BIOECOBALANS

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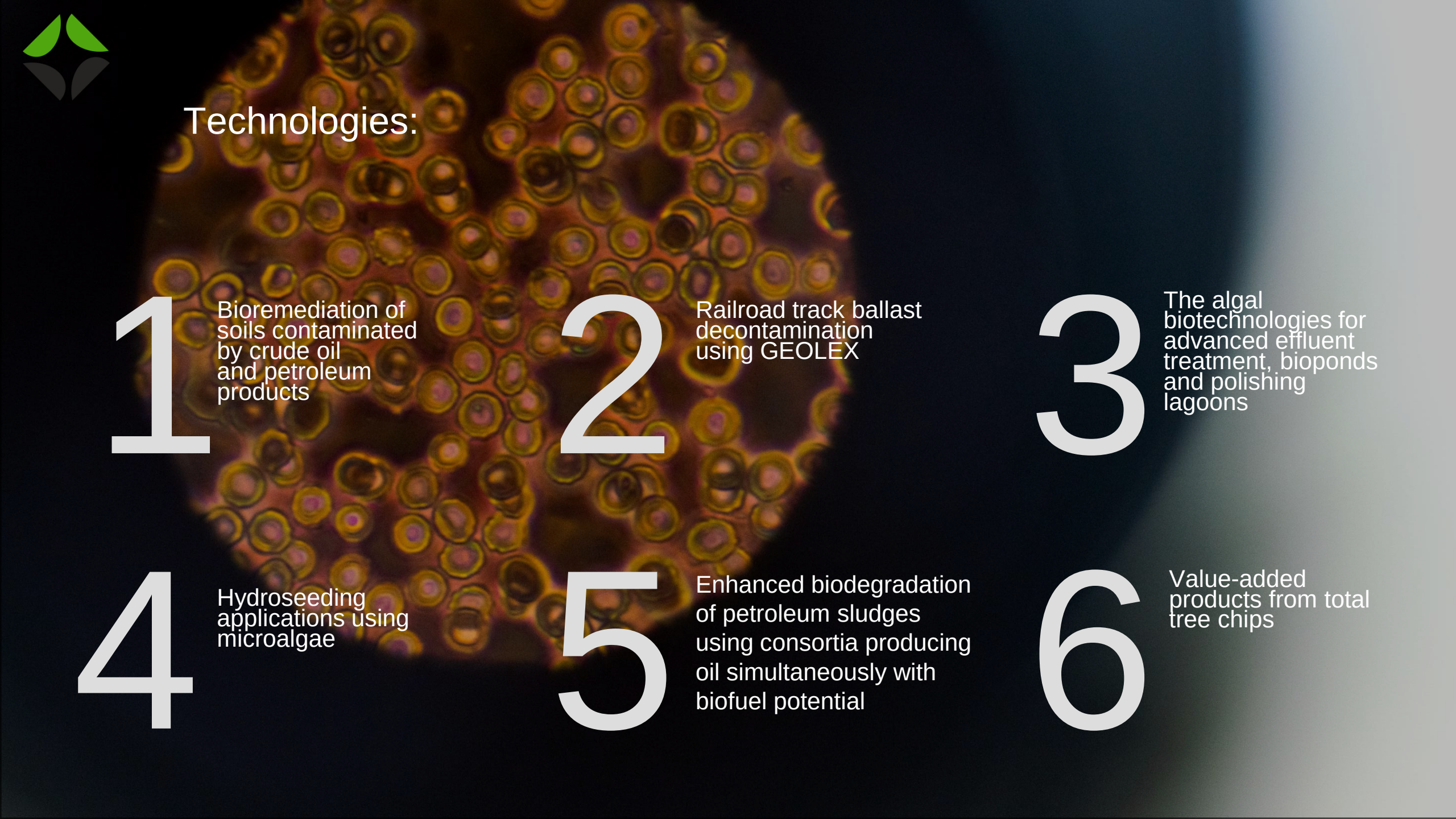
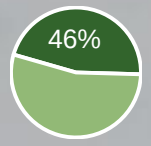
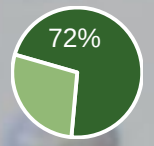
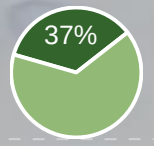
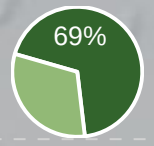
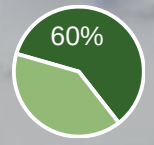
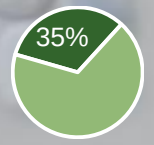
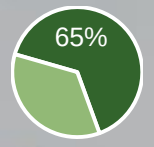
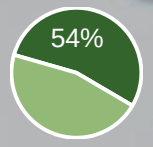


Technologies:

1. Bioremediation of soils contaminated by crude oil and petroleum products
2. Railroad track ballast decontamination using GEOLEX
3. The algal biotechnologies for advanced effluent treatment, bioponds and polishing lagoons
4. Hydroseeding applications using microalgae
5. Enhanced biodegradation of petroleum sludges using consortia producing oil simultaneously with biofuel potential
6. Value-added products from total tree chips

Biotrin

Efficiency based on criteria included processing time, contaminant type

BIOTRIN	t, days	Removal efficiency, %		Alkane and PAH transformation, %	
		used oil	petroleum	fluorene,phenanthrene, pyrene,benz(a)anthracene,fluoranthene	*n*-alkanes C13-C25
Yeast	7	–			–
Bacteria	14				
Microalgae	7	–	–		
	30			–	–

The rate of biodestruction under aerobic conditions and temperature ranging from +10°C to +35°C (for 120 days) is 75–90%.
The rate of biodestruction under aerobic conditions and temperature ranging from +2°C to +10°C is 50–60%

BIOTRIN is used for oil-contaminated sites (soil, water, etc.), the treatment and post-accident remediation in oil fields, petroleum pipelines and storage facilities. It is recommended for the environmental remediation in northern, middle and southern taiga zone.

BIOTRIN is a versatile product as its composition and a supporting matrix can vary significantly depending on a specific task.

BIOTRIN is delivered as a suspension or a finished biotechnological product on the supporting matrix.

Supporting matrices:
- Glauconite
- Argillite
- Peat
- Dewatered activated sludge
- Lignin
- Diammonium phosphate
- Biopolymers

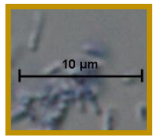
After reducing of the TPH in soil, water or bed silt the number of microorganisms introduced with the product diminishes because of a lack of available carbon.

Reference publications:
Shchemelinina, T.N. et al., 2021. The analcime-bearing rock immobilized microalgae: Stress resistance, psychrotolerance, phenol removal. *Bioresour.Technol*. 322,124560. DOI: 10.1016/j.biortech.2020.124560
Tarabukin, D.V. et al., 2017. Biosorbents based on esterified starch carrying immobilized oil-degrading microorganisms. *J. biotechnol*. 260, 31-37. DOI: 10.1016/j.jbiotec.2017.08.024

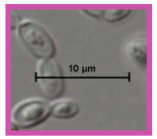
GEOLEX

Principal characteristics:

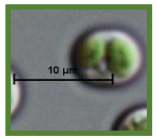
	Comparables	GEOLEX
Buoyancy, days	20–30	60
Oil sorption capacity, kg (oil/sorbent)	4–10/1	from 8/1
Biodestruction under aerobic conditions and in the temperature range of +10°C to +25°C	20–70%	65–98%
Biodestruction under aerobic conditions and in the temperature range of 0°C to +10°C	12–40%	60–70%
Biodegradability	–	+
Specific disposal	required	not required



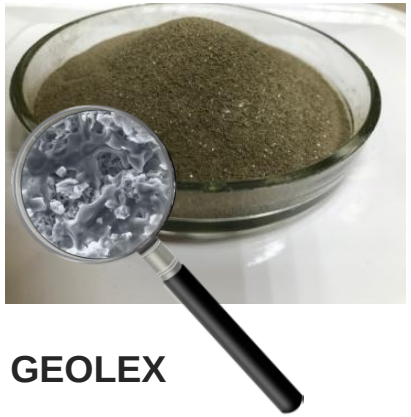
Pseudomonas yamanorum (VKM B-3033D)



Rhodotorula glutinis (VKM Y-2998D)



Chlorella vulgaris f. *globosa* (SYKO A Ch-011-10)



GEOLEX

Consortium of algae, bacteria and yeast

Reference publications:
Shchemelinina, T.N. et al., 2017. New trends in the mechanisms of increasing productivity of mineral-based materials. *Vestnik IG*. 270. 40-42. DOI:10.19110/2221-1381-2017-6-40-42
Shchemelinina, T.N. et al., 2018. Zeolite and clay raw: experimental modeling of biogeosorbents. *Vestnik IG*. 285. 50-57. DOI:10.19110/2221-1381-2018-9-50-57
Shushkov, D.A. et al., 2020. Analcime-bearing rocks as advanced sorbents. *Építôanyag – JSBCM.* 72 (5), 156-164. DOI:10.14382/epitoanyag-jsbcm.2020.26

Railroad track ballast decontamination using GEOLEX:

The TPH removal efficiency is 97 – 99 %.

1

2

3

4

5

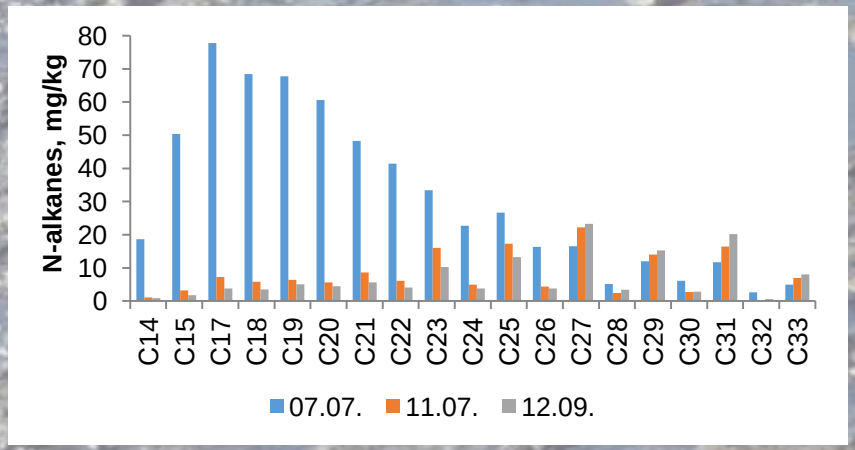
	The exposure period in the aeration rotor, h	TPH content
Initial	-	24
The GEOLEX Biogeosorbent applied	1	0.6
	36	0.7

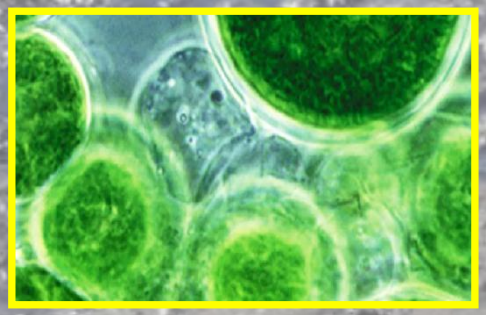
The algal biotechnologies of the effluent treatment

During 2014, the efficiency of the phenol removal in effluent treatment facilities of the pulp and paper mill was 73.6%. Having been inoculated with a suspension of the microalgal strain *Acutodesmus obliquus* with the cell titer of 10^5-10^6 for a week the efficiency of the phenol removal rose to 85.9%. The suspension consumption was 19 L/day.

Microalgal application for soil remediation

The TPH removal efficiency - 74%





Tests of the biogeosorbent "GEOLEX" on oil-contaminated sitesin Western Siberia, 2018

Cleaning efficiency in 60 days

87%

Industrial reclamation of polluted areas in 2020with the use of biogeosorbent "GEOLEX"

Cleaning efficiency in 60 days
85-91 %

Industrial reclamation of polluted areas 2016-2022 with the use of BIOTRIN biologics and GEOLEX ® biogeosorbent

Cleaning efficiency
in 60 days
85-95 %


Thanks for your attention