# Eosin Y Interaction with Ni-Fe LDH nanoparticles

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#### Research Aim

To investigate the interaction between Ni<sub>2</sub>FeOH layered double hydroxide (Ni-Fe LDH) and the dye eosin Y (Eos) in aqueous suspensions

# Objectives

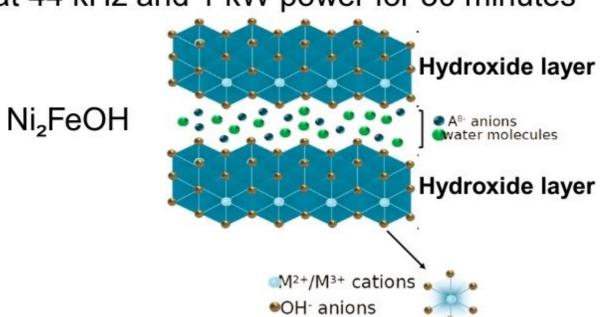
- To elucidate the type of Eos interaction with Ni-Fe LDH
- To calculate the Eos loading parameters to Ni-Fe LDH
- To determine the influence of Eos on the hydrodynamic properties of Ni-Fe LDH nanoparticles

# **Experimental Techniques**

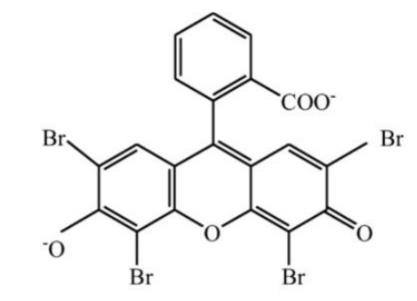
Dynamic and electrophoretic light scattering UV-VIS spectroscopy X-ray diffraction

### Reagents

Ni-Fe LDH samples were synthesized via coprecipitation under a nitrogen atmosphere. Aqueous suspensions of Ni-Fe LDH were prepared by ultrasonic treatment at 44 kHz and 1 kW power for 30 minutes



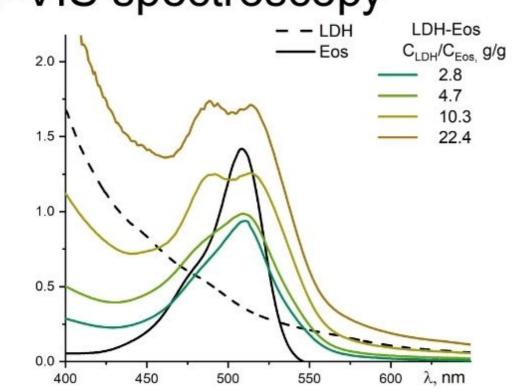
Eosin Y (Eos), Reachim 2,4,5,7- tetrabromofluorescein disodium salt, pK<sub>2</sub> = 3.8



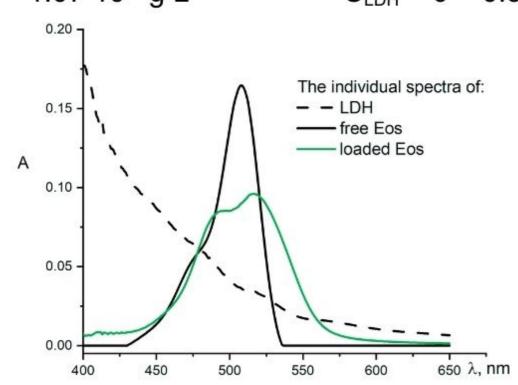
Eosin Y double-charged form

#### Results

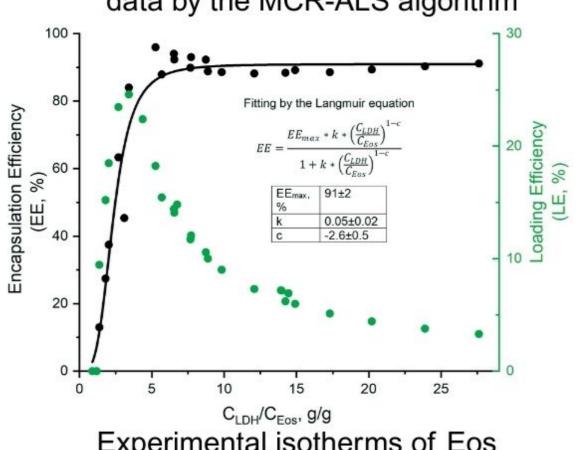
### **UV-VIS** spectroscopy



The titration experiment in Ni-Fe LDH - Eos system  $C_{Eos} = 1.07 \cdot 10^{-2} \text{ g L}^{-1}$   $C_{LDH} = 0 \div 0.33 \text{ g L}^{-1}$ 

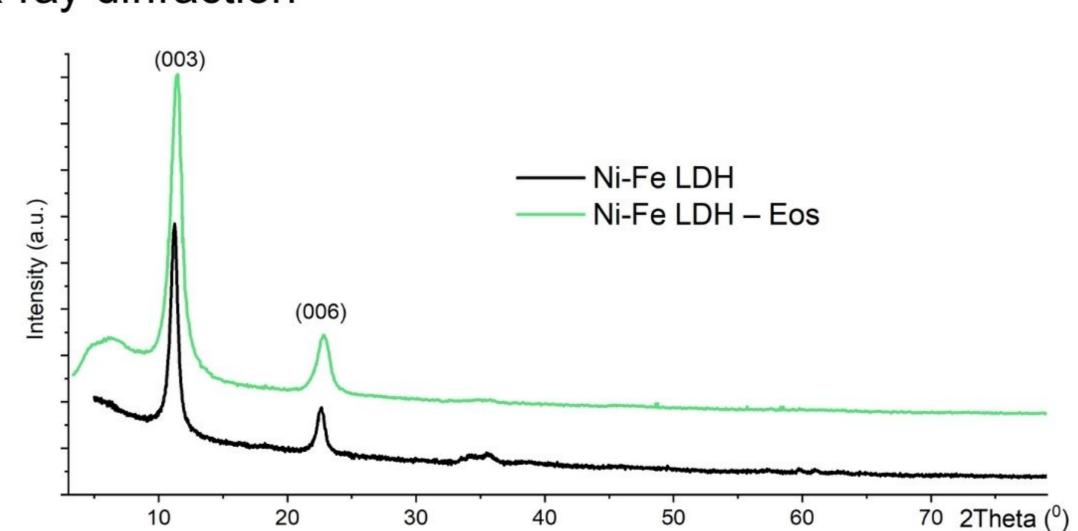


The decomposition of the Ni-Fe LDH - Eos titration data by the MCR-ALS algorithm



Experimental isotherms of Eos loading on Ni-Fe LDH nanoparticles

### X-ray diffraction



XRD patterns of Ni-Fe LDH and the dried precipitate from the Ni-Fe LDH - Eos suspension with  $C_{Eos}/C_{LDH}$  = 25 g/g. Positions of the most intensive reflections of Ni-Fe LDH are marked (indexed in an hexagonal lattice)

# Dynamic and electrophoretic light scattering

Colloidal stability Colloidal instability Colloidal stability

Dependence of Ni-Fe LDH zeta potential ( $\zeta$ ) on relative Eos concentration ( $C_{LDH} = 0.02 \text{ g L}^{-1}$ )

Size distribution (d) of Ni-Fe LDH nanoparticles with adsorbed Eos:

by intensity (1), by volume (2), and by particle number (3)

### Conclusions

- Eosin Y loads on Ni<sub>2</sub>FeOH nanoparticles predominantly through surface adsorption.
- Due to the high positive surface charge (zeta potential is about 50 mV),  $Ni_2FeOH$  LDH exhibits strong sorption capacity toward eosin Y, as indicated by high encapsulation efficiency ( $EE_{max} = 91\%$ ) and loading efficiency ( $EE_{max} = 25\%$ ).
- Eosin Y adsorption on Ni<sub>2</sub>FeOH reduces the nanoparticles' zeta potential and the colloidal stability of the suspensions. At high eosin Y concentrations, surface charge reversal (down to –45 mV) occurs, restoring colloidal stability.

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