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Comparison of ice nuclei from fruit juices and their properties

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Heterogeneous ice nucleation is a crucial process in the atmosphere. Recent findings indicate the importance of biological ice nuclei (IN) in this process. Pratt et al. (2009) sampled ice-crystal residues at approx. 8 km high altitude over Wyoming, U.S.. They found a third of the dry residues to be biological and further that 60% of the highly abundant mineral dusts to be internally mixed with biological or humic substances. Huffman et al. (2013) showed a burst of biological IN over woodlands connected to rain events. Previous investigations in our group (Pummer et al. 2012) showed that pollen and pollen washing water from several plants native to the boreal forests trigger heterogeneous ice nucleation.
Recent work from our group (Felgitsch et al. 2016) showed that several juices of berries are ice nucleation active. Based on this research we examined ice nucleation activity (INA) and general properties of five juices: sea buckthorn, black currant, chokeberry, acerola, and elder berry. We elucidated particle size dependency of the ice nucleation activity to differentiate between coarse ice nucleating particles and nanoparticles or macromolecules. Investigations with different solvents and with chaotropic agents were performed in order to further clarify properties concerning chemical polarity of the IN, and the importance of hydrogen bonds and other structure forming polar interactions. The results are compared to known plant originated IN. Our results suggest similarities in terms of nucleation temperature and structure stability between different IN of plant materials. These properties show a clear differentiation to known bacterial and fungal IN.

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