

# TOXICITY OF IRON OXIDES AND METABOLITES OF BENZO[a]PYRENE ALONE OR IN COMBINATION IN CELLS CULTURE AND IDENTIFICATION BY LASER MICROPROBE MASS SPECTROMETRY

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## SUMMARY

The goal of the gas-phase studies of well-characterized transition-metal systems is to enhance our understanding of the chemistry and sometimes of the toxic, carcinogenic effects of transition metal oxide clusters and compounds. The analysis of inorganic solids by time of flight laser microprobe mass spectrometry (TOF-LMMS) shows the formation of clusters in the mass spectra which can be used for the identification of inorganic particles. First, we have applied non-resonance ionization ( $\lambda = 226$  nm) or resonant ionization ( $\lambda = 293.7$  nm) of iron to study the non stoichiometric  $\text{Fe}_{1-x}\text{O}$ ,  $\text{Fe}_3\text{O}_4$ ,  $\text{Fe}_2\text{O}_3$  compounds in positive mode by TOF-LMMS. The positive mass spectra are characterized by many differences between the clusters detected and their intensities. Then, we have analysed the benzo[a]pyrene (BaP), the 1-hydroxybenzo[a]pyrene (1-OH-BaP) and the 3-hydroxybenzo[a]pyrene (3-OH-BaP) of TOF-LMMS and by Fourier Transform Ions Cyclotron Resonance Mass Spectrometry (FT-ICR-MS). It is possible to distinguish these different compounds by their respective fingerprint. Later on, we have studied toxic effects of iron oxides (Hematite  $\text{Fe}_2\text{O}_3$  and Magnetite  $\text{Fe}_3\text{O}_4$ ), benzo[a]pyrene (BaP) and Pyrene, alone or in combination. The LC50 was appreciated by colony-forming cell culture method. Cells were observed by electron microscopy and the valence of particules was analysed by TOF-LMMS. With  $\text{Fe}_2\text{O}_3$  we have observed a significant decrease (20 %) at higher concentration (0.5 mmol/l) and smaller quantities of BaP were highly toxic. The association of BaP at the LC10 dose (0.05  $\mu\text{mol/l}$ ) with growing doses of  $\text{Fe}_2\text{O}_3$  or  $\text{Fe}_3\text{O}_4$  (0.0125; 0.025; 0.05; 0.1; 0.2 mmol/l), appeared to increase the toxic effect of BaP 3 to 4 times. These results suggest that  $\text{Fe}_2\text{O}_3$  and  $\text{Fe}_3\text{O}_4$  alone are not very toxic but the association of one of these compounds with BaP increases the toxicity of the latter. On the other hand, TOF-LMMS seems to show a metabolization of iron oxide into reduced form. But, it is necessary to raise the ambiguity about the iron which is always in the cells present. For that purpose, studies with iron oxides enriched by  $^{54}\text{Fe}$  isotope have begun.

*Key words: iron oxides, benzo[a]pyrene, cell cultures, laser microprobe mass spectrometry*

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