Aerosols are very important components of the Earth's atmosphere. On the one hand, they have a negative impact on human health, on the other hand they directly and indirectly affect the climate. In the case of high emissions and in favorable weather conditions, aerosols create a smog. Small aerosol grains (grain diameter below PM 2.5) penetrate deeply into the respiratory system and toxic chemicals from the aerosol grains get into the bloodstream. Not only the aerosol in the form of smog, accumulating in the vicinity of heavily urbanized areas, has a significant impact on human life. An aerosol dispersed throughout the atmosphere has a great and not fully recognized impact on climate. Aerosol grains dissipate solar radiation, cooling the atmosphere and counteracting global warming. They are also condensation seeds and affect the process of cloud formation. More clouds less solar radiation reaches the surface of the Earth. These processes are very complicated and usually atmospheric models are used to quantify them. These, in turn, have trouble estimating the amount of aerosol generated. They estimate a much smaller amount of aerosol than it results from measurements carried out in the atmosphere. Of particular interest is the secondary organic aerosol (SOA) consisting of very low volatile organic compounds very often additionally mixed with inorganic compounds. The interest in SOA results from the fact that this aerosol dominates in the atmosphere. SOA arises as a result of shifting from the gas phase to the liquid non-volatile oxidation products emitted into the atmosphere, in large quantities, as the biogenic volatile organic compounds (BVOC). The mechanism of SOA formation, according to the scheme described above, is relatively well known at the moment, despite the fact that the amount of SOA calculated by atmospheric models according to this mechanism is insufficient. This project investigates the alternative mechanism of SOA formation. According to this mechanism, the products formed in the BVOC oxidation reactions dissolve in atmospheric water (rain drops, mist, water aerosol, etc.) and undergo further oxidation in the aqueous phase. The resulting products have such a low volatility that even when the water evaporates they remain as aerosol seeds. A number of factors cause the oxidation of organic compounds in water. Only some of the oxidizing agents, such as OH radicals, ozone (O_3) or SO_4^- radical are important in atmospheric chemistry. In addition, some of the BVOC oxidation products absorb UVA and UVB radiation reaching the Earth's surface. In order to determine the extent to which the oxidation reactions in water or photolytic activity is significant, it is necessary to know the speed of oxidation and photolysis (decomposition under the influence of light). The project will measure parameters allowing to evaluate the above-mentioned processes: reaction rate coefficients, UV absorption cross sections and quantum yields of photolytic processes. The oxidation reaction and photolysis products will be identified. For this purpose, separation techniques (capillary gas chromatography and high performance liquid chromatography) combined with the most modern instrumental techniques used for identification of the molecular structure of unknown chemical compounds (tandem mass spectrometry and high resolution mass spectrometry) will be used. In addition, nuclear magnetic resonance will be used for identification. The last stage of research will be the assessment of the significance of oxidation processes in atmospheric water using first a simple box model and later using an advanced atmospheric CAPRAM model. These calculations will be carried out in cooperation with Leibniz-Institute for Tropospheric Research (TROPOS) from Leipzig, Germany.