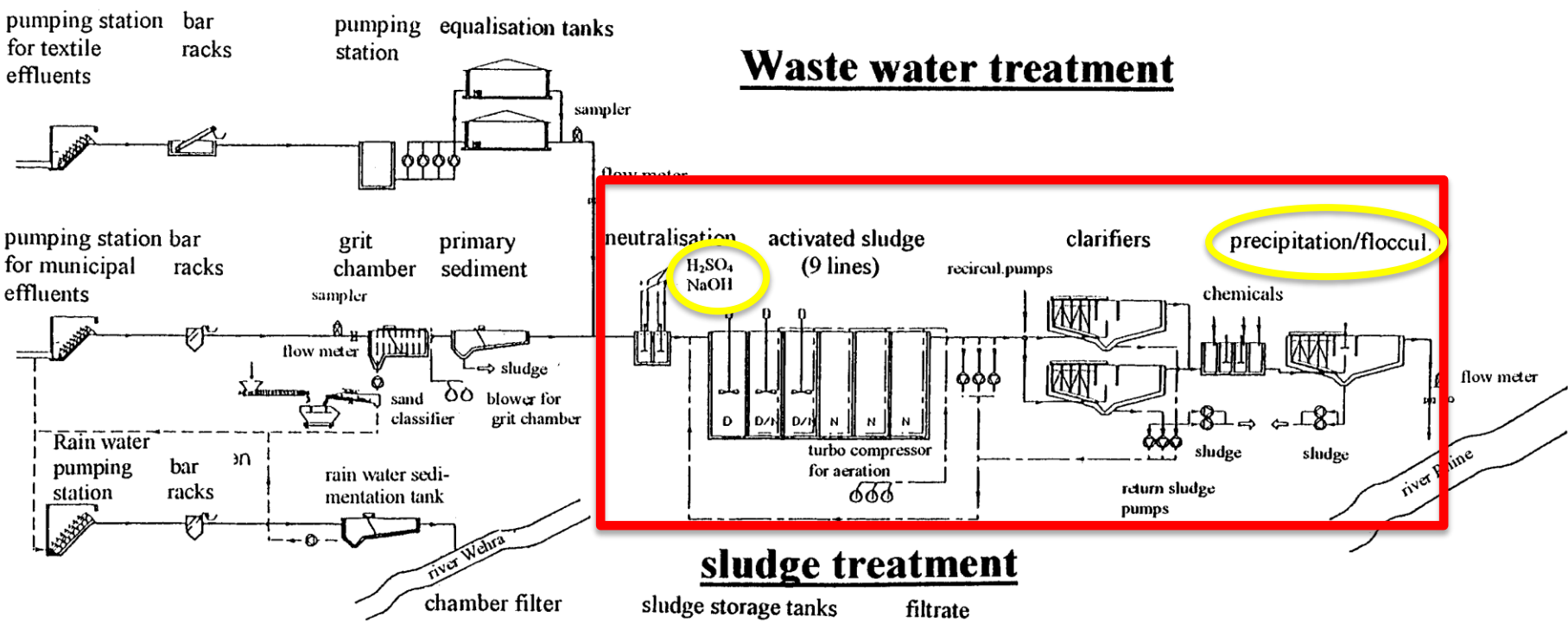
# Calcium phosphate precipitation for removal of textile dyes from industrial wastewaters

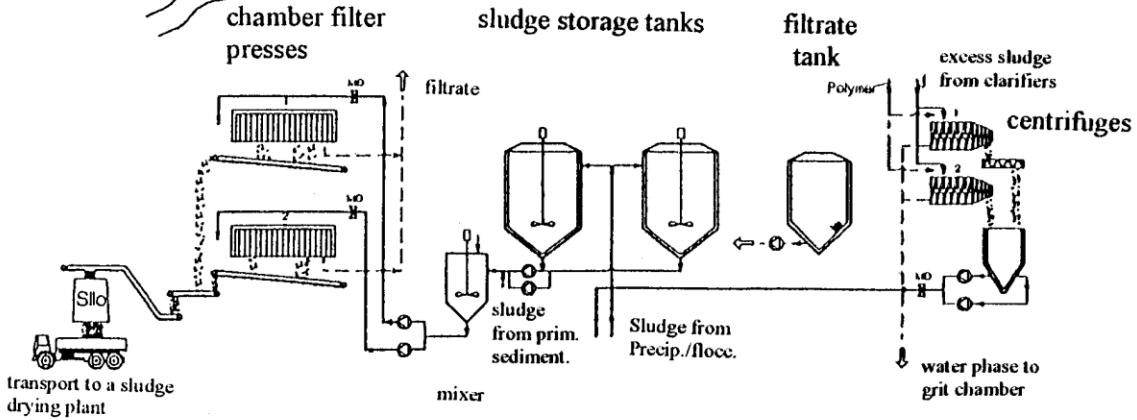
W. Lemlikchi, N. Oubagha, P. Sharrock,
M. Fiallo, M.O. Mecherri


Université Mouloud Mammeri
Tizi-Ouzou 15000 Algérie
Université Paul Sabatier Toulouse 3,
Castres 81104 France

# Waste water treatment




# sludge treatment



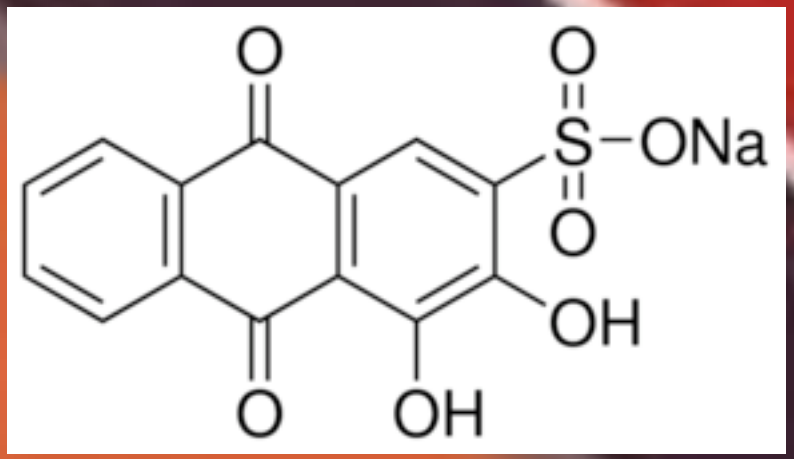
# Adsorption of dyes on hydroxyapatite

$[Ca_{10}(PO_4)_6(OH)_2]$ = HA

Sorbant material
used for heavy metals remediation

Solid state
Gel
Co-precipitation (nucleation)

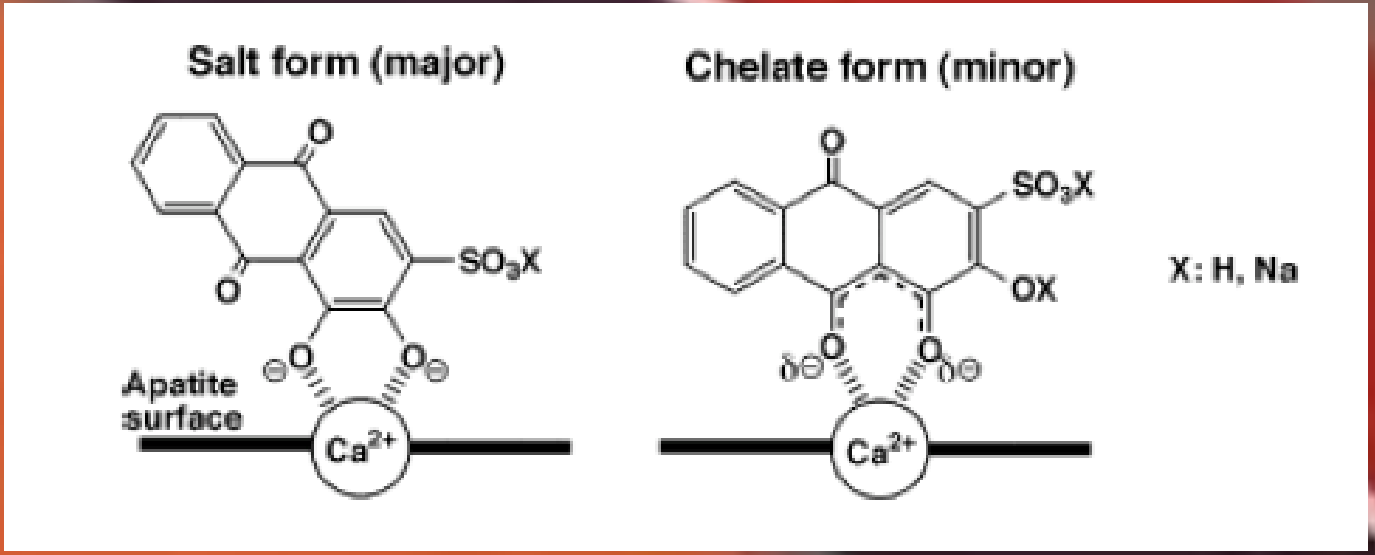
# Remediation of textile dyes by HA




Alizarin red S

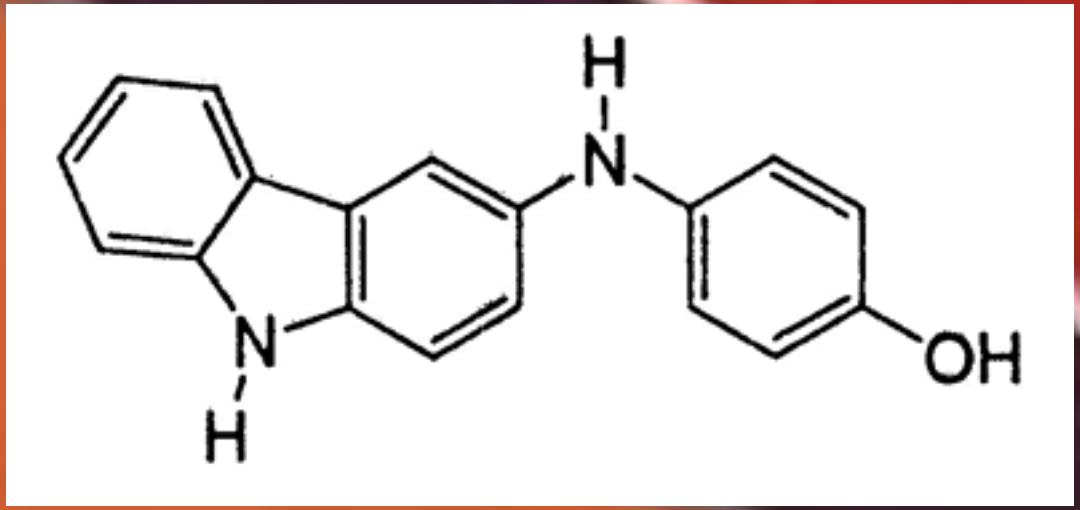
Adsorption: 1.4 g of dye in 1 g HA

Nucleation of hydroxyapatite = 99 %


Salt form (major)
Chelate form (minor)
O
O
SO3X
O
O
Apatite surface
Ca2+
SO3X
OX
O
O
Ca2+
X: H, Na

# Blue Hydron (Vat Blue 43)

1909



# Interaction between Blue Hydron and HA

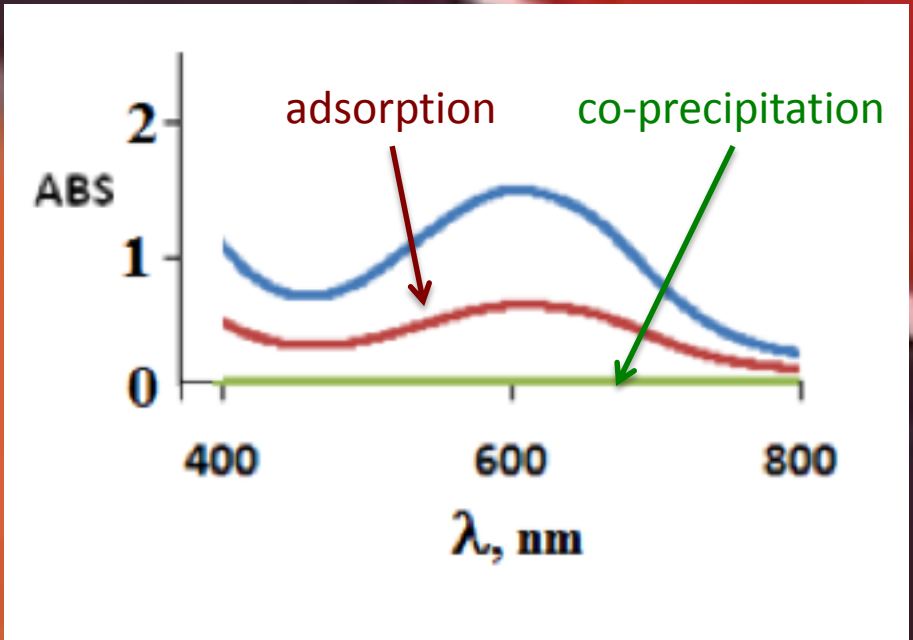



Fig.1. UV-VID spectrum of BH dye solution at 100mgL$^{-1}$ (top spectrum), and following decantation after sorption on CaP solids (middle spectrum) or after coprecipitation with CaP (bottom line)

# Thermogravimetric analysis of the precipitate

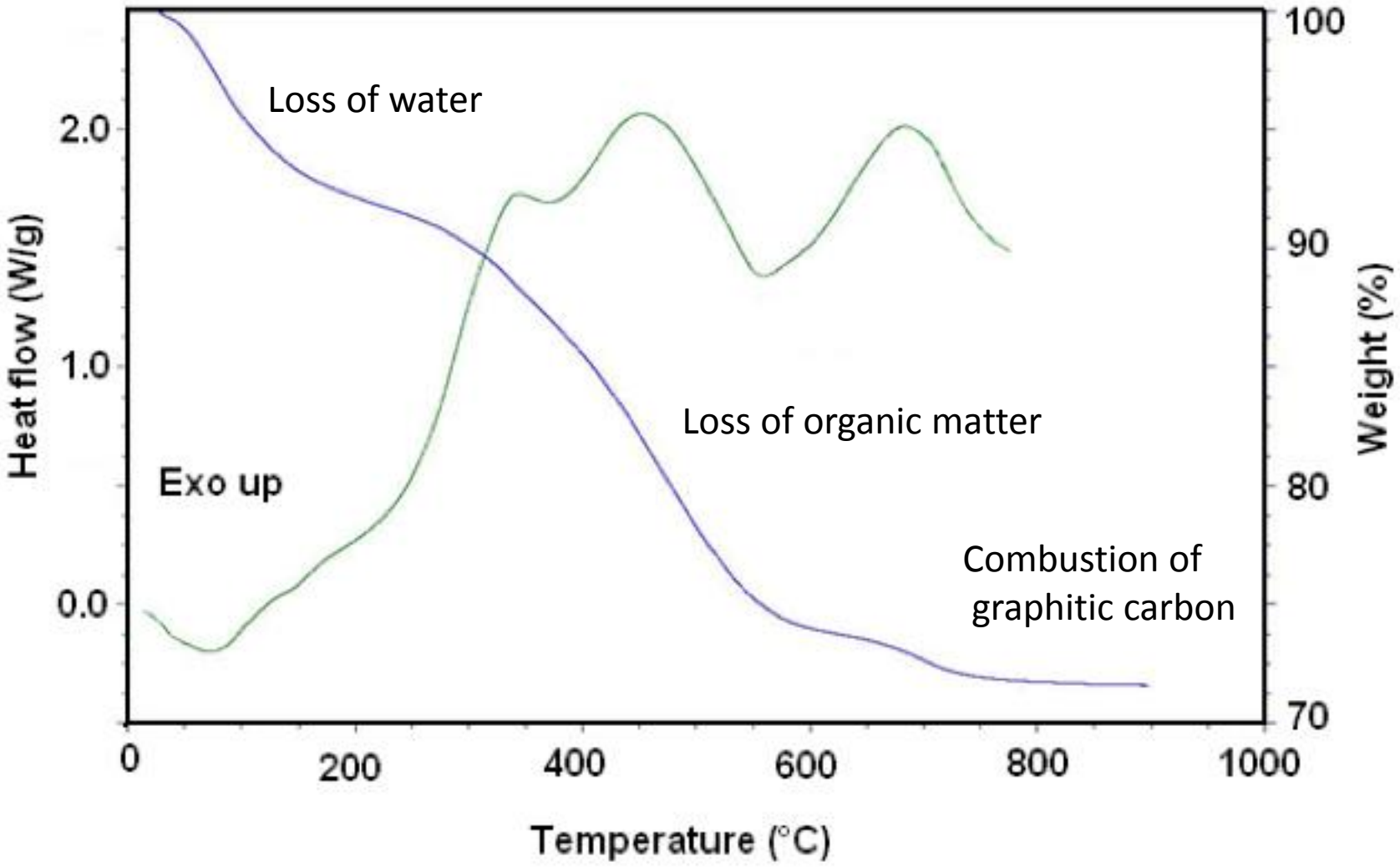



Figure 2 : TG-DSC analysis of BH dye sorbed on calcium phosphate solids

adsorption

Table 1: Evaluation of dye removal by thermogravimetric analysis

| Mi (mg) | Mr ads.(mg) | Mr copr. (mg) | %E ads. | %Ecopr. |
|---|---|---|---|---|
| 100 | 21.3 | 99.50 | 21.30 | 99.54 |
| 50 | 13.8 | 49.9 | 27.60 | 99.80 |
| 20 | 7.48 | 19.96 | 37.42 | 99.82 |
| 10 | 8.41 | 9.98 | 83.94 | 99.68 |
| 5 | 4.41 | 4.99 | 88.24 | 99.85 |

Co-precipitation

Time 75 min; pH 7.3

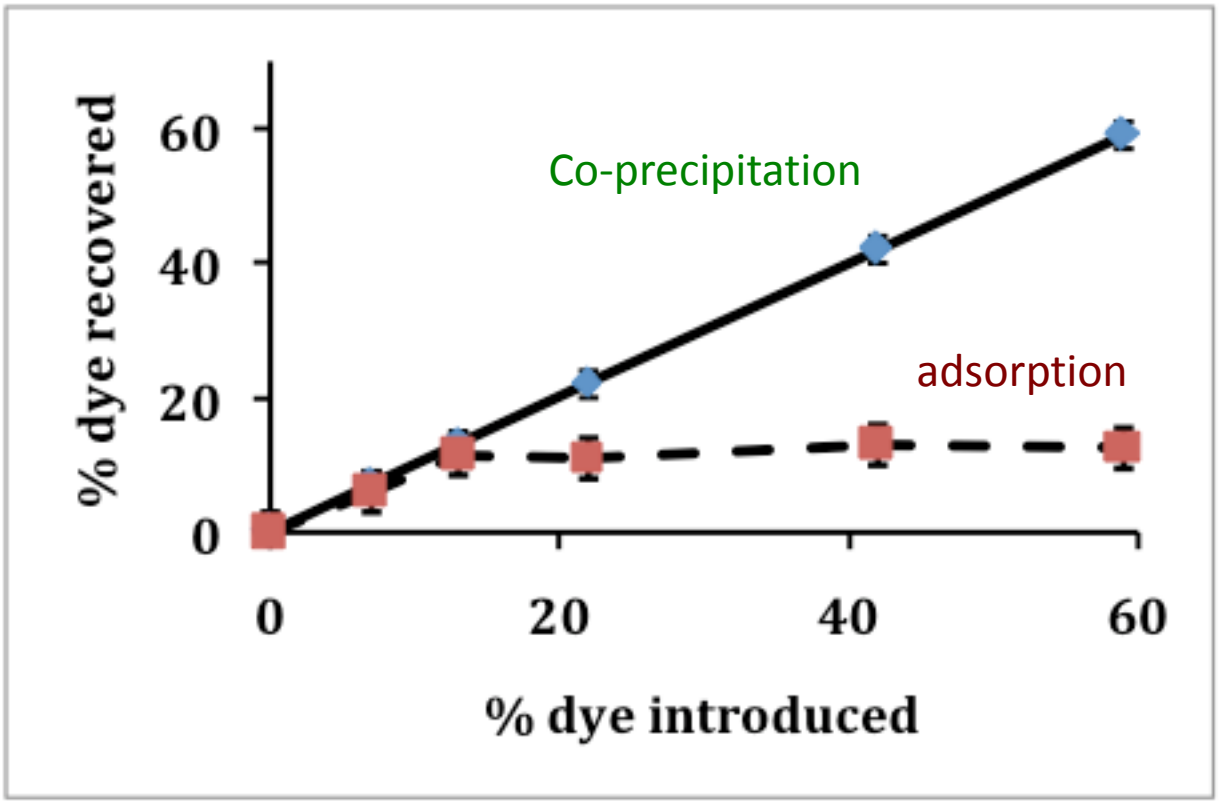
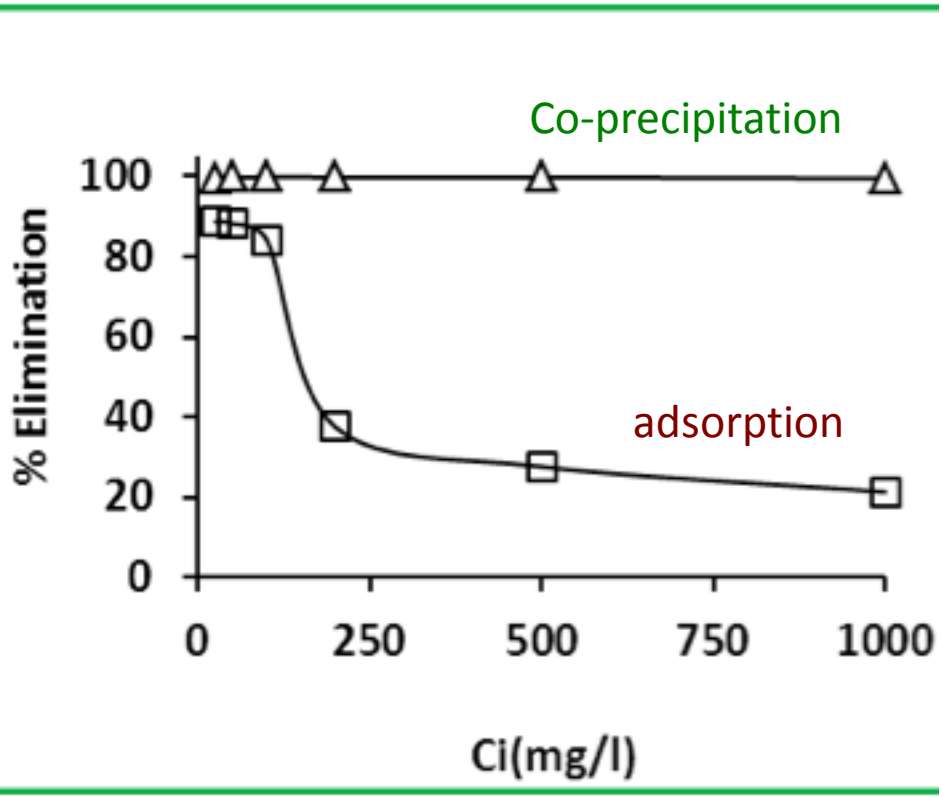



Figure 3: BH mass loss on CaP by sorption (dashed for adsorption mode and full line for coprecipitation mode, with increasing concentrations of BH dye (50; 100; 200; 1000 mg.L-1) after 75 minutes of equilibration time and at pH7.3.

Time 75 min




Time 15 min

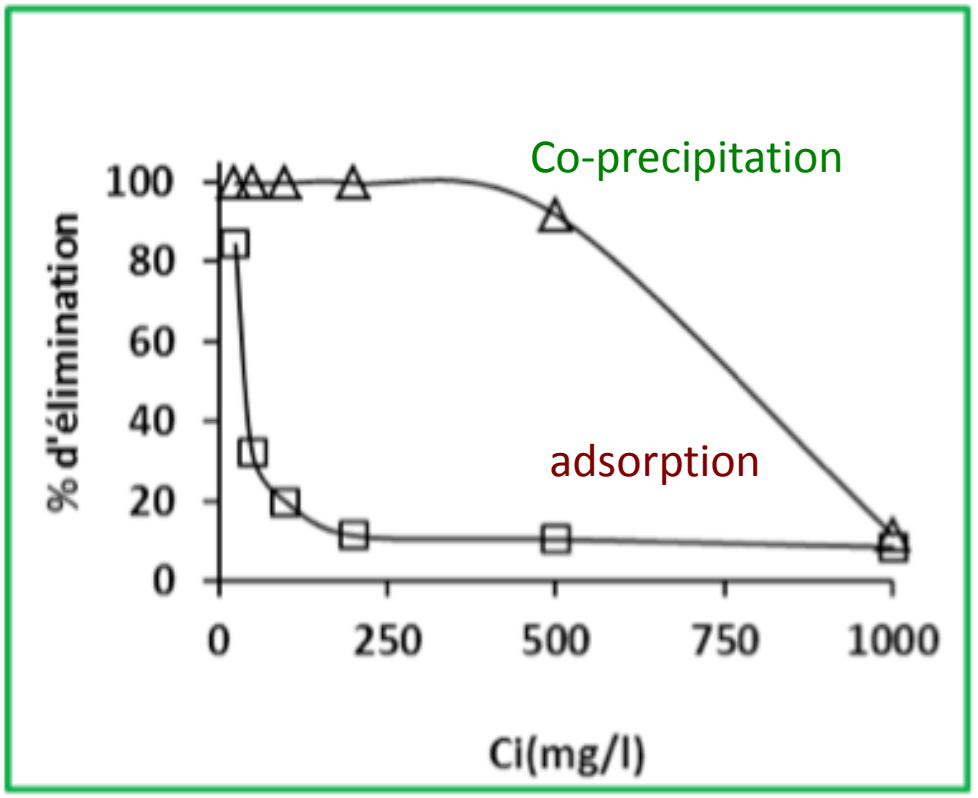
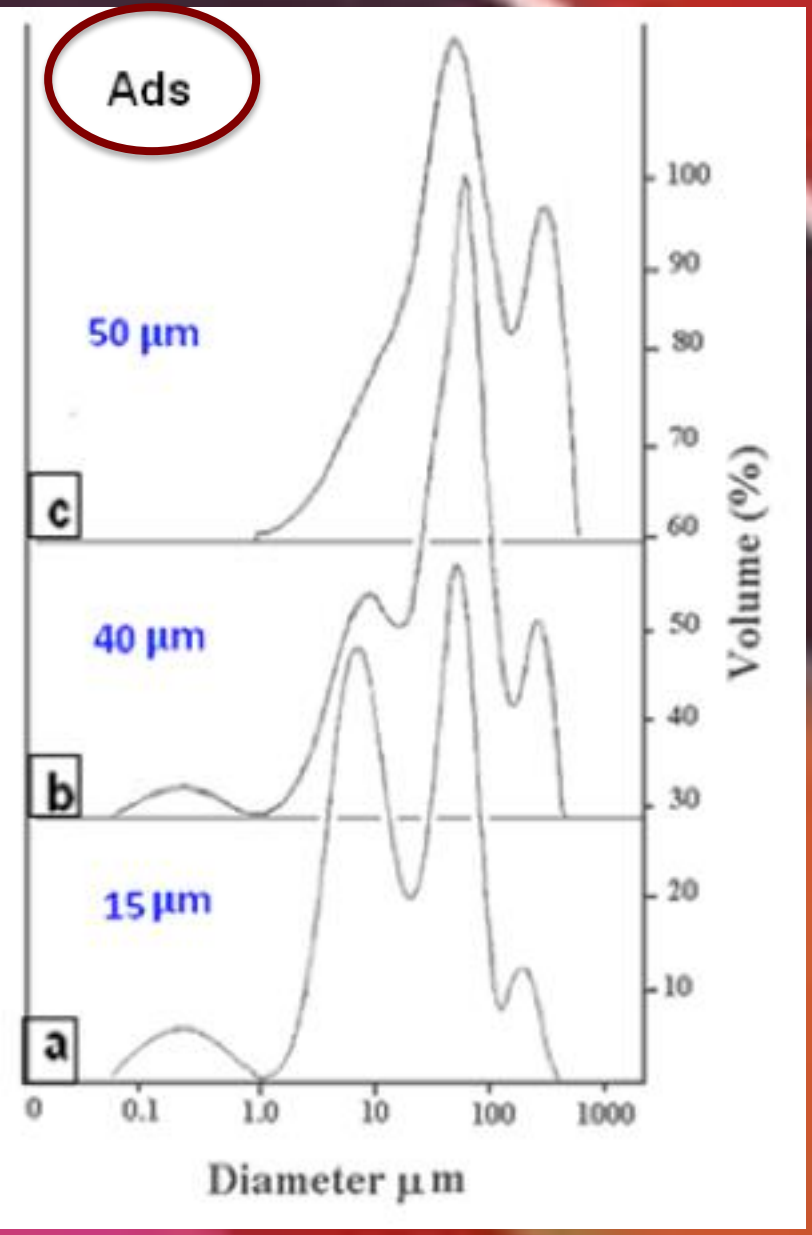



**Figure 4 :** Variation of BH dye removal (%) with the initial dye concentration at pH 7.3 and after 75 minutes of equilibration time. Triangles represent co-precipitation and squares adsorption



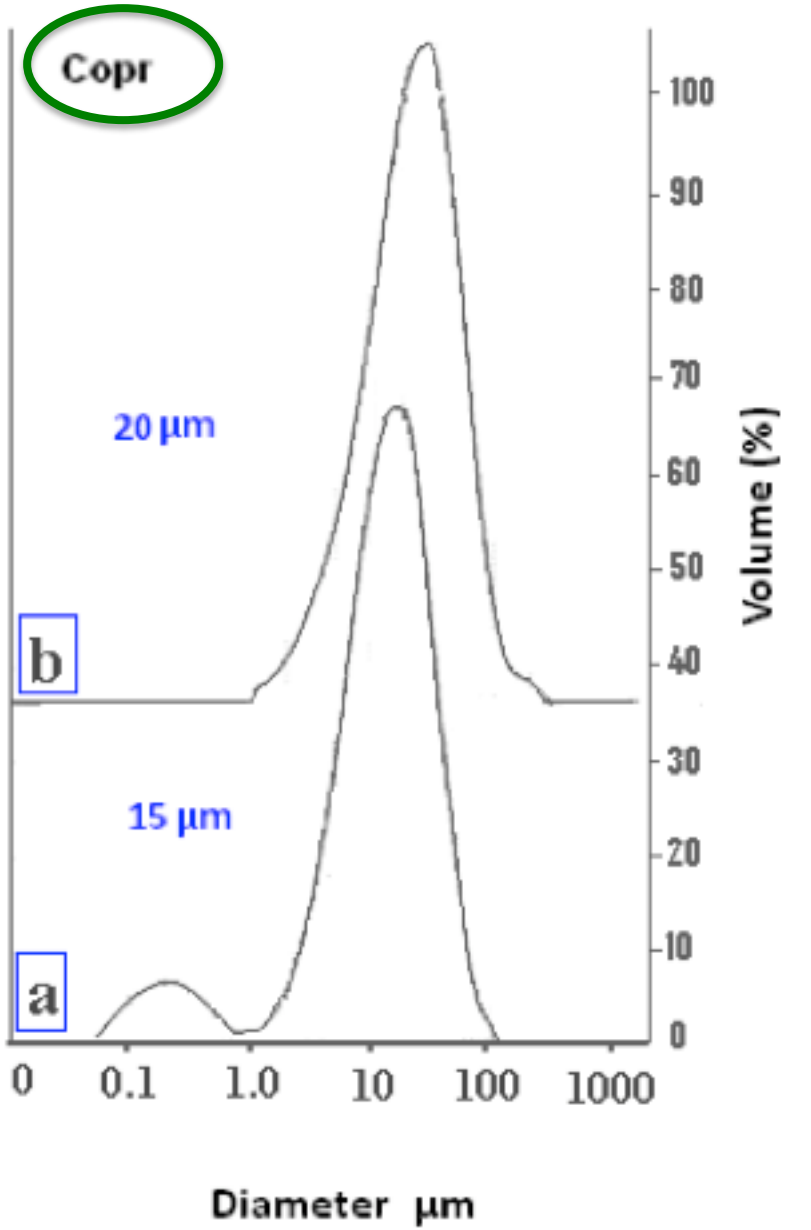
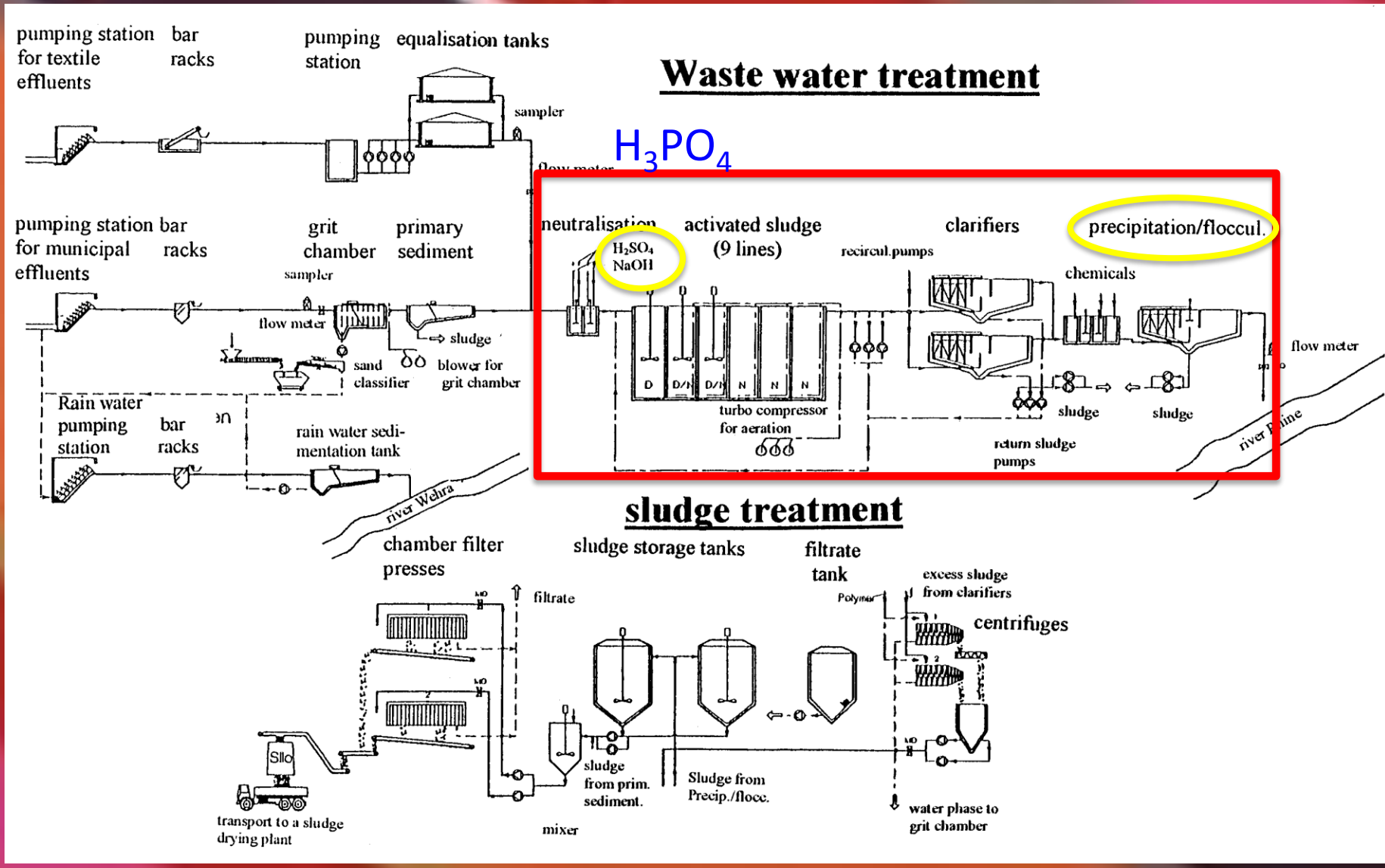




**Figure 6**. Particle size distribution of CaP precipitates formed at pH 7.4, following mixing with BH, at a) 5 min, and b) 15 min.


Waste water treatment
pumping station for textile effluents
bar racks
pumping station
equalisation tanks
sampler
$H_3PO_4$
pumping station for municipal effluents
bar racks
grit chamber
primary sediment
sampler
flow meter
sludge
sand classifier
blower for grit chamber
Rain water pumping station
bar racks
rain water sedimentation tank
river Wehra
neutralisation
$H_2SO_4$
NaOH
activated sludge (9 lines)
recircul.pumps
clarifiers
precipitation/floccul.
chemicals
D
D/N
D/N
N
N
N
turbo compressor for aeration
sludge
sludge
return sludge pumps
flow meter
river Rhine
sludge treatment
chamber filter presses
sludge storage tanks
filtrate tank
filtrate
Polymer
excess sludge from clarifiers
centrifuges
Silo
transport to a sludge drying plant
sludge from prim. sediment.
mixer
Sludge from Precip./flocc.
water phase to grit chamber


CASTRES
Pays de cocagne