Morphology and Structure of Biomorphous Silica Isolated from Equisetum hyemale and Equisetum telmateia

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Z. Naturforsch. 2010, 65b, 1113 – 1120; received March 4, 2010

The family of horsetails (Equisetaceae) is characterized through their high content of silica (SiO₂), which is the highest in known vascular plants. This work has focussed on two species of this family, Equisetum hyemale and Equisetum telmateia, where the biomorphous silica is deposited basically as amorphous SiO₂ in the outer epidermis of the plants. As source of SiO₂, the original plant material was air-dried and carved or powdered. For the isolation process the biomaterial was pre-treated with acetotropic HCl. This pre-treatment has the advantage of the extraction of high amounts of the natural inorganic matrix. In a second step the organic matrix was removed by a thermal oxidative process in the temperature range of 275 – 1200 °C to isolate the biogenic silicon dioxide from the perennial plant. Parameters of time, temperature and the thermal gradient were varied to optimize the process and to get products with the highest possible surface area. Furthermore, the particle morphology of the biogenic SiO₂ from leaves and stems was examined separately. The silica deposits were characterized by optical microscopy, scanning electron microscopy, infrared spectroscopy, gravimetry, nitrogen sorption analysis, and sedimentation analysis.

Key words: Equisetum hyemale, Equisetum telmateia, Horsetail, Biomorphous Silica, Silicon Dioxide