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NITROGEN AND SULPHUR COMPOUNDS IN COASTAL ANTARCTIC FINE AEROSOL PARTICLES - AN INSIGHT USING NON-DESTRUCTIVE X-RAY MICROANALYTICAL METHODS

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X-ray microanalytical methods, such as a near edge X-ray absorption fine structure (NEXAFS) were used in conjunction with total reflection X-ray fluorescence (TXRF) analysis to characterize fine Antarctic aerosol samples. The techniques provided information on low-Z elements such as C, N and O. Size-segregated fine aerosol samples were collected at the Italian base at Terra Nova Bay (Antarctica) in February 2004. The TXRF-NEXAFS measurements were carried out at the PGM monochromator beamline for undulator radiation in the PTB laboratory at the electron storage ring BESSY II. It was possible to quantify the molar ratio of ammonium and nitrate based on linear combinations of standard reference spectra of $(NH_4)_2SO_4$ and $NaNO_3$. Using TXRF-NEXAFS, the ammonium-to-nitrate ratio was determined in Antarctic fine aerosol samples collected from less than 2 m^3 of air, i.e. considerably lower than the sampling volumes usually used for ion chromatography analyses (30 m^3). This reduced sampling volume should enable Antarctic aerosols to be characterized in higher temporal resolutions. For fine aerosols in the size range of 0.25–0.5 μm, nitrogen was observed to be present as almost entirely ammonium species. When the size of aerosol particles increased in the range of 0.25–2 μm, the content of ammonium decreased and yet the content of nitrate increased. The stoichiometry of the main chemical component of particles containing nitrogen and sulphur as major elements was found to be NH_4HSO_4.