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pH-dependent release of trace elements including platinum group elements (PGEs) from gasoline and diesel catalysts

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The release of trace metals and platinum group elements (PGEs) from automobile exhaust catalysts represents a remarkable source of higly dispersed environmental contamination. Especially, PGEs have shown increasing research interest due to their possible bioaccessibility. In our research, we focused on leaching behaviour of trace metals from gasoline and diesel automobile catalysts. While catalysts for gasoline engines contain a mixture of Pt-Pd-Rh or Pd-Rh, catalysts for diesel engines are composed only of Pt. We used dust from two crushed gasoline and two crushed diesel catalysts (new and aged). The dust of gasoline catalysts contains significant concentrations of Pt (700 mg.kg-1), Pd (11 000 mg.kg-1) and Rh (700 mg.kg-1). And the dust of diesel catalysts are composed of Pt (3 900 mg.kg-1) and they contains negligible amounts of Pd dan Rh (< 0.5 mg.kg-1, < 0.1 mg.kg-1, respectively).
To evaluate leaching of trace metals from dust we used pH-stat leaching test according to the European standard CEN/TS 14997.
The concentrations of cations: PGEs (Pt, Pd a Rh), K, Na, Ca, Mg, Al, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb, La and Ce were determined by inductively coupled plasma mass spectrometry (ICP-MS) and atomic absorption spectrometry (AAS), and anions: F-, Cl-, SO42- and NO_3- by high-performance liquid chromatography.
Although the dusts from catalysts were relatively stable to acid/base influence, the leaching of trace metals from catalysts showed a dependence on pH. Generally, the highest concentrations were released under acidic conditions. The leaching of PGEs was higher for Pt in diesel catalysts and for Pd and Rh in gasoline catalysts. The highest concentrations of Zn and Pb were observed in old catalysts. The rare earth metals were released more from gasoline catalysts. Catalysts particles represent health risk especially with respect to their PGEs contents.