

Název: **Interaction of heavy metals with
graphene and iron based particles**

Školitel: **Mgr. Monika Kremplová, Ing. Dana Fialová, Ph.D.,
Ing. et Ing. David Hynek, Ph.D.**

Datum: **12. 9. 2014**

Water contamination



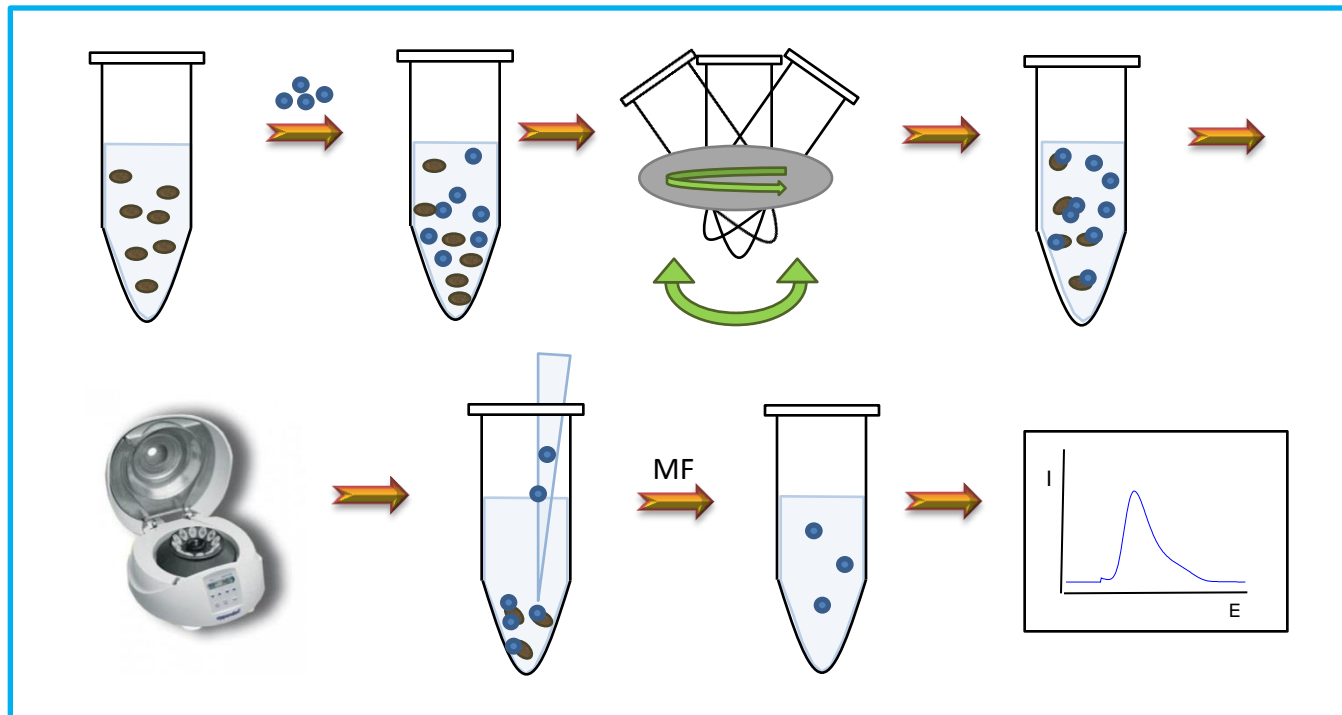
- The availability of clean water is essential for all industries
- 2025 - 1.8 billion people will live in countries or regions with absolute water scarcity and two-thirds of the world's population will be exposed to stress conditions in relation to the lack of water sources
- One of the most serious environmental problems is water pollution by heavy metals
- Nanotechnology is nowadays considered as a promising way for the removal of pollutants from ground water and wastewater



Experimental part



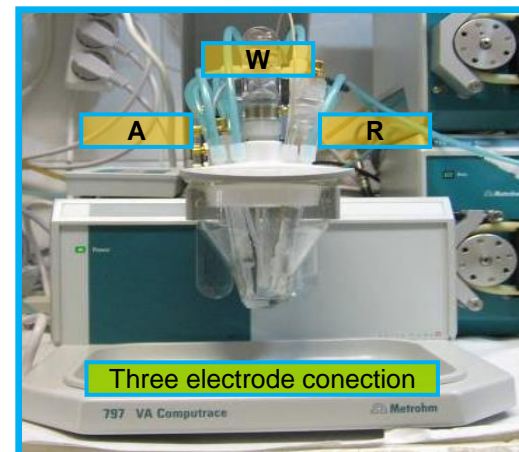
- Four types of adsorbents – expanded carbon
MWCNT
reduced graphene oxide
 Fe_2O_3 magnetic particles
- Scheme of experiment



Experimental part

Electrochemical determination of heavy metals

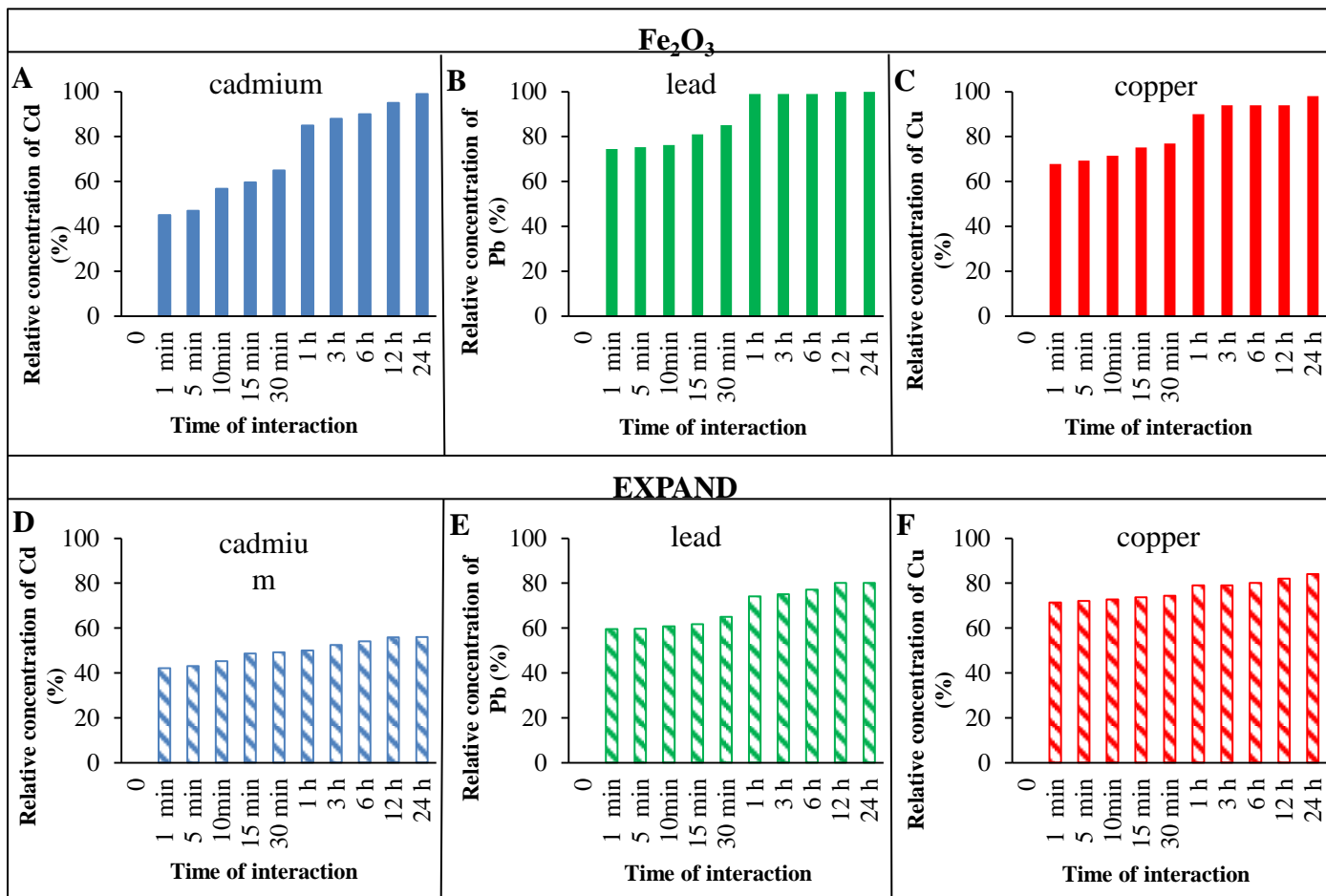
- 797 VA Computrace (Metrohm, Switzerland)
- Method: differential pulse voltammetry
- 3-electrodes system: **WE** – HMDE, drop size 0.4 mm²
RE – Ag/AgCl/3M KCl
AE – Pt
- Supporting electrolyte: 0.2 M acetate buffer, pH=5
- Method parameters:
 - Deposition potential -1.2 V
 - Accumulation time 240 s
 - Sample volume 15 μ l
 - Volume of supporting electrolyte 1985 μ l



Results



- Time interaction of heavy metals with different adsorbents
- 0-30 min, 1-24 hrs, applied concentration of metals 100 μ M
- Concentration of adsorbed metal calculate from free metal in supernatant after filtration



For Fe₂O₃ after 24 hrs:

- Cd – 98%
- Pb – 99%
- Cu – 100%

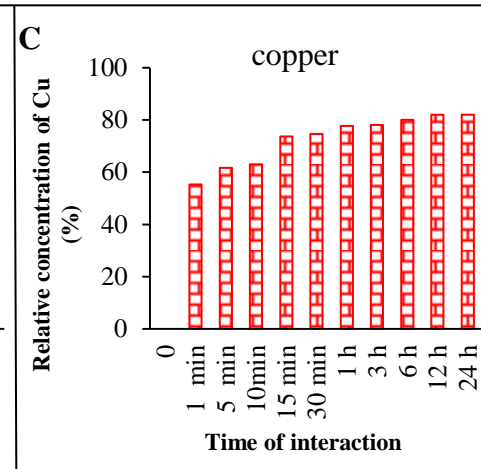
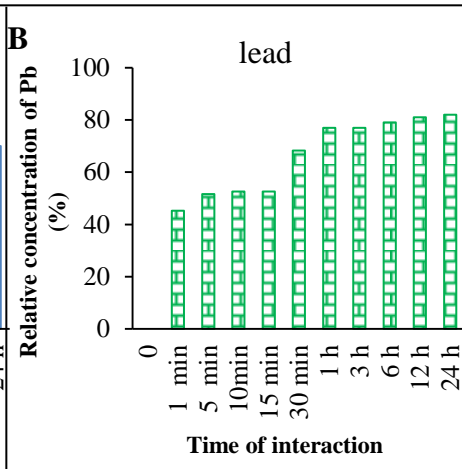
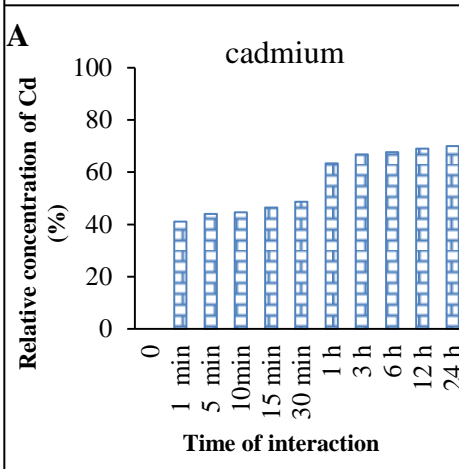
For Expand after 24 hrs:

- Cd – 52%
- Pb – 80%
- Cu – 83%

Results



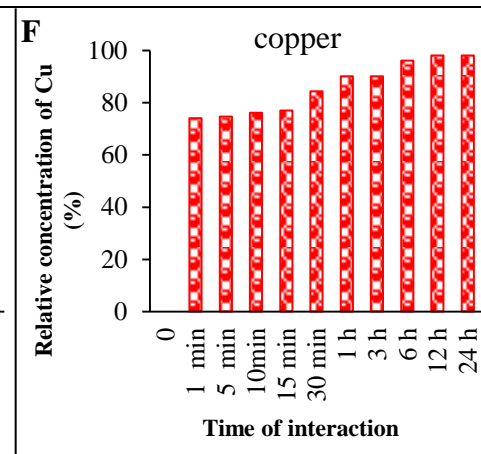
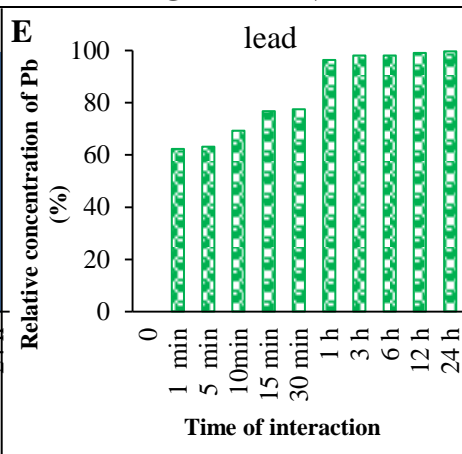
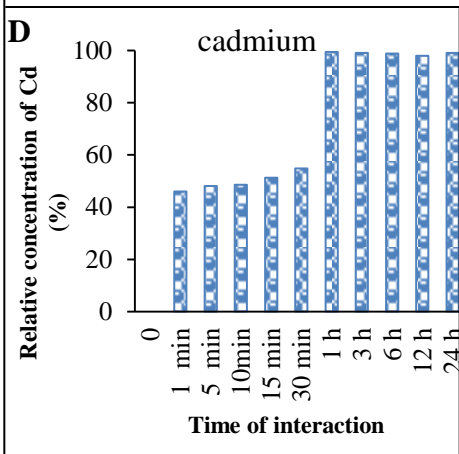
MWCNT



For MWCNT after 24 hrs:

- Cd – 71%
- Pb – 84%
- Cu – 81%

GRAPHENE



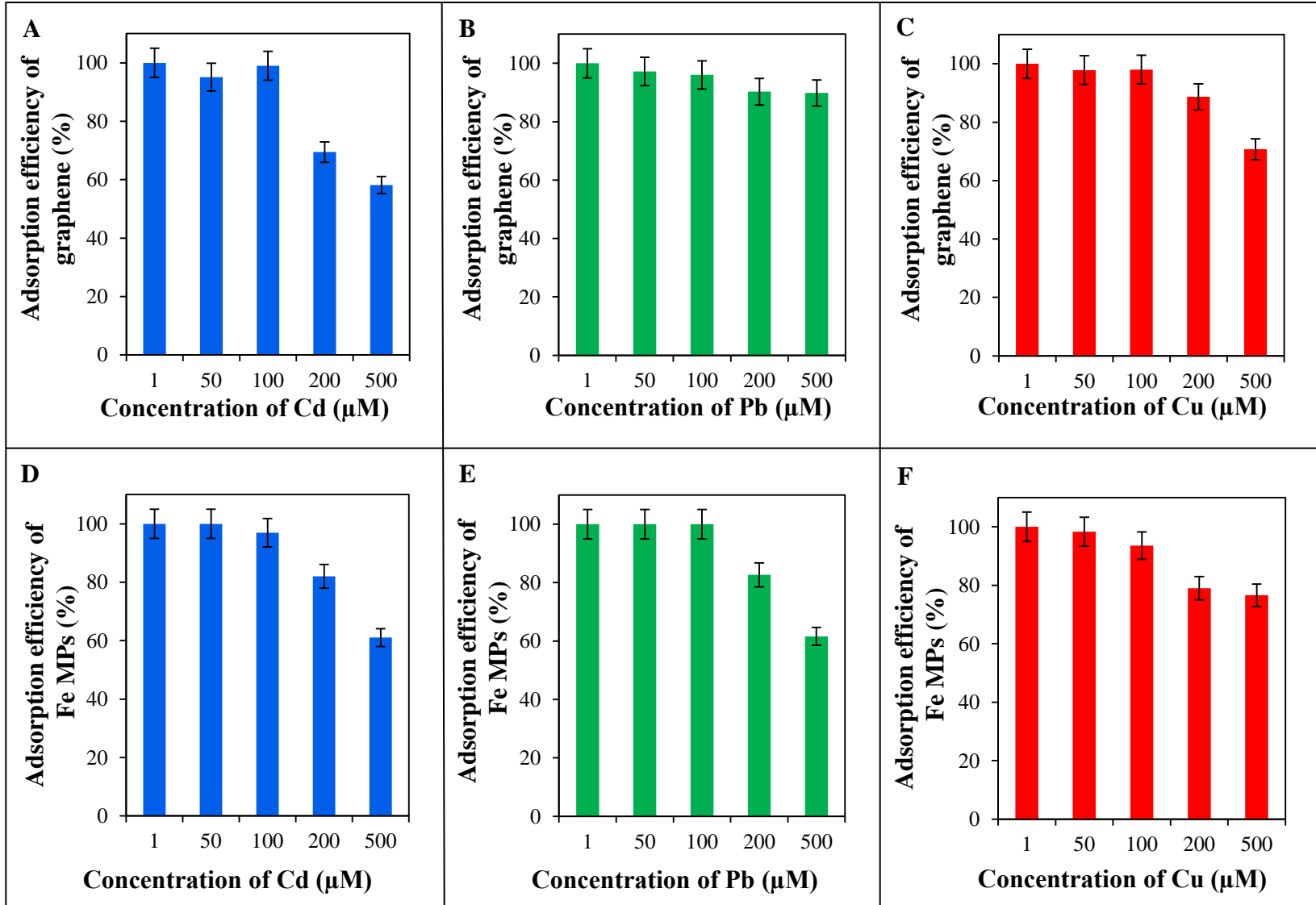
For graphene after 24 hrs:

- Cd – 100%
- Pb – 100%
- Cu – 100%

Results



- Adsorption capacity of graphene and FeMPs for Cd, Pb and Cu



Conclusion



- Four types of absorbents (reduced graphene oxide, expanded carbon, carbon nanotubes, and magnetic particles Fe_2O_3) were tested for adsorption of cadmium, lead, and copper ions.
- It has been found that reduced graphene oxide and Fe_2O_3 MPs have higher adsorption efficiency for all tested metals than the other two carbon materials
- For reduced graphene oxide and Fe particles the adsorption capacity was determined – $100 \mu\text{M}$

Acknowledgement

Ing. Simona Dostálová

Ing. et Ing. David Hynek, Ph.D

Prof. Ing. René Kizek, Ph.D



CZ.1.07/2.3.00/20.0148



evropský
sociální
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání
pro konkurenceschopnost

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

**Thank you for your
attention**

