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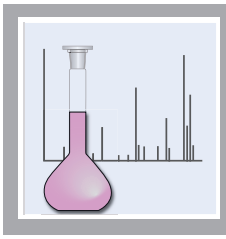

Highlights of Analytical Chemistry in Switzerland

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A Tough Nut to Crack: Quantitative Analysis of Heavy Metals in Automotive Brake Linings

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Brake linings used in automotive traffic are designed to optimally dissipate the frictional energy during the braking process with minimal loss of lining material. This is achieved by the manufacturers by using proprietary mixtures of highly temperature-resistant binder materials and metals.

The list of currently used metals also includes toxic heavy metals like chromium, antimony or lead. The abraded material ends up in the environment, where it considerably impairs the quality of roadside soils, drainage water from the roads, and the ambient air. Quantitative knowledge on the composition of brake linings is therefore important for regulating agencies to have a reliable handle on the existing legal limits for the use of heavy metals in the manufacturing process. Cracking the complex matrix of brake pads is, however, an analytical challenge; reliable analytical methods are still rather scarce.

In a recent study we presented a novel extraction method for brake pads, deploying a high-pressure asher and microwave-assisted extraction. This allowed for the quantitative analysis of the extracted elements by inductively coupled plasma optical emission spectrometry (ICP-OES) in a number of brake pad test samples from used passenger cars.

Despite the high accuracy of this method, it is not suitable for screening a large number of samples, as preferentially desired by regulating agencies. Therefore we also used our method as reference to assess the use of handheld X-ray spectrometers (ED-XRF) for *in situ* brake lining analysis, which have emerged as efficient screening tools in the last years. The comparison indicated that the applied brake pad screening procedure using the handheld ED-XRF-spectrometer provided a reliable determination of many (although not all) of the considered metals (Mo, Pb, Sb, Mn and Sn). **In future work this screening procedure will be refined by the design and validation of brake pad standard samples intended for use with handheld ED-XRF measurements.**

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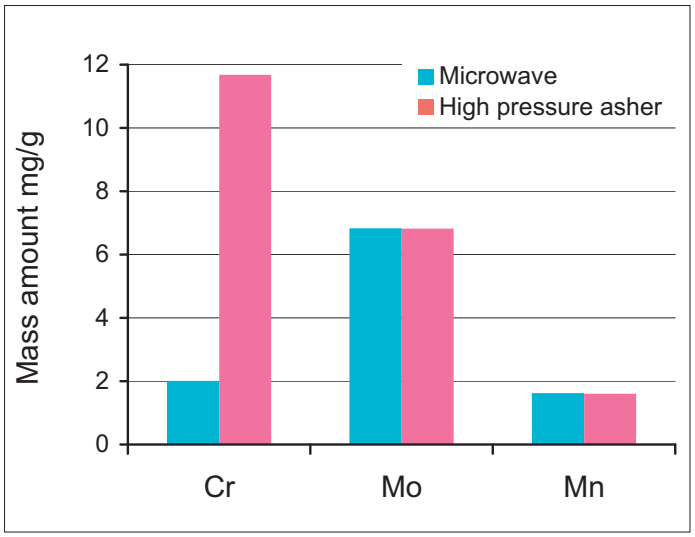
Brake pads with their temperature-resistant, hard linings composed from binder materials and heavy metals, some of them toxic.



Extraction efficiency of the microwave method vs. the high pressure asher (HPA). It is obvious that Cr with the microwave method is 6 times lower then with the HPA method. The cause is the formation of chromiumcarbide (CrC) with the microwave method.

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