Method development and first measurements of marine biopolymers and ice nucleating particles for the application in Arctic field samples

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The knowledge about the origin and chemical composition of aerosol particles in the Arctic is sparse. Recently, marine biopolymers, found in both the sea surface microlayer (SML) and the bulk sea water, have been discussed as potential constituents of ice nucleating particles (INPs) [1] and cloud condensation nuclei (CCN) [2].
Transparent exopolymer particles (TEP), a special group of marine biopolymers, are gelatinous, stainable exudates from marine microorganisms in seawater. To date, there are few analytical measurements for TEP available, especially in marine aerosol particles. As a first step for increasing existing data, an analytical method based on staining the TEP and measuring them spectrophotometrically was adopted within this project to detect TEP and their concentrations in marine field samples. In preliminary experiments with samples from the Baltic Sea we could demonstrate that TEP are present in sea water and aerosols as well. Diameters of these particles ranged from 10-200 µm. These findings might suggest a sea-air phase transfer of TEP.
For a more detailed characterization of the chemical composition of marine aerosols and sea water on molecular level, a new procedure for the quantification of carbohydrates is currently being developed. High Performance Anionic Exchange Chromatography with Pulsed Amperometric Detection (HPAEC-PAD) is a highly sensitive and quick method for sugar analysis, but suffers from strong vulnerability to sea salt. Therefore electrodialysis as a desalting preparation step has been tested. We could demonstrate that electrodialysis allows a reduction of sea salt up to 99.4% for small (5 ml) and high (200 ml) quantities, while carbohydrate analytes can be retained.
Existing methods for the quantification of the ice nucleation behavior of INPs on liquid samples [3,4] have been adapted, optimized, and applied to SML samples of different origins.

These newly developed and/or optimized analytical methods will be applied to Arctic sea water and aerosol samples that will be collected during the field campaign PASCAL aboard the German research vessel *Polarstern* from May to July 2017. From our comprehensive measurements we aim to identify relations between chemical information (e.g. the presence of marine biopolymers) and their physical properties (e.g. IN and CCN activity).

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References

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