Modification of Silica Surface With Supercritical Water as a Tool Indicating New Possibilities of Existing Separation Methods

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Silica capillaries have been an integral part of the instrumentation used in many areas of analytical chemistry for decades, especially in analytical separations. In most cases, they are used without treatment, occasionally forceless chemical surface treatments are made to suppress or enhance the activity of silanol groups. The aim of this work was to disrupt the inner surface of the capillary, perfectly smooth from production, so that relatively coarse and various structures would be created, and to study their influence on the separation efficiency. The uniqueness of the used solution is based on the use of special properties of water exposed to high temperatures and pressures (supercritical water), which is able to disrupt this chemically inert material because of its aggressivity. In total, over 2000 experiments were carried out in order to define conditions suitable for the formation of various types of surface structures. Due to the high amount of resulting data, own database application was created, allowing not only to save the picture of the structure and experimental conditions information, but also to clearly sort them out and create image reports according to the specified parameters. A number of silica capillaries with different types of structures were prepared in configuration suitable for electromigration analysis and used for the separation of substances and biosamples, which cannot be analyzed on original capillaries with a smooth surface.

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