.

Sand contamination: 0,75-2%.

Beach cleaning machine was used only in the final stage of cleaning.

Amfibious tipe collector

Productivity: 6 cub.m/h, - not satisfying.

Useful only for collection in water.

No sand contamination.

Comparison of algae collecting technologies used in Baltic Sea region countries

State	Technology	Collection site
Estonia	Pumping from lagoon or agricultural technics	Lagoon or coast
Latvia	Front loader or hand work	Coast
Lithuania	Front loader	Coast
Poland	Grab loader or hand work	Coast
Germany	Front loader	Coast
Denmark	Front loader	Coast
Sweden	Front loader	Coast

Comparison of macroalgae collecting technologies

Gathering technology	Productivity (m^3/h)	Costs (EUR/h)	Mean relative costs (EUR/ m^3/h)	Suitability
Grid bucket	80	96.18 -144.27	1.50	Beach and water
Pontoon machines	4 - 12	144.27-192.36	10.52	Harbour
Beach cleaners	2 - 10	144.27-192.36	28.07	Beach
Dry pumping	2 - 7	192.36 – 288.54	48.09	Beach
Water pumping	2-12	192.36 – 288.54	34.36	Beach
Deep-water pumping	10 - 40	96.18 -144.27	4.80	5-10 m depth

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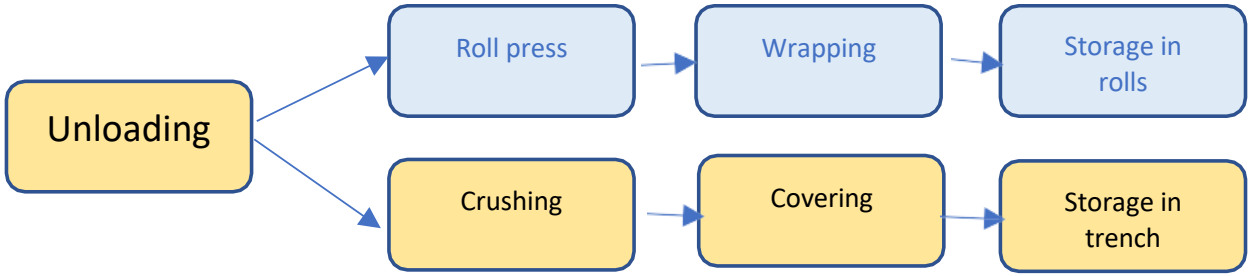
Study “Technological Solutions for the Collection and Removal of Algae from the Beach, Sea and Coastal Strip in Trelleborg Municipality”. Viewed in 31.07.2019. Retrieved from http://wabproject.pl/files/Technological%20solutions%20for%20the%20collection%20and%20removal%20of%20algae%20from%20the%20beach,%20sea%20and%20coastal%20strip%20in%20Trelleborg%20Municipality%20%20 ENGLISH.pdf

Seaweed preparation for storage: recommendable technological charts



Comparison of algae storage technologies

Algae storage technology	Advantages / Disadvantages
Using ensiling towers	Few manual work / not widely available
Making silage in bunkers (trenches)	Widely available, relatively cheap / product decay related risk factors
Using wrapping (in film) for silage	Agricultural machinery can be used

Conclusions

1. Globally the most common way for algae gathering is utilization of communal or agricultural technology – front loaders; for transportation – tractor trailers or motor transport.
2. Such a technology is suitable for different users since these machines are broadly available and do not requires special adjustment. This kind of technology is economical and universal (i.e. suitable for different types of algae). It is also productive enough and does not require application of specialized machines.
3. Algae gathered in this way do not need additional treatment if intended for biogas production or soil fertilization.
4. Whereas, if algae will be used for extraction, they must be preliminary washed in order to get rid of sand and impurities.
5. Roll press utilization possibility is of particular interest since it would ensure separation of considerable amounts of water obtaining thus easily transportable collected algae material. Still, field tests have to be carried out in order to get full confidence on suitableness of this machine.

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