

# **The Use of Critical Solution Mixtures for Contaminated Sediments Remediation**

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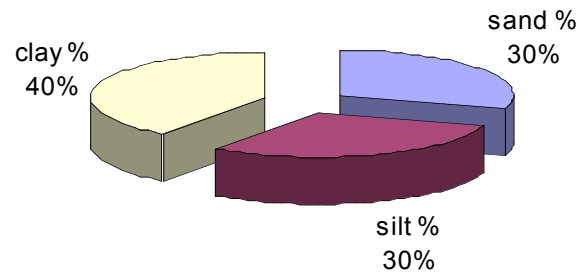
## The problem:

Polluted sediments in the Kishon River,  
Israel

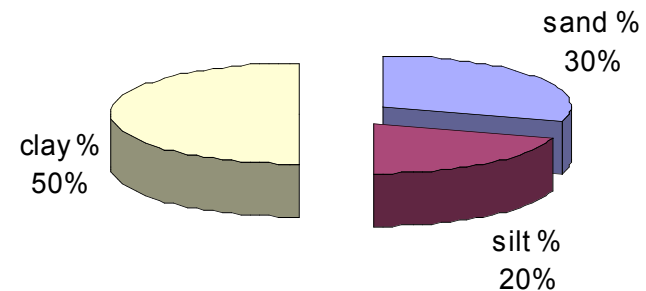


# Sediment composition at both ends of the Kishon River

Kfar Yehushua

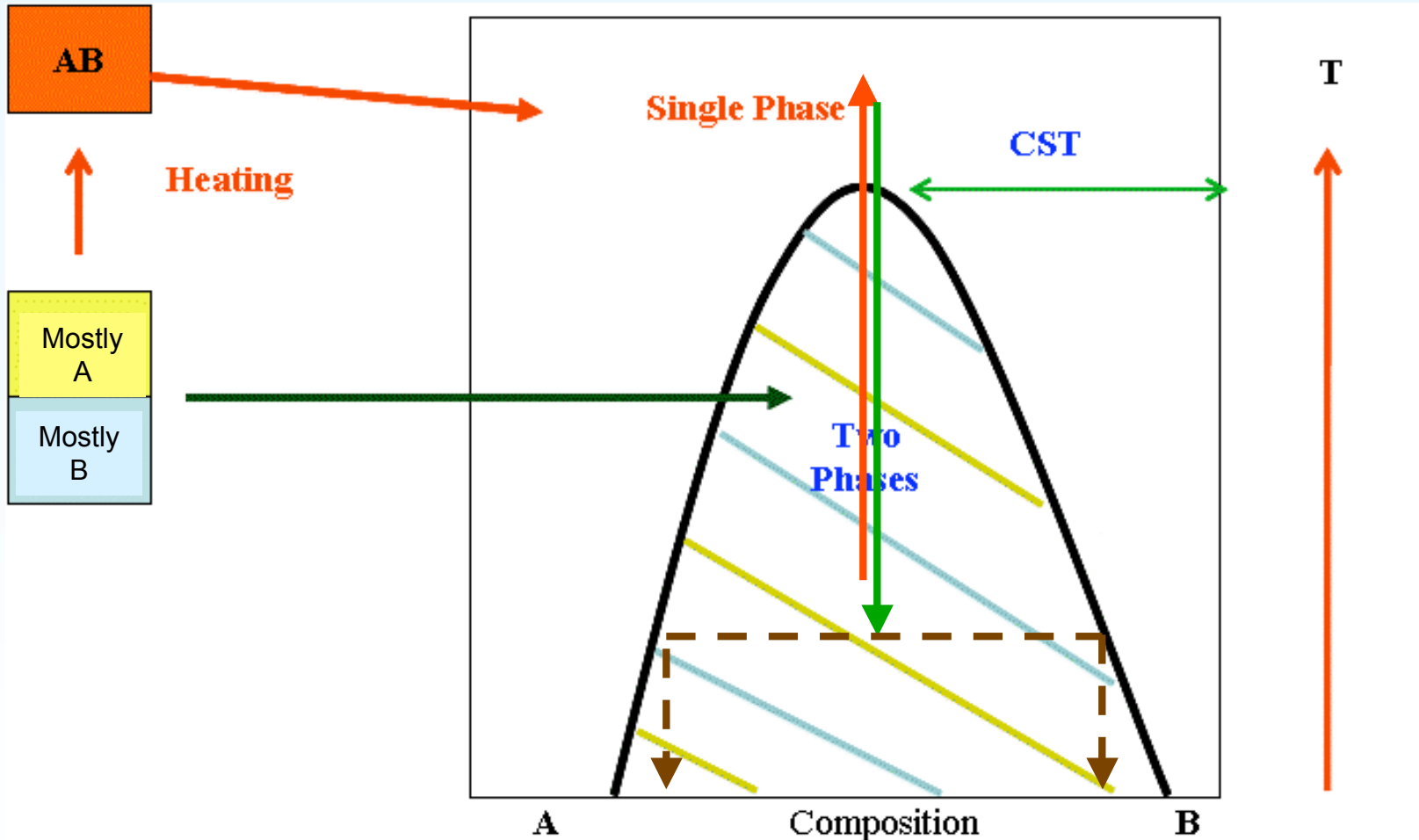


Haifa industrial zone



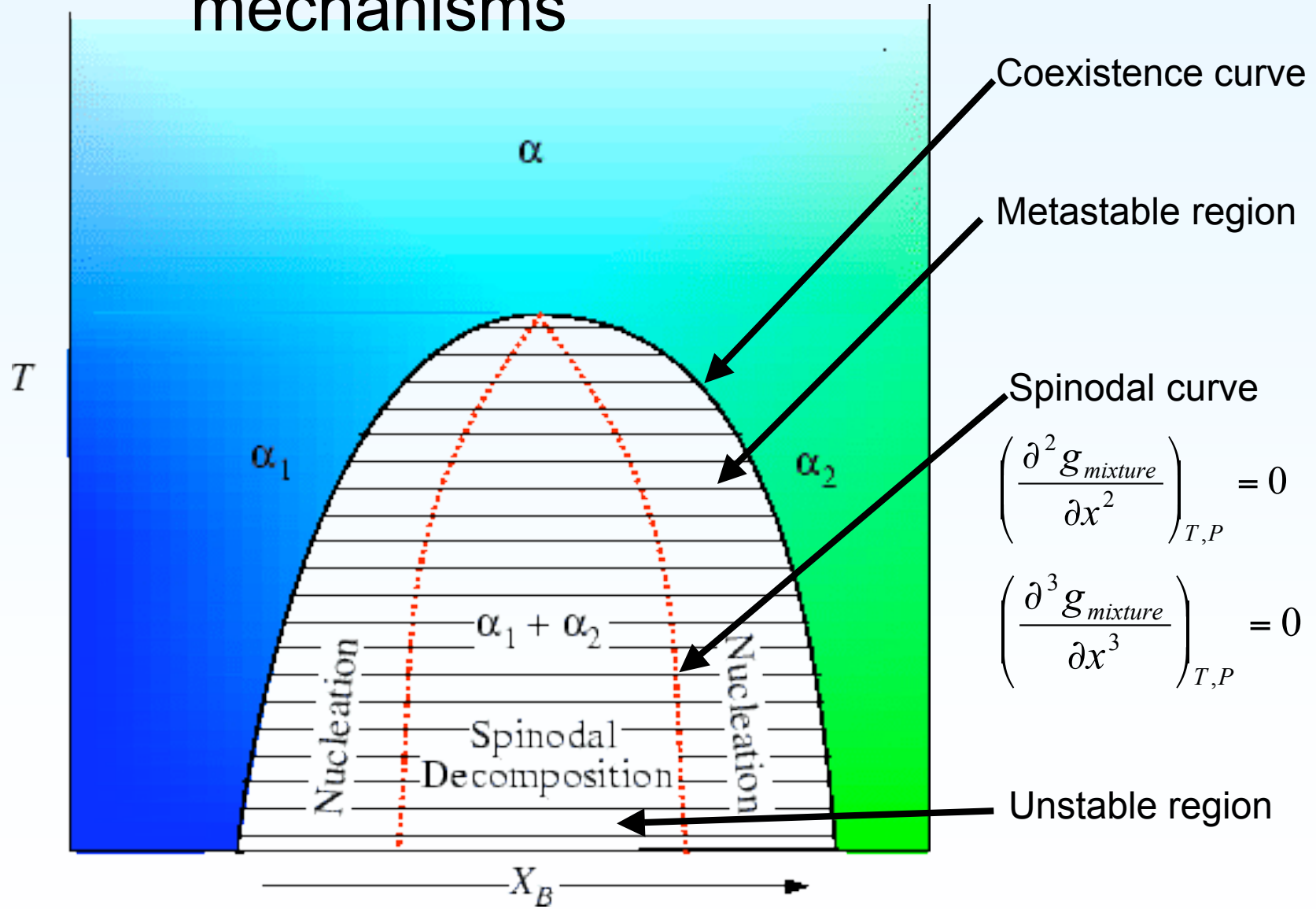
**Pollution: heavy metals and organic pollutants**

# Concept of extraction using critical solution mixtures



**Phase A: Water**  
**Phase B: Organic solvent**

# Phase separation mechanisms

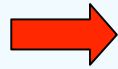


# Why Use Critical Solution Mixtures?

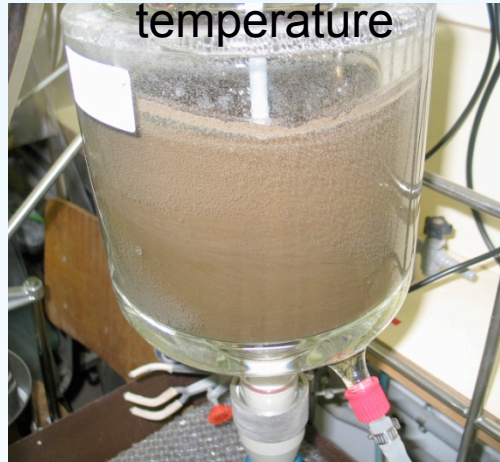
- Using water as one of the mixture components enables the formation of one phase with the water inside the solid particles.
- Superior penetration of the organic solvent of the mixture into the solid pores.
- Enables contact, almost on a molecular level, between the extracting system and the target pollutants.
- On slight temperature change phase separation is achieved.

# Experimental setup

Contaminated dry sediments



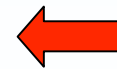
Mixing with solvents at elevated temperature



Phase separation at room temperature



Decontaminated wet sediments



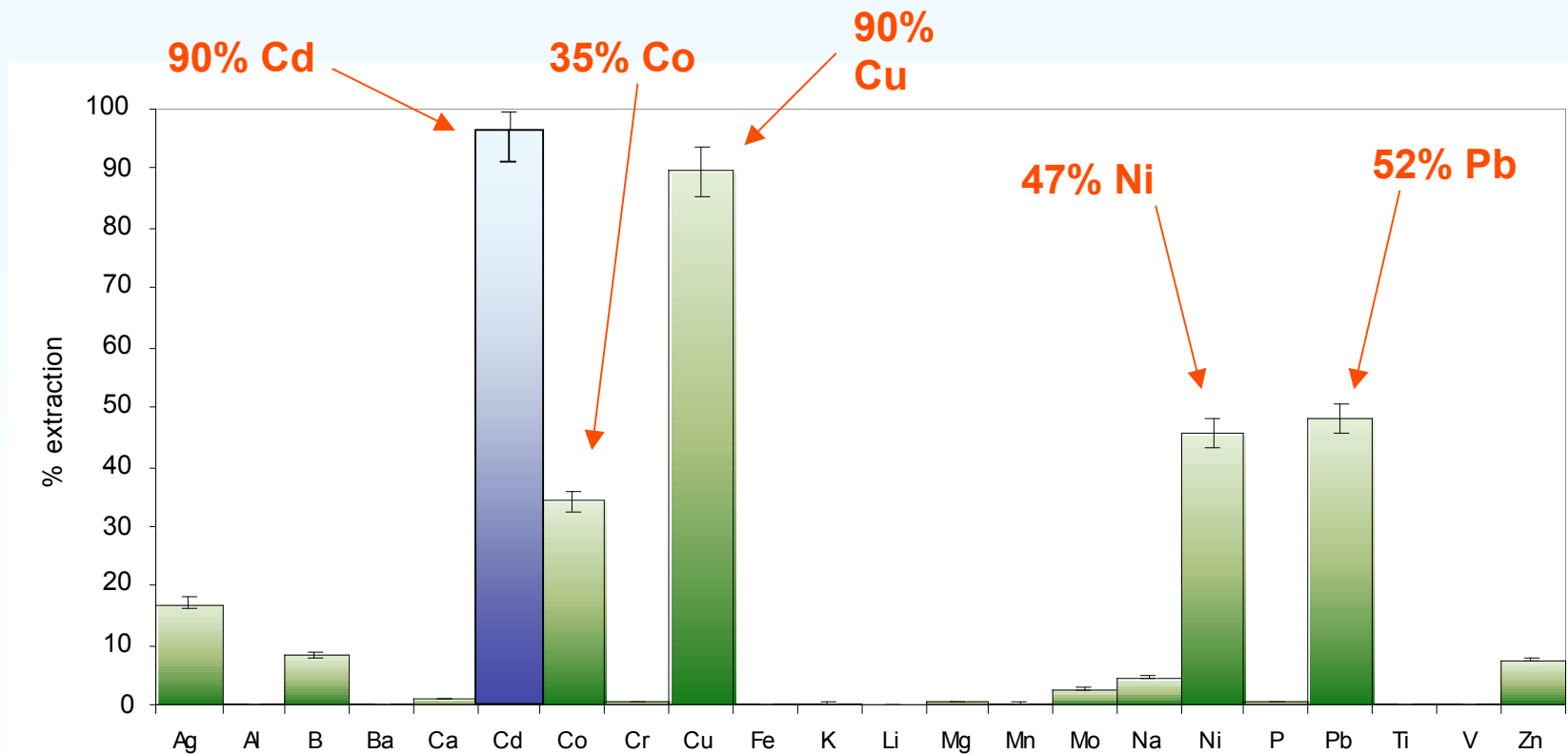
Filtration



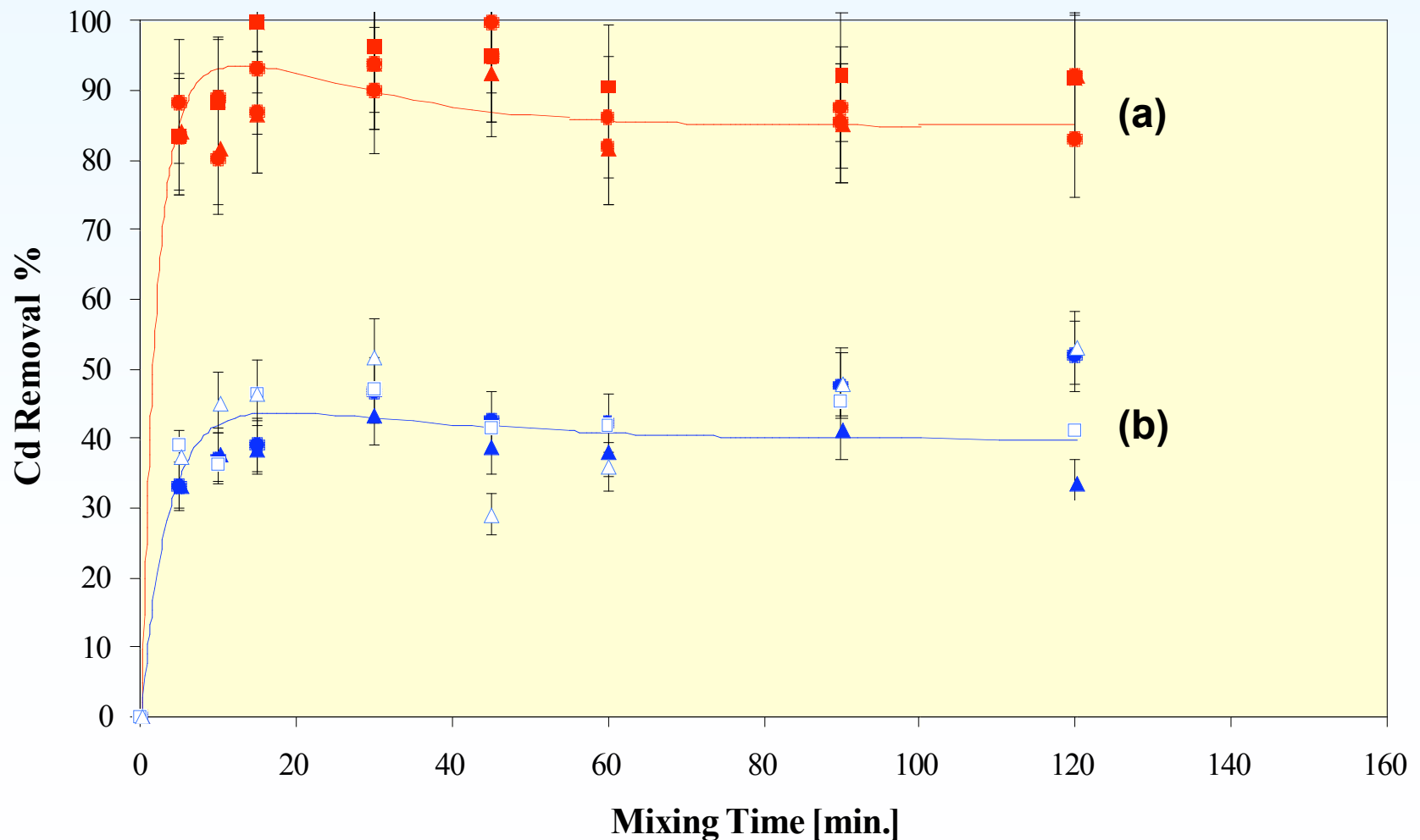
# Results



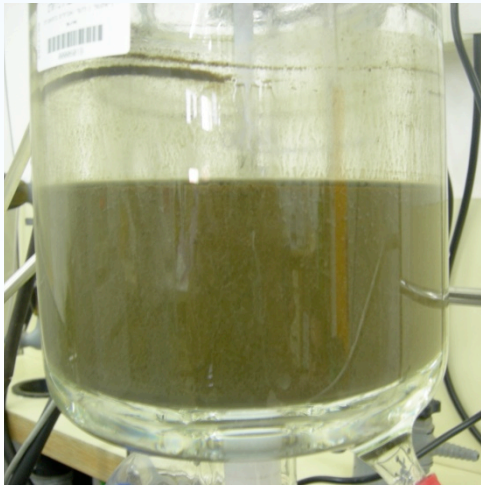
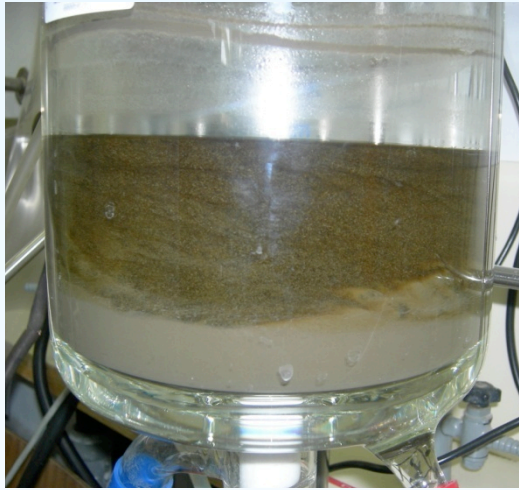
# Heavy metals extraction with Ammonium diethyldithiocarbamate (ADDC) using critical solution mixture



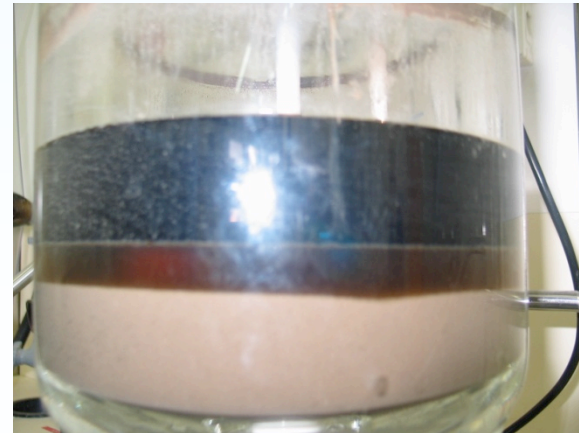
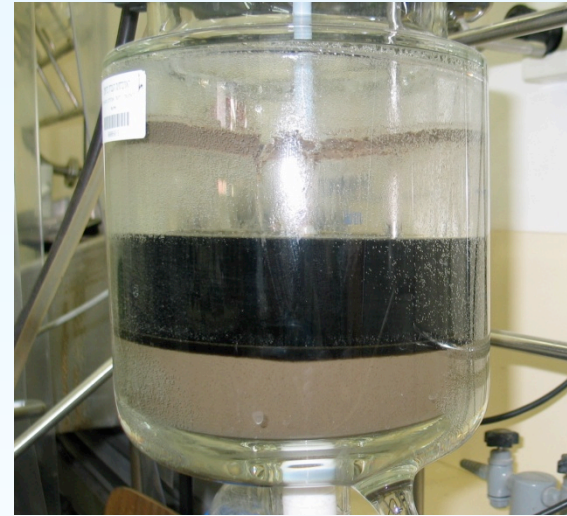
# Kinetics of cadmium extraction : A comparison between extraction via heating-cooling cycle (a) and isothermal extraction (b)



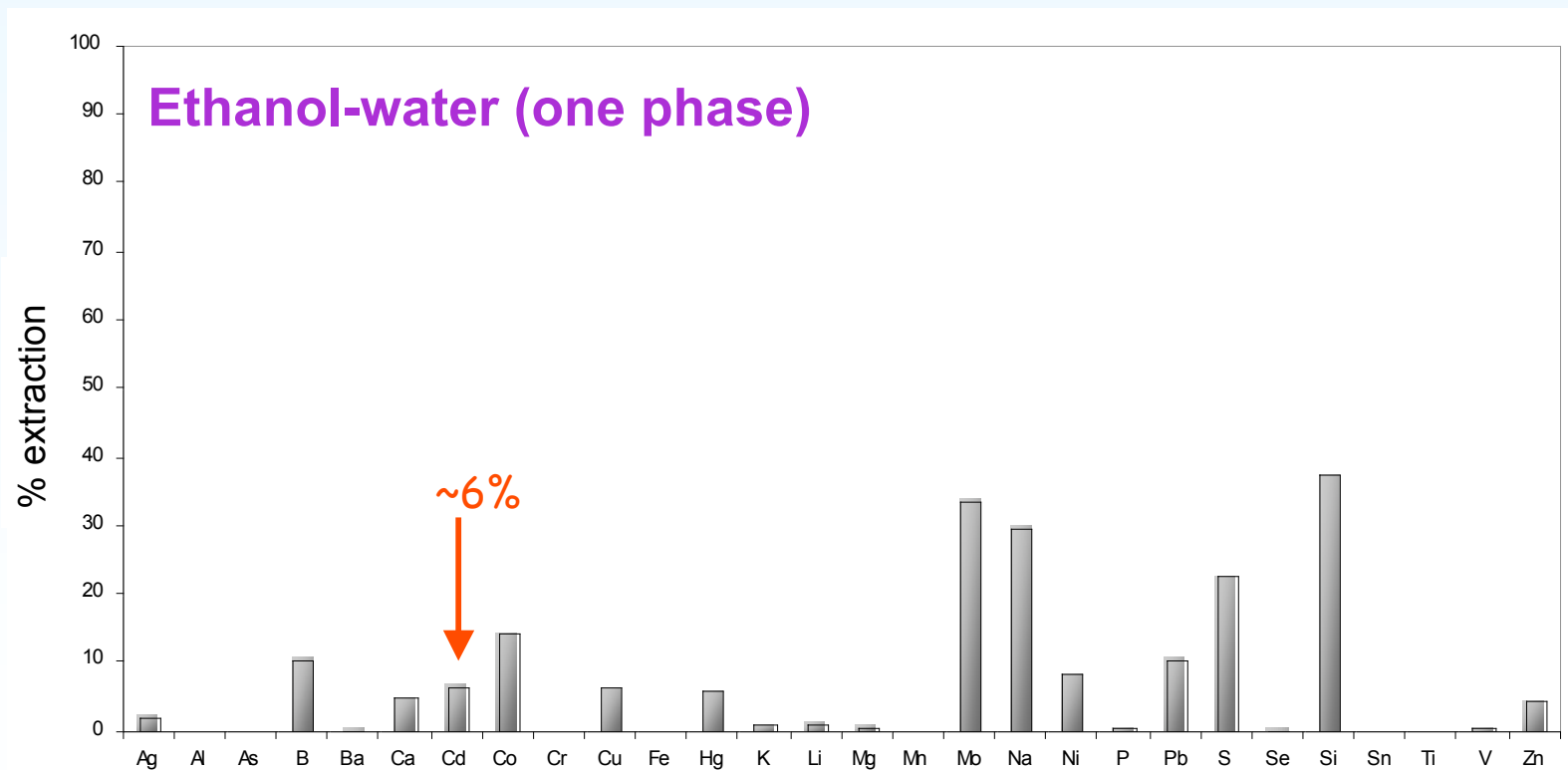
## Isothermal mixing

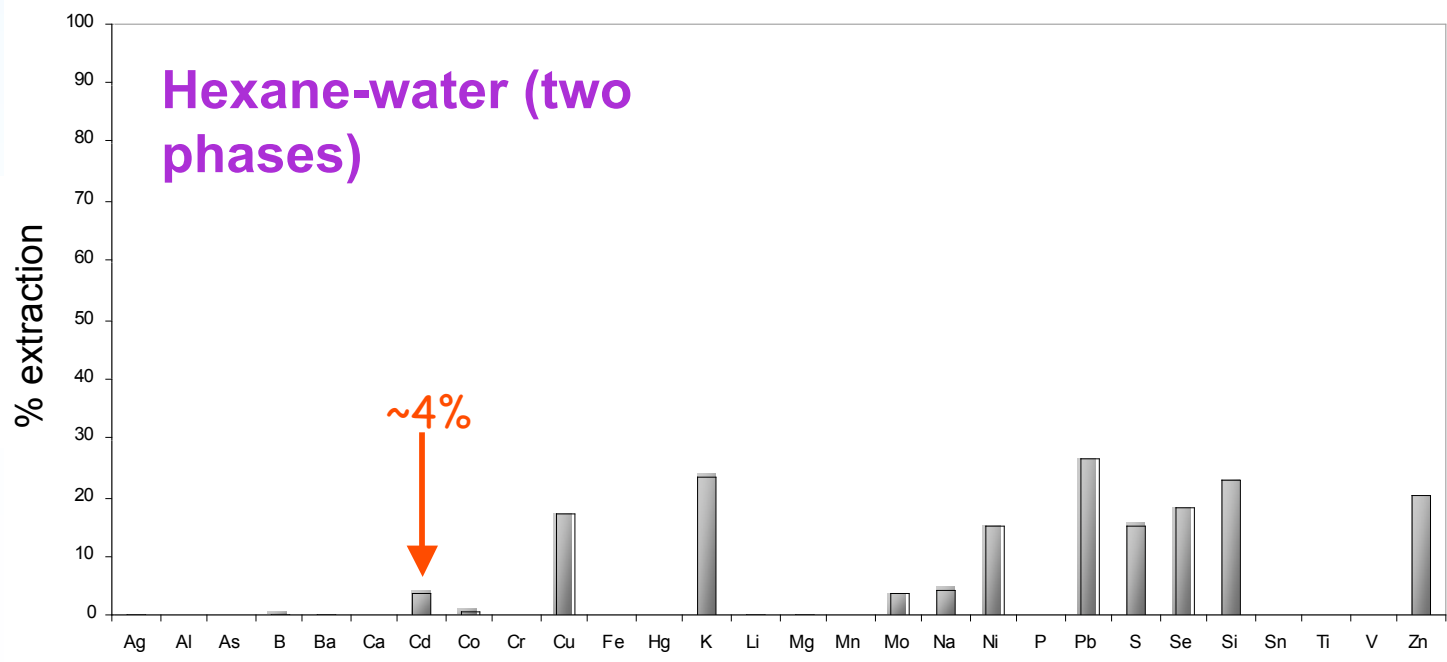
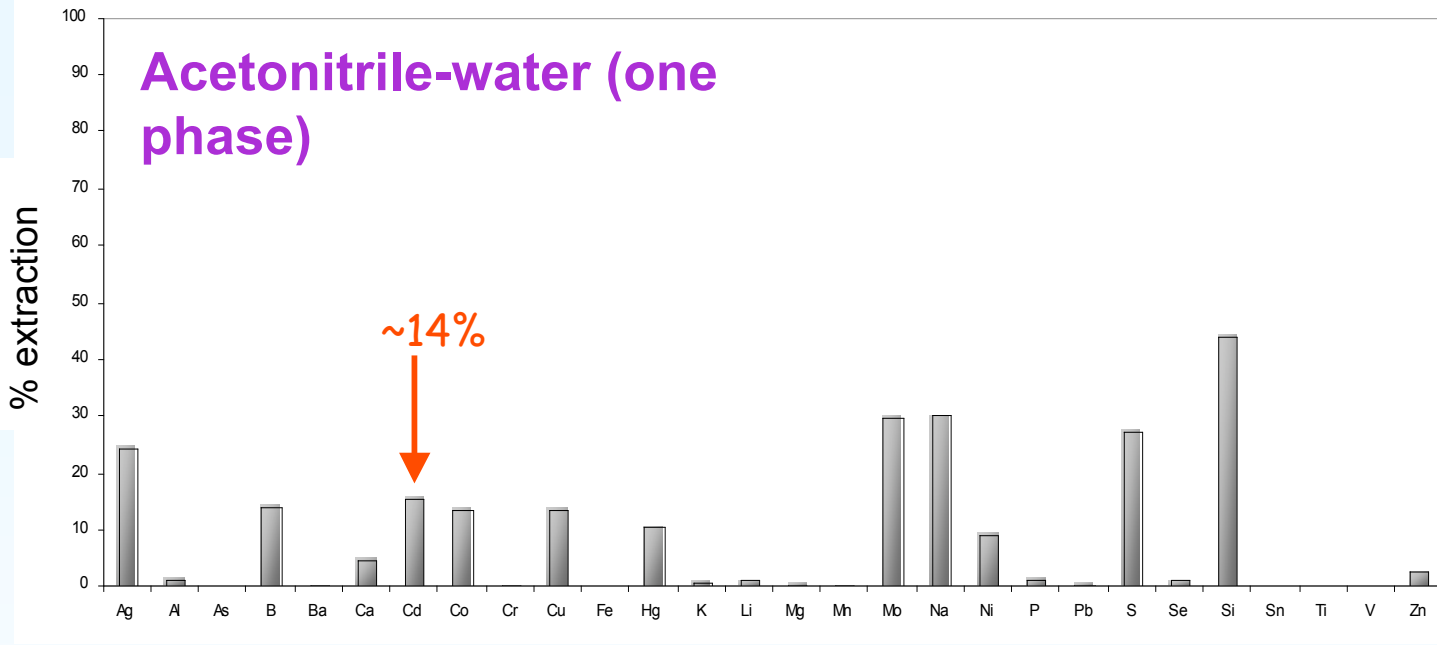


## Phase transition



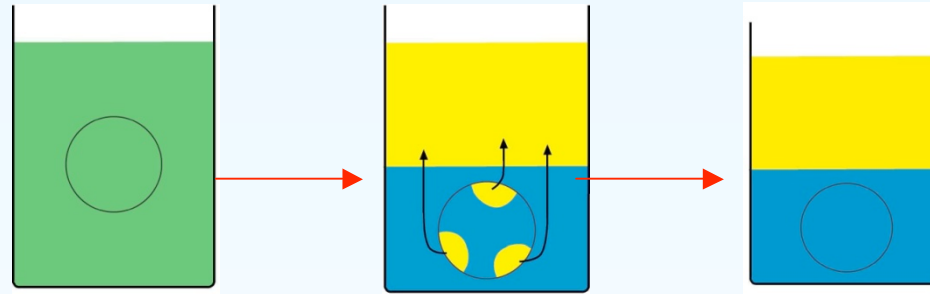
# The use of different solution mixtures for heavy metals extraction with ADDC



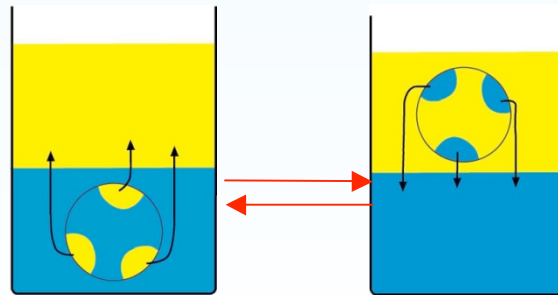


# Possible mechanism of extraction

Heating and cooling

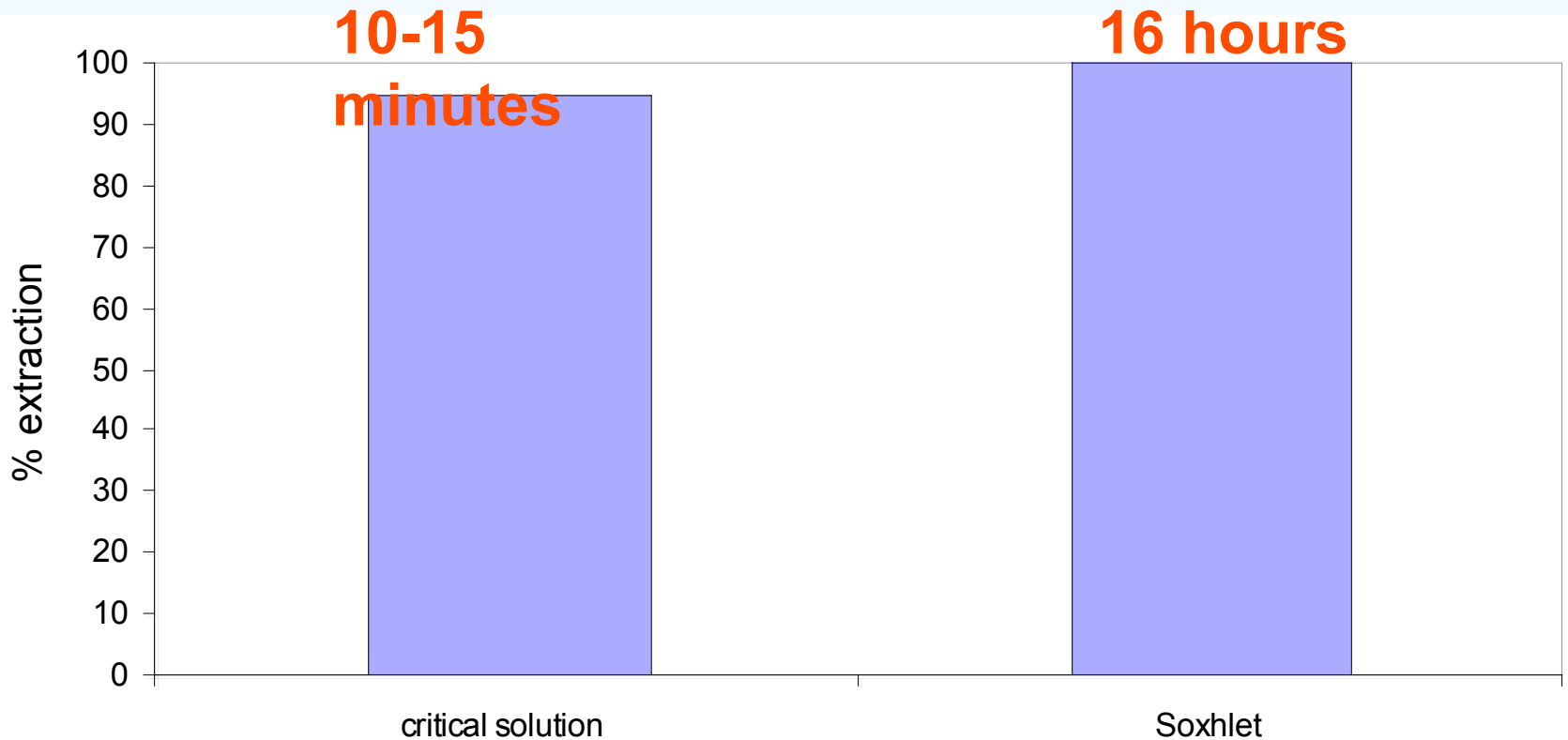


Isothermal



**Conclusion:** Extraction occurs during phase separation

# Organic Pollutants extraction using critical solution mixtures, compared to Soxhlet extraction (preliminary results)



# Summary



Using the critical solution mixture, at the mode of heating and cooling, it was possible to extract close to 90% of the cadmium from the Kishon's sediments, in a single cycle of 10-15 minutes.



The organic pollutants were simultaneously extracted and directed into the mainly organic phase.



By the use of an appropriate chelating agents, it is possible to direct the heavy metals towards the mainly organic or aqueous phase.



Thank you!



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