

Foretaksnavn University of South Bohemia
Hjemmeside: www.jcu.cz

Utfyller

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Mottaker: Svalbards miljøvernfond - Sysselimesteren på Svalbard

SØKNAD

REFERANSEN R.: 19/60

Nutrients availability in drinking/waste waters

Beskrivelse av tiltaket/prosjektet:

The aim of the proposed project is to characterize the quality of drinking and waste waters in Longyearbyen. Such analysis is crucial for drinking water supply and waste water treatment management and maintenance of facilities. The algal growth potential (AGP) and nutrient limitation tests based on EN ISO 8692 and its miniaturized version TNV 75 7741 (Ministry of Agriculture of the Czech Republic) are suitable for evaluation of nutrient contents and their availability for growth of photosynthetic microorganisms as well as possible toxic effects of e.g. heavy metals. The samples will be collected at different sites covering incoming water from snow and glacial streams, the water in the water supply facilities, and the waste water from the settlement. To cover the seasonal changes, the sampling will be performed three times per year. After sampling, chemical analyses and AGP tests will be performed. The data should reveal nutrient loads in drinking and waste waters during year and may be used for improvement and planning of the drinking water supply and waste water treatment in future.

Utfyllende om tiltaket/prosjektet

Søknadskategori: Kartleggings- og overvåkningstiltak

Utfyllende beskrivelse av tiltaket/prosjektet, formålet med tiltaket/prosjektet gjennomføring og metode:

The quality of drinking and waste water is crucial for the quality of life of Longyearbyen inhabitants and visitors, as well as for evaluation of human impact of Longyearbyen settlement on the Svalbard environment. The most important factors that influence the water quality are the nutrient loads, especially nitrogen (N) and phosphorus (P), and presence of heavy metals. The increased temperatures could lead to increased weathering rates, and hence to increased nutrient loads in polar waters. Higher nutrient load in the drinking water supply may lead to growth of harmful algae and cyanobacteria producing toxic compounds; at least the presence of cyanotoxins was proved in the Arctic as well as in the Antarctic. Moreover, higher temperatures may lead to increased toxin production, either due to increased toxin content in the cells or abundance of toxic strains. The high nutrient loads in the waste waters will inevitably lead to changes in the community structure, as the pristine polar environments are usually nutrient limited. As raised temperature may support introduction of the invasive species, such nutrient rich niches may serve as initial habitats for colonization and for development of adaptation/acclimatization mechanisms to polar environment in the invasive species. The heavy metals in polar may originate from geological basement as well as from human

activity. While they inhibit microbial growth at elevated concentrations, they may even stimulate it, beside their direct effects on human health. Therefore, the knowledge of the nutrient contents, possible nutrient limitation and heavy metal inhibitory effects in drinking and waste waters will be necessary for management and future development of drinking water supply and waste water treatment in Longyearbyen area, including state-of-the-art biotechnological solutions of some issues in near future.

For such purpose, the miniaturized algal growth potential (AGP) test, developed at the Institute of Botany CAS in Trebon, Czech Republic, collaborating institute with the Centre for Polar Ecology, Faculty of Sciences, University of South Bohemia, seems to be very suitable, as it may detect easily the nutrient availability, limiting nutrient(s) and heavy metal inhibition.

Objectives of proposed projects are following:

- to characterize physical and chemical properties of drinking and waste waters in Longyearbyen - to analyze nutrient load in these waters and if they are limiting or not using AGP test - to follow seasonal changes
Methodology:

1) Sampling

Sampling will be performed three times per year, as indicated in the timeline of the project. The sampling will cover water source for Isdammen and Isdammen water, river in Gruvendalen, as well as the uppermost parts of Longyearelva as references, samples in the drinking water supply system, and finally, the samples of Longyearelva waters at different sites in Longyearbyen. The exact sampling sites are indicated at attached map.

2) Physical and chemical analyses

The temperature, pH, conductivity, oxygen concentration and alkalinity will be measured immediately after sampling. The concentrations of N-NO₃, N-NO₂, N-NH₄, dissolved inorganic nitrogen (DIN), soluble reactive phosphorus (SRP), total nitrogen (TN), total phosphorus (TP) and chlorophyll a (Chl a) content will be performed in accredited laboratory. The availability of inorganic carbon (C-CO₂, C-HCO₃ and C-CO₃) will be determined from temperature, pH and alkalinity values.

3) AGP test

The water samples will be transported frozen to the Institute of Botany CAS in Trebon, where the AGP will be evaluated. The APG tests are based on standards EN ISO 8692 and Czech TNV 75 7741 (Ministry of Agriculture). The AGP test will be performed at standard (25 °C) and low (5 °C) temperatures using standard and low-temperature adapted algal strains, obtained from the CCALA, a culture collection in the Institute of Botany CAS in Trebon. The AGP will be measured in water samples. For determination of the limiting nutrient, the water samples will be enriched by N, P and N+P. For detection of heavy metal effects, EDTA will be added to the samples, and limiting nutrient analysis will be performed with the EDTA enriched samples as well. The tests will include negative (distilled water) and positive (growth medium) controls.

4) Data management and processing

The data will be stored in our internal database and SIOS and RiS data managements. The database exports will be used in statistical analyses to reveal AGP values and their changes in time, to determine limiting nutrient(s) and heavy metal effects.

Miljøeffekt av tiltaket/prosjektet:

Proposed analyses will give us overview of drinking and waste water quality in respect of physical and chemical composition and also in respect of which mineral nutrients could be incorporate to microbial loops (algal cells). Such a information could help to understand of the quality of drinking waters, including biotechnology which could improve their quality in Lonbyearbyen. In respect of waste waters analyses will give us information how nutrients from waste waters are incorporated into microbial look and results will suggest which biotechnology should be used for waste water treatments.

Proposed research will improve management of drinking and waste water in Longyearbyen. Proposed project will increase research collaboration between Czech Arctic Research Infrastructure "Josef Svoboda Station" (polar.prf.jcu.cz) in Longyearbyen and Longyearbyen society.

Research results will be published in international journal and research results will be recorded in SIOS and

RiS data managements.

Forvaltningsrelevansen i prosjektet:

In respect of nature protection in Svalbard the proposed research will suggest how to improve drinking and waste water management in Longyearbyen by determination of their nutrient loads and availability. Such data are necessary to estimate the risk of development of algal blooms in water sources and the impact of human activity on the surrounding environment. Further, the data will be crucial for planning, development and implementation of novel technologies for drinking water processing and supply, and waste water treatment in Longyearbyen.

Ris ID: 11137

Forskningsinstitusjon:

Har det tidligere vært utført tilsvarende prosjekt innenfor samme type hovedkategori eller lignende prosjekter? Nei

Trengs det særskilt teknisk og/eller faglig kompetanse? Ja

Beskriv hvilken kompetanse søker besitter i forhold til oppgaven som skal løses og hvilken metode som skal anvendes:

To fulfill the project aims, following special items are crucial:

- access to water supply and waste water treatment facilities for sampling will be provided by Longyearbyen localstyre - water & waste water service
- logistical support during the sampling will be provided by Czech Arctic Research Station in Longyearbyen
- water chemical analyses, will be provided by analytical laboratory
- algal strains will be provided by CCALA (algae culture collection of Institute of Botany CAS, Trebon, Czech Republic)
- specific skills for AGP determination and data analyses will be covered by proposed team

Inngår det flere faglige og/eller økonomiske samarbeidspartnere i tiltaket/prosjektet? Nei

Gjennomføring av tiltak/prosjekt

Varighet: 01.07.2019 - 30.06.2021

Fremdriftsplan		
Start	Slutt	Milepæl/aktivitet
01.07.2019	14.07.2019	Project start, sampling period preparation
15.07.2019	15.08.2019	Sampling period 2019/1
16.08.2019	31.10.2019	Analysis of samples 2019/1
01.11.2019	30.11.2019	Sampling period 2019/2
01.12.2019	31.03.2019	Analysis of samples 2019/2
01.04.2020	30.04.2020	Sampling period 2020/1

01.05.2020	14.07.2020	Analysis of samples 2020/1
15.07.2020	15.08.2020	Sampling period 2020/2
16.08.2020	31.10.2020	Analysis of samples 2020/2
01.11.2020	30.11.2020	Sampling period 2020/3
01.12.2020	31.03.2021	Analysis of samples 2020/3
01.04.2021	30.04.2021	Sampling period 2021/1
01.05.2021	30.06.2021	Analysis of samples 2021/1 and data summarization

Kostnadsoverslag

Kostnadsoverslag			Beløp
Eget arbeid	Sats	Timer	
Dugnad	200,-	240	48 000
Lønnsutgifter	126	2 087	262 962
Lønnsutgifter	0	0	0
Lønnsutgifter	0	0	0
Kjøp/leie av tjenester (håndverkere, konsulenter m.m)			
Sample analyses			24 612
Spesifiser			0
Spesifiser			0
Andre kostnader			
Materialkostnader			113 593
Fraktkostnader			0
Reiser, transport, opphold			189 599
Annet - spesifiser			0
Totale prosjektkostnader			638 766


Finansiering

Finansieringsplan			Beløp
Egeninnsats	Sats	Timer	
Dugnad	200,-	0	0
Lønnsmidler	146	417	60 882

Lønnsmidler	0	0	0
Lønnsmidler	0	0	0
Egenkapital			
Egne midler utenom lønnsmidler			3 786
Verdi av egne materialer			0
Lån (långiver)			0
Private tilskudd (stipend, fond, sponsorer, gaver)			
Spesifiser			0
Spesifiser			0
Spesifiser			0
Offentlige tilskudd (søknad sendt til: navn/status)			
Spesifiser			0
Spesifiser			0
Spesifiser			0
Omsøkt tilskudd fra Svalbards miljøvernfond			574 098
Total finansiering			638 766

Kan tiltaket/deler av tiltaket gjennomføres med mindre tilskudd enn omsøkt? Nei

Vedlegg

 Map2018.pdf (Kart)

 Budget.pdf (Annet)

Merknad:

Ingen merknad

Ettersende vedlegg per post: Nei

Er nødvendige tillatelser vedlagt søknaden? Ja

[sign] **Josef Elster for University of South Bohemia**

Lvert 01.02.2019