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Macroalgal harvestation effects - an important aspect of ecological efficiency

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The causes of the mass apperance of filamentous green algae.

EUTROPHICATION PROCESS



of water

Rapid growth of biomass

MASS APPEARANCE OF MACROALGAE



Characteristics of the mat structure



Macroalgae mat formations can be divided into:

- free-floating mats taking shapes of flocs (B), mats or felts, tufts, clouds (E), net-like structures (G);
- attached to the bottom upright growth forms
 (aligned), bush-like structures (F), solitary thalloid
 growth forms (D stonworts);
- overgrowing the entire water column includes both
 free floating and attached forms, also the forms that
 overgrow each element that can serve as a pillar e.g.
 submerged water plants.

Research area -the source of biomass



Oporzyn Lake

- location:
 Wielkopolska region
 near the town of Wągrowiec
- area: 17.5 ha (20.5 ha)
- average depth: 0.9 m maximum depth: 1.7 m
- visibility: 0.1 0.4 m
- pH 8.5 8.9
- flowing lake
- Trophic state: eutrophic



Intensive growth of filamentous algae



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GAM pattern- taxa answer in respect to nutrient changes





• *Tribonema* and *Ulothrix* with occurrence optimum in temp. lower than 20°C. There are early spring, cold-loving taxa.

C. glomerata begins its development at lower temperatures - a pioneering species.

• *Oedogonium capillare* showed the optimum of occurrence in water at 20 ° C. It is a thermophilic species.

GAM pattern- taxa answer in respect to chloride concentration changes



Proline (Pro) an indicator of stress



Why macroalgae? Valuable compounds



- Natural fertilizer
- Feed ingredient
- Algicides
- Biofuels
- Absorbent in watsewater treatment
- Plant biostimulator

- Improvment of water quality
- Biodiversity increase
- Improving the recreational attractiveness of the bathing
- areas







Stages of macroalgal harvesting



Further analyzes in laboratory

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Essential and beneficial elements for plants

Elements necessary

for the growth and development of plants



Macronutrients: N, P, K, Ca, Mg, S



Elements beneficial

for the growth and development of plants



Na, Al, Co, Se, Ti, V, La, Cr



Micronutrients: Fe, Mn, Cu, B, Zn, Mo, Cl, Ni, Si

Macroalgae – adition to natural fertilizers

D	7. 20 F		
	520 5 4		
		S	
S.			
2°			33)
		Store .	in the
100µm		Ser.	1292



*Maćkowiak i Żebrowski 2000				
Chemical components	MANURE* [%]	ALGAE [%]		
water	ca. 77	ca. 80		
Organic substances	20-27	20-30		
Nitrogen	0,4-0,7	0,3-0,7		
Phosphate	0,2-0,9	0,3-0,8		
Magnezium	0,1-0,3	0,2		
Potassium	0,5-0,7	0,2-0,6		
Sodium	0,1	0,1		
Calcium	0,4-0,8	0,5-1,0		
Silicon	0	0,3-1,0		
рН	7,5	7,9		

Macroalgae have a high content of bioactive <u>compounds</u>





- (1) Wet biomass increase in moisture content of dried manure; immediate availability of all bioactive substances; longer storage = homogeneity of the material (humidity, penetration of layers)
- (2) Dry biomass extracts (easy to store, can be used in doses during spraying)

Key benefits of macroalgae as bio-fertelizers.



Ultra-fast nutritional effect - quick and easy absorption of macronutrients



Very high concentration of nutrients - up to 55% more nutrients compared to standard chelates



High performance



Biodegradability



Excellent solubility and miscibility with agrochemicals

Algae-enhanced cosmetics



EXTRACT

- POLYPHENOLES
- FATTY ACIDS
- VITAMINS
- CHLOROPHYLL
- \rightarrow ACTIVE SUBSTANCE

SPENT MATERIAL

- LIGNOCELLULOSE
- DIATOMS
- CALCIUM CARBONATE
 CRYSTALS
- \rightarrow IDEAL ECO-SCRUB

Fatty acids content in C. glomerata extracts



fatty acid in the freshwater *C. glomerata* is: palmitic acid (C16: 0),

and between others saturated fatty acids there have been detected such miristic (C14:0), pentadecanoic (C15: 0), stearic (C18: 0) and arachidic (C20: 0).

Saturated and unsaturated fatty acids

Chlorophylls and carotenoids in C. glomerata extracts



UAE and MAE extractions are the most effective for obtaining chlorophylls.

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Phenolic compounds analysis

Total phenols content in algae extracts (Cladophora), water from the mat (Water M) and water from outside the mat (Water) in the period May-October - Lake Oporzynskie.



Microwave-assisted extraction (MAE); Supercritical fluid extraction (SFE)

Sulfated polysaccharides



anionic polysaccharides, contain a sulphate group, come from cell walls, where constitute a building material
8-29% of algae dry matter
Ingredients: glucose, xylose, rhamnose, mannose, arabinose, galactose, uronic acids



Algae-enhanced cosmetics – COSMETIC SAFETY REPORT

CONSERVATION STABILITY

• BACTERIA AND FUNGI

• E.G. "CHALLENGE TEST" (MUST ELIMINATE CONTROLLED, DELIBERATE CONTAMINATION)

EMULSION STABILITY

- LOW-TEMP AND HIGH-TEMP
- MEASUREMENTS OF DROPLET
 SIZE AND AGGLOMERATION
- MUST SURVIVE WITHOUT BREAKING AND IMPORTANT PHYSICOCHEMICAL CHANGES



Conclusions

Freshwater green macroalga C. glomerata was found as a source of various bioactive compounds:

- Fatty acids;
- Carotenoids;
- Phenolic compounds;
- Sulfated polysaccharides
- **Extracts from the alga possess antioxidant properties**
- **Extracts added to cosmetics increased skin hydration and elasticity**

Biomass of C. glomerata can be used as a new cosmetic raw material

CONCLUSIONS



- Natural fertilizer
- Feed ingredient
- Algicides
- Biofuels
- Absorbent in watsewater

treatment



Plant biostimulator

- Improvment of water quality
- Biodiversity increase
- - Improving the recreational attractiveness
 - of the bathing area



DEMONSTRATION OF ALGAE HARVESTING IN THE KAUNAS RESERVOIR KAUNAS, LITHUANIA; 06 SEPTEMBER 2022



THANK YOU FOR YOUR ATTENTION

Freshwater green macroalga Cladophora glomerata.