Abstract

The difficulty of modern analytical samples is going to require higher separation power and higher peak capacity, one solution for these could be the use of 3D-spatial chromatography. Three dimensions of separation could reduce the time while increasing the separation power. One proposal for the first dimension could be the use of isoelectric focusing, therefore a 2D titanium chip has been produced to see if it is a viable method. The titanium chip has a capillary of 1 mm, which is a large internal diameter for electrophoresis separation. The effect of increasing the size is therefore researched on titanium dioxide coated capillaries with smaller internal diameters. In this research, capillaries are coated with titanium dioxide and tested with capillary electrophoresis (CE), isoelectric focusing (IEF) and Fourier-transform infrared spectroscopy (FT-IR). The first results on the CE had shown that there is indeed a difference inside the capillary, in combination with the FT-IR there is a strong possibility that this could indeed be titanium dioxide, which could be confirmed more with Inductively Coupled Plasma (ICP) or with a Scanning Electron Microscope (SEM). The difference in EOF was tested with relation to the pH and the internal diameter of the capillary. The conclusion was with the pH measurements that the EOF increased when the pH increased, but for titanium there could be concluded that there was a slight difference in the EOF when the composition of the electrolyte was changed, which would agree with Hsieh et al. and Fujimoto et al. that the EOF is depended on the composition of the electrolyte. Because the composition of the electrolyte has an influence on the EOF, this could be an asset of titanium dioxide as surface on CE, because this would grant more separation possibilities. The relation between the internal diameter and the EOF was a logarithmic relation when the internal diameter was increased the EOF was decreased. Titanium and fused silica capillaries were compared with CE with the separation of the Î±-casein digest, where there is clearly visible that titanium has a better separation, this is probably due to the lower EOF. For isoelectric focusing the titanium showed until now not very good prospects, first buffer without EOF was found, but although there was no EOF, no good results were obtained. Different measurements were used to exclude what the problem was, but no certainty of the problems was found. One possibility could be that there is still no uniformity of titanium dioxide in the capillary or that instead of a positive EOF that there is a negative, which would give weird results and no detection. Overall it was according to CE and FT-IR the coating of titanium dioxide on a fused silica capillary was probably succeeded, but more research has to be conducted to be totally certain. Next, the results of the comparison of the CE chromatography of Î±-Casein digest shows that there is a clear improvement of the separation of the titanium dioxide coated capillary. And last the use of titanium dioxide for isoelectric focusing does not show great promise, so coating the 2D-titanium chip would be a better method, which could be a dynamic or permanent coating.