



Distribution of inorganic nanoparticles in a Norwegian fjord

Bruvold, Are S.; Bienfait, André Marcel; Ervik, Torunn Kringlen; Loeschner, Katrin; Valdersnes, Stig

Published in:
10th Nordic Conference on Plasma Spectrochemistry

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Bruvold, A. S., Bienfait, A. M., Ervik, T. K., Loeschner, K., & Valdersnes, S. (2022). Distribution of inorganic nanoparticles in a Norwegian fjord. In *10th Nordic Conference on Plasma Spectrochemistry: Programme and Abstracts* (pp. 55-55). Article O-32 Norwegian Chemical Society.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

(O-32)

DISTRIBUTION OF INORGANIC NANOPARTICLES IN A NORWEGIAN FJORD

Are S. Bruvold^{1,2}, André Marcel Bienfait², Torunn Kringlen Ervik³, Katrin Loeschner⁴, Stig Valdersnes^{1,2}

¹University of Bergen, Department of Chemistry, P.O. Box 7803, N-5020 Bergen, Norway

²Institute of Marine Research, P.O. Box 1870 Nordnes, NO-5817 Bergen, Norway

³Norwegian Institute of Occupational Health, Gydas vei 8, 0304 Oslo, Norway

⁴National Food Institute, Technical University of Denmark, Kemitorvet 201, DK-2800 Kgs. Lyngby, Denmark

The marine environment is the principal sink for natural, incidental and engineered nanoparticles (NPs). Due to the analytical challenges of detecting and quantifying nanoparticles in seawater, the data on distributions of NPs in the marine environment is limited to qualitative studies or by ensemble measurements subject to various analytical artifacts. Single particle inductively coupled plasma mass spectrometry (SP-ICP-MS) is a technique allowing precise determination of individual inorganic NPs at concentrations in the nanograms per liter range, yet thus far only few studies have been done on select elements in surface sea water. Here, a multi-element screening method using SP-ICP-MS was developed and applied using a trace element sampling procedure using acidification and a neutral sampling protocol developed for NP specific purposes. Employing this method, a first survey of the horizontal and vertical distributions of inorganic nanoparticles and trace elements was performed in a pristine Norwegian fjord prospect for submarine tailings deposition. Statistical control of false positive detections while minimizing the size detection limit was ensured using a novel raw signal processing. To confirm the results of the single particle measurements, and for qualitative information regarding particle morphology and composition, scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) was used. Following SP-ICP-MS screening for particles of 16 elements, particulate Al, Fe, Mn, Pb, Si and Ti were found and determined to number concentrations in the range 4×10^6 to 10^8 particles per liter. A strong depth dependence was observed for both trace elements and particles, concentrations increasing with depth. The particulate fraction was for all elements found to comprise only a few mass percent of the total metals, at concentrations mostly in the hundreds of ng/L range versus $\mu\text{g/L}$ for total metals. The sampling protocol was found to have a strong influence on the particles consisting of Fe, Mn, Pb and Ti, whereas no significant influence was found for Si and Al containing particles. Our results provide a baseline for the fjord and new data on environmental levels of both total metals and metal containing nanoparticles including the vertical and horizontal distribution of natural nanoparticles.