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Vanadium speciation in sea water samples using IC-ICP-MS system- prelimenary studies

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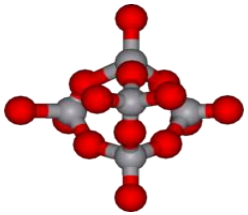


Vanadium [V]

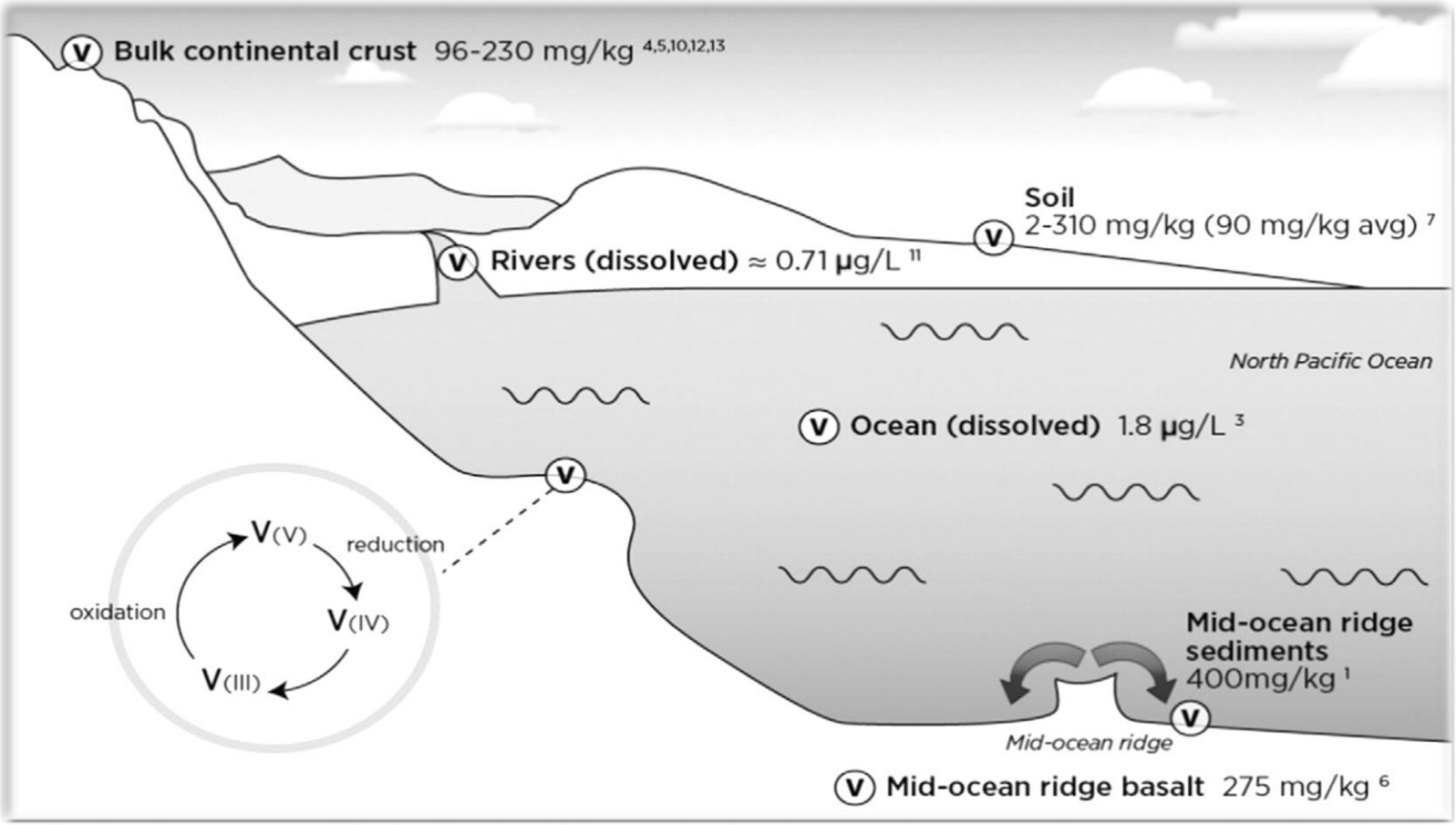


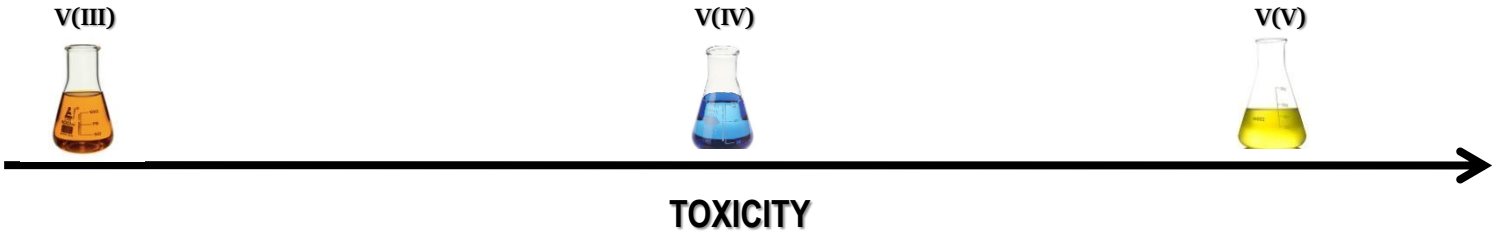
Figure 1. *Reserves and distribution of vanadium species on Earth*

- Necessity for qualitative and quantitative determination of vanadium specification in enviromental samples.

- Expressed pH, Eh and enviroment biology dependence of vanadium species.

- Oxidation states:+2,+3, +4 and +5

- V(III) and V(IV) in the enviroment are generated by reduction of V(V) species.



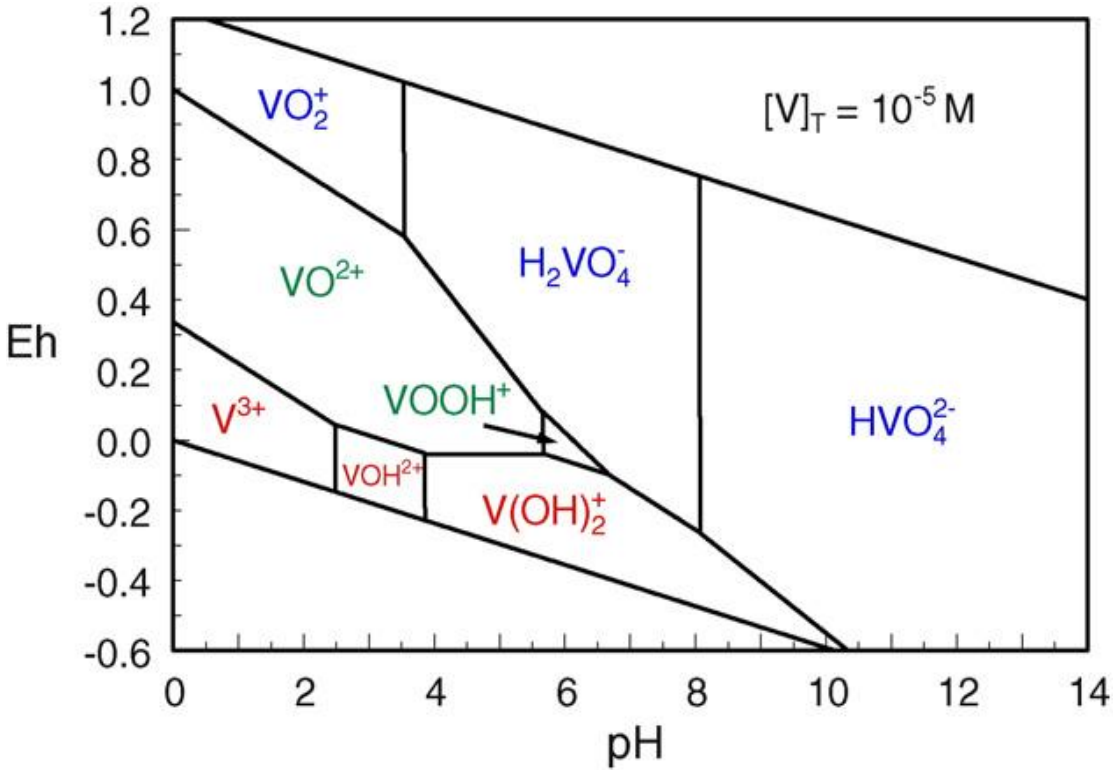
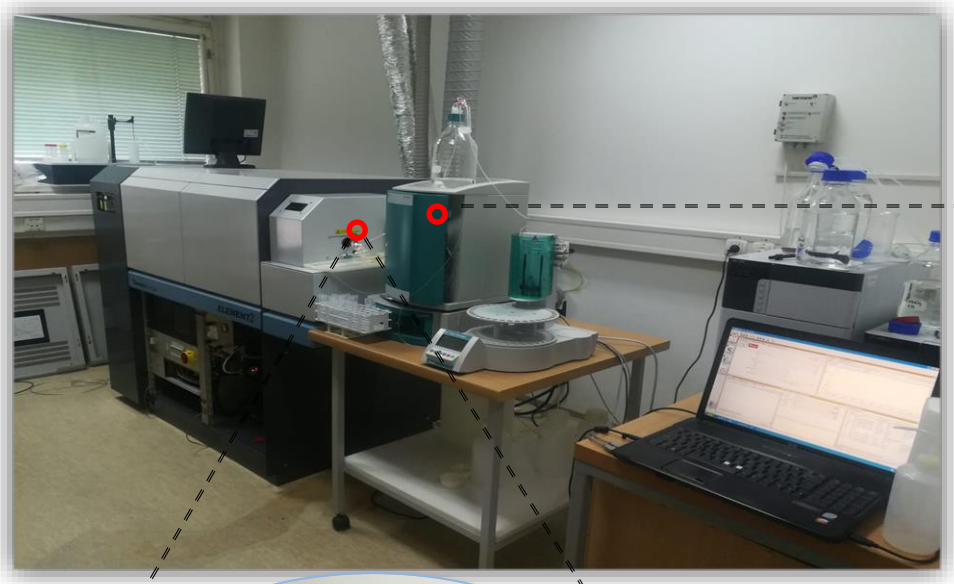
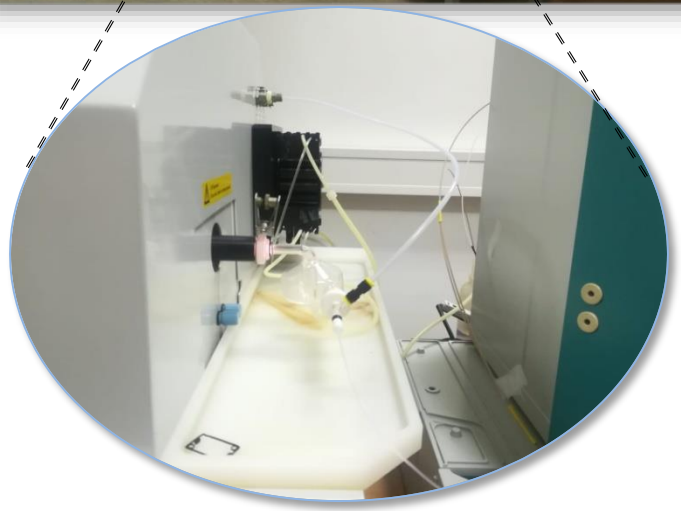


Figure 2. *Dependence of vanadium species on Eh and pH.*

Experimental

IC-ICP MS system



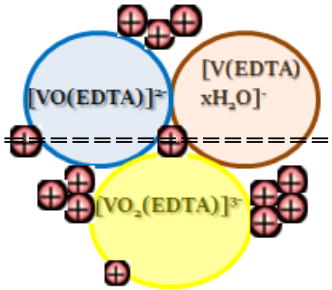


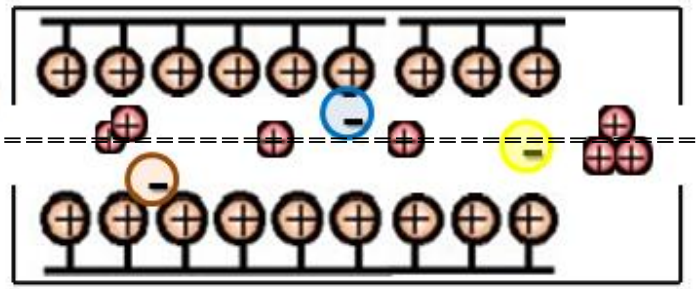

ELUENT
2 mmol dm-3
EDTA
3% acetonitrile
80 m mol dm-3
NH4HCO3

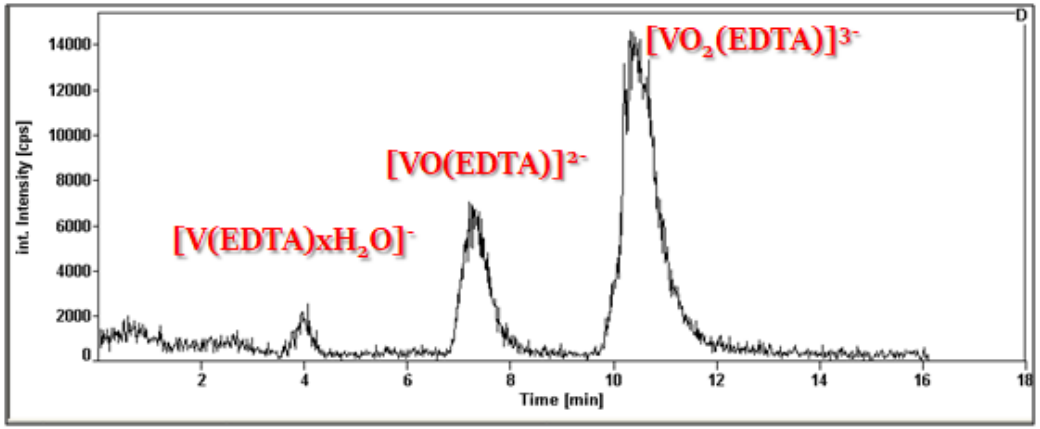
V(V)

V(IV)

V(III)


[VO(EDTA)]2-
[V(EDTA) xH2O]-
[VO2(EDTA)]3-




[VO2(EDTA)]3-
[VO(EDTA)]2-
[V(EDTA)xH2O]-
int. Intensity [cps]
Time [min]
14000
12000
10000
8000
6000
4000
2000
0
2
4
6
8
10
12
14
16
18

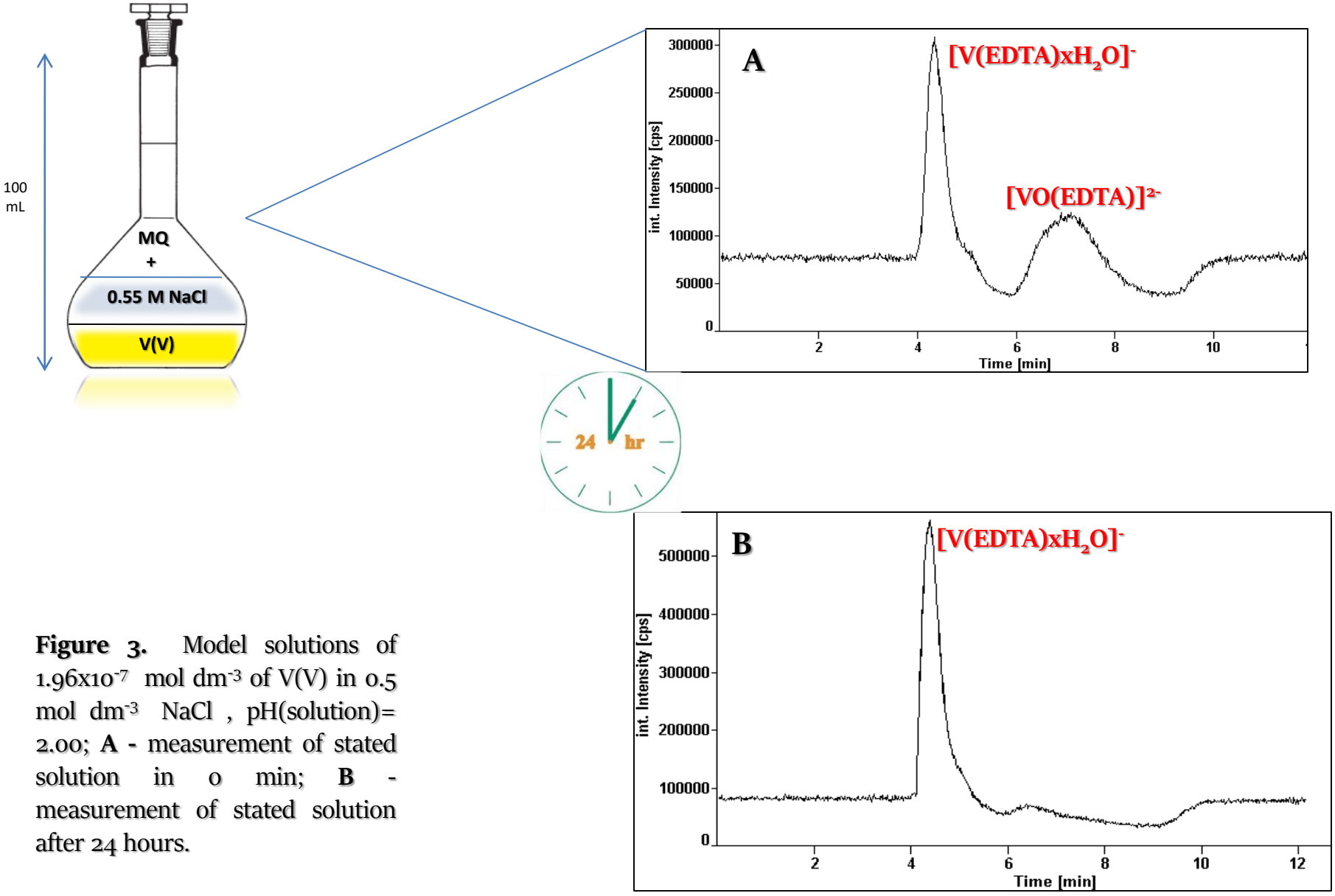


Figure 3. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(V) in 0.5 mol dm^{-3} NaCl , pH(solution)= 2.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.

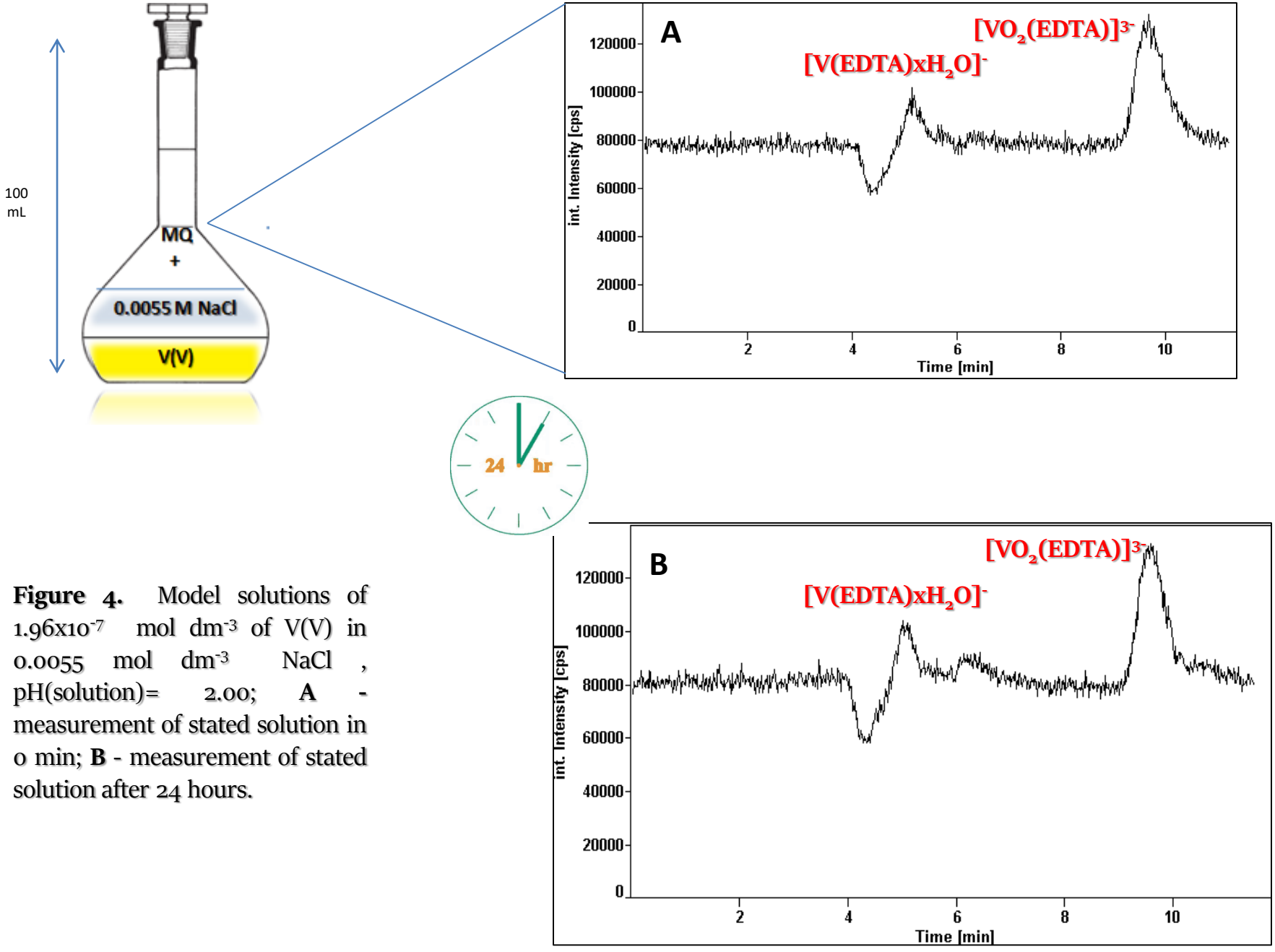


Figure 4. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(V) in 0.0055 mol dm^{-3} NaCl , pH(solution)= 2.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.

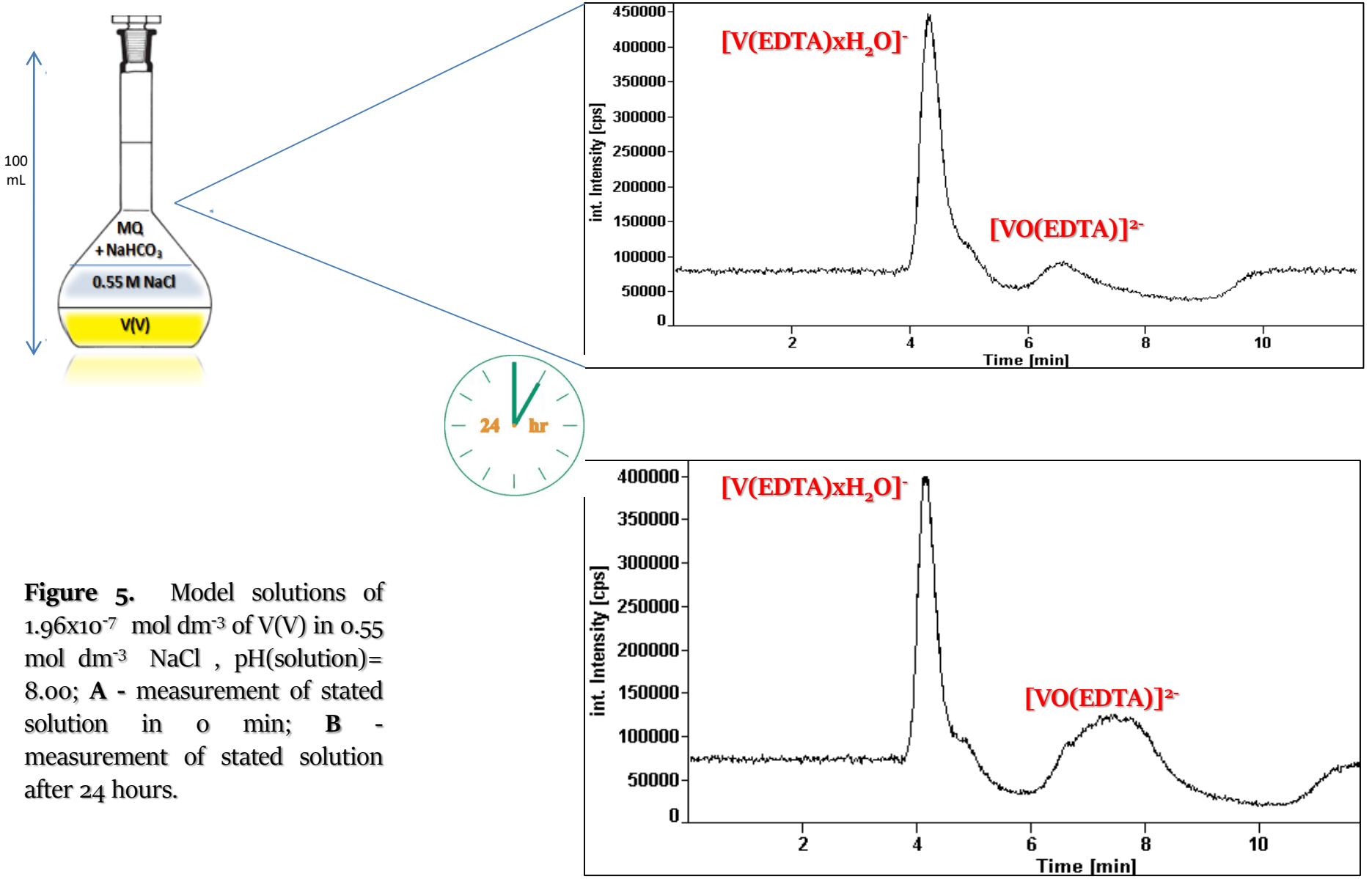


Figure 5. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(V) in 0.55 mol dm^{-3} NaCl , pH(solution)= 8.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.

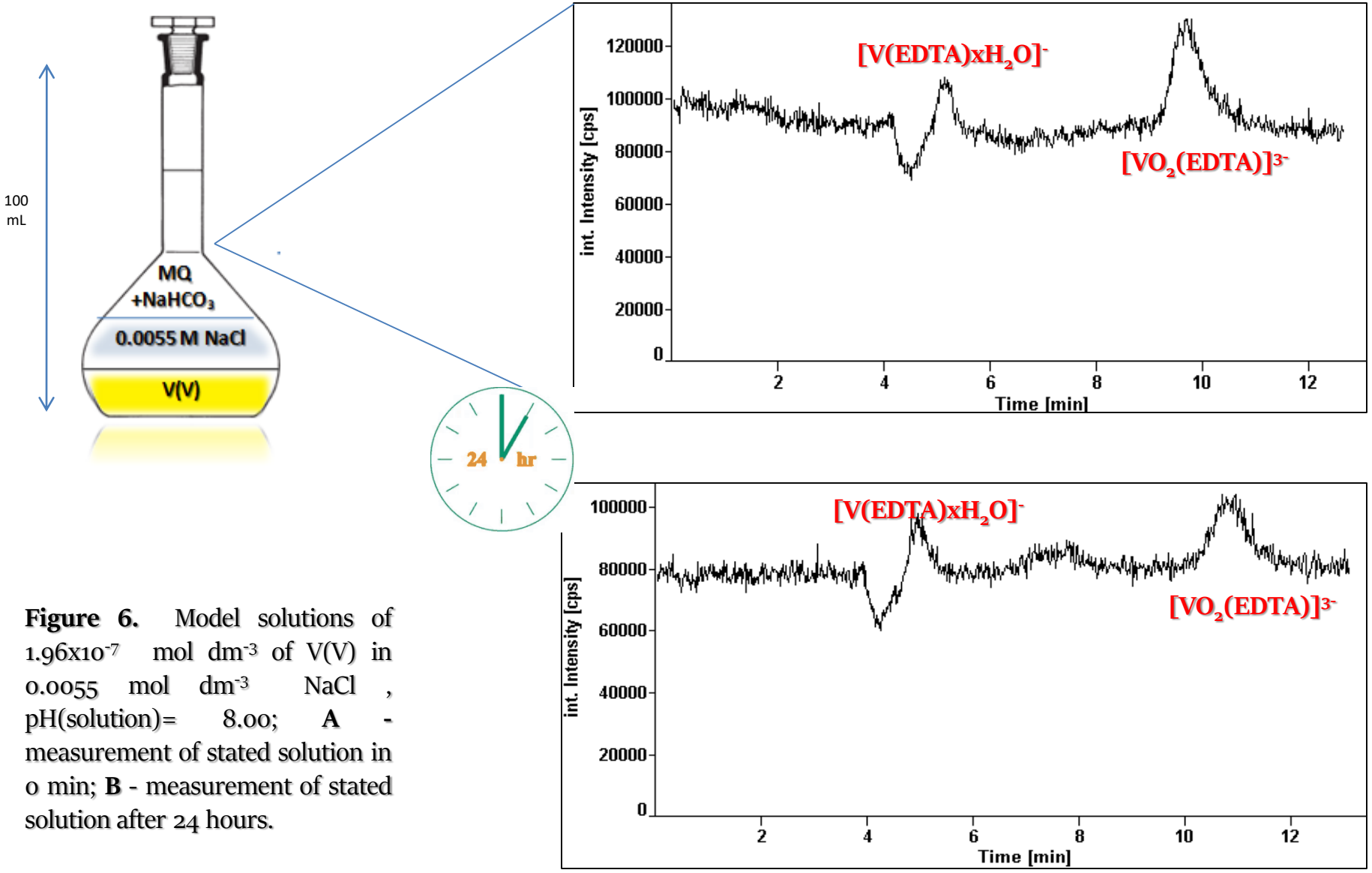


Figure 6. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(V) in 0.0055 mol dm^{-3} NaCl , pH(solution)= 8.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.

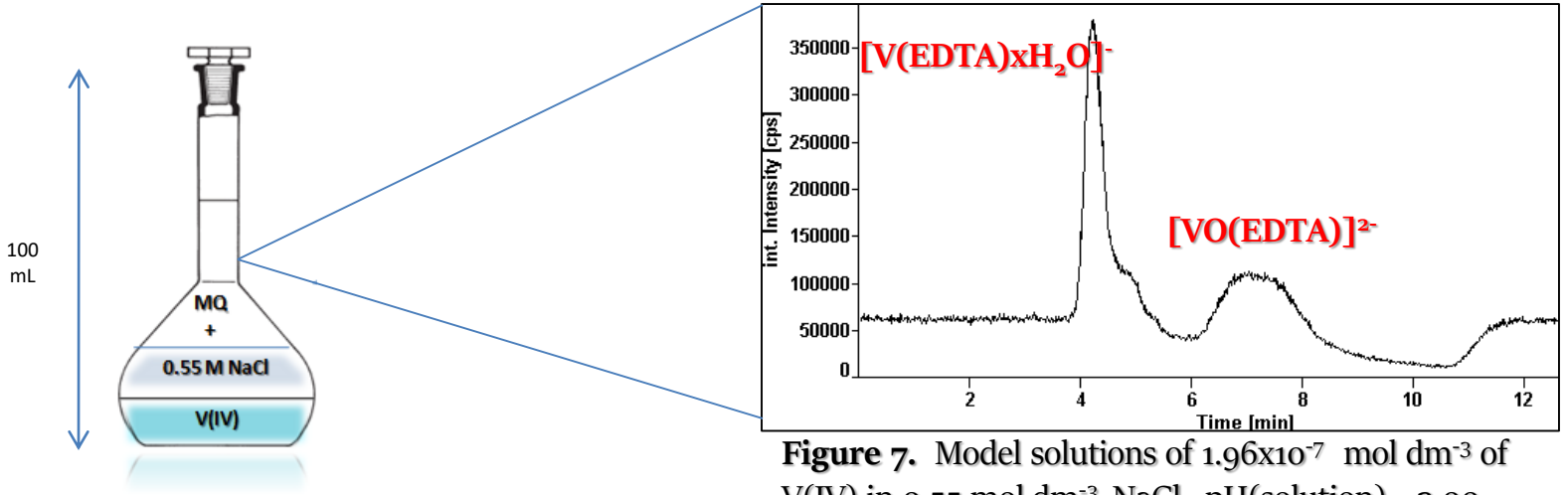


Figure 7. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(IV) in 0.55 mol dm^{-3} NaCl , pH(solution)= 2.00.

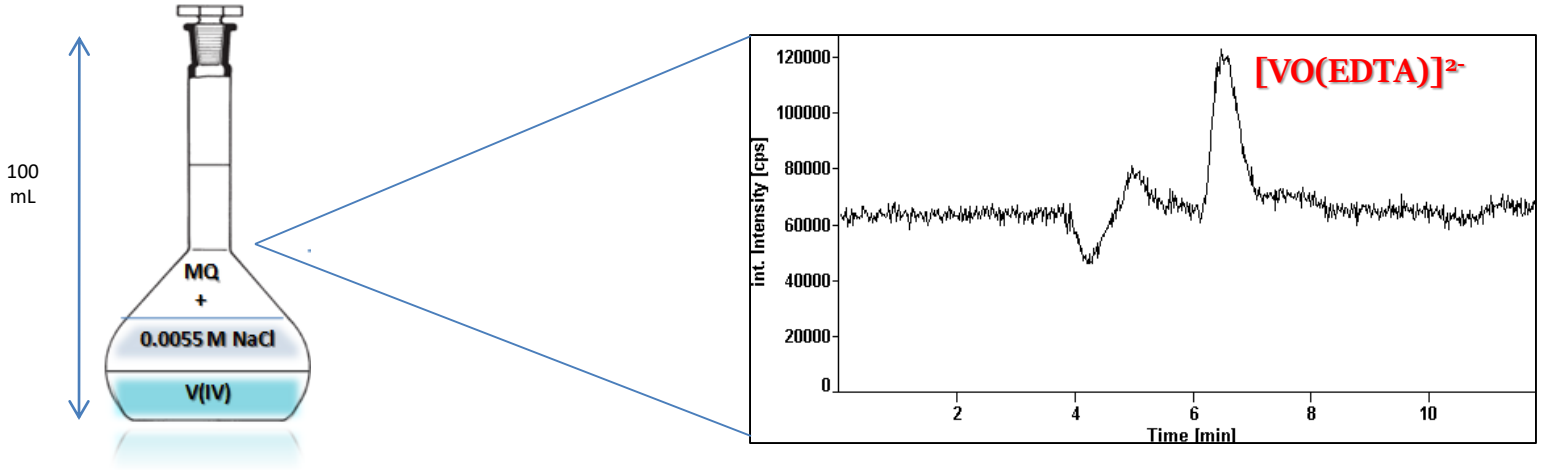
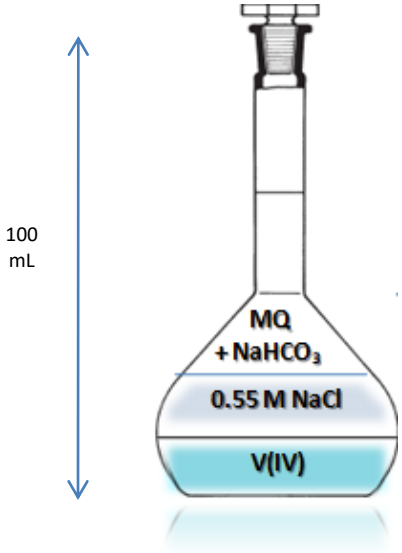
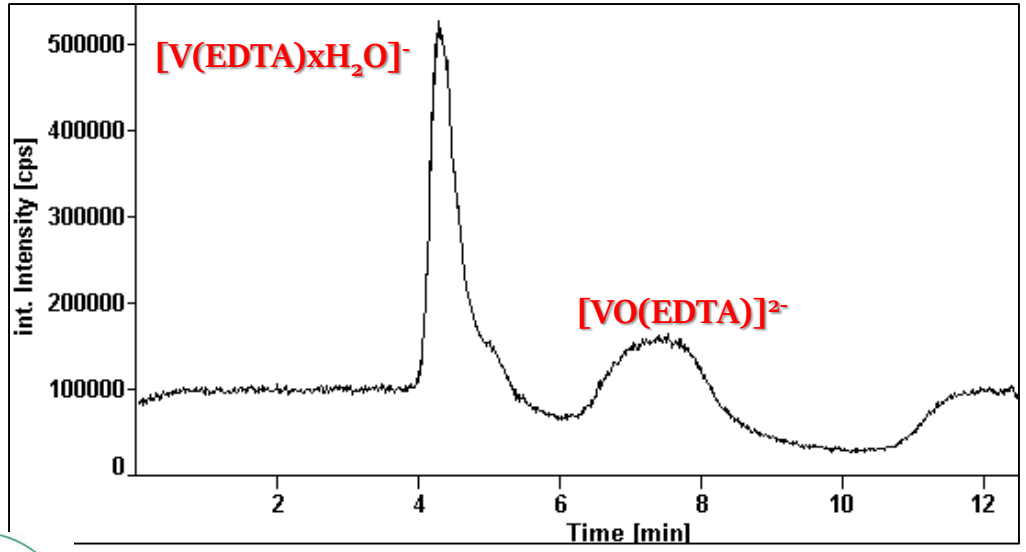


Figure 8. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(IV) in 0.0055 mol dm^{-3} NaCl , pH(solution)= 2.00.





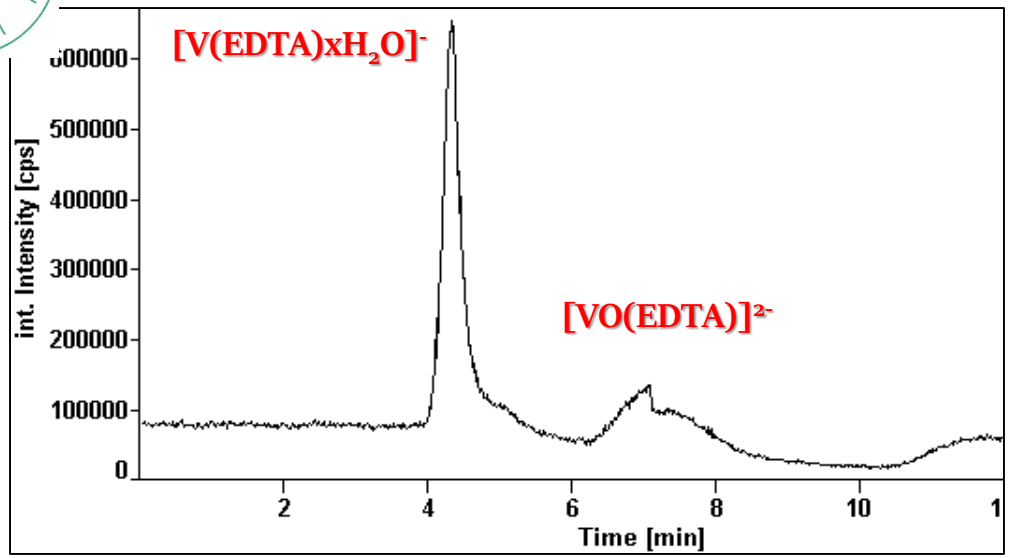


Figure 9. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(IV) in 0.55 mol dm^{-3} NaCl , pH(solution)= 8.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.

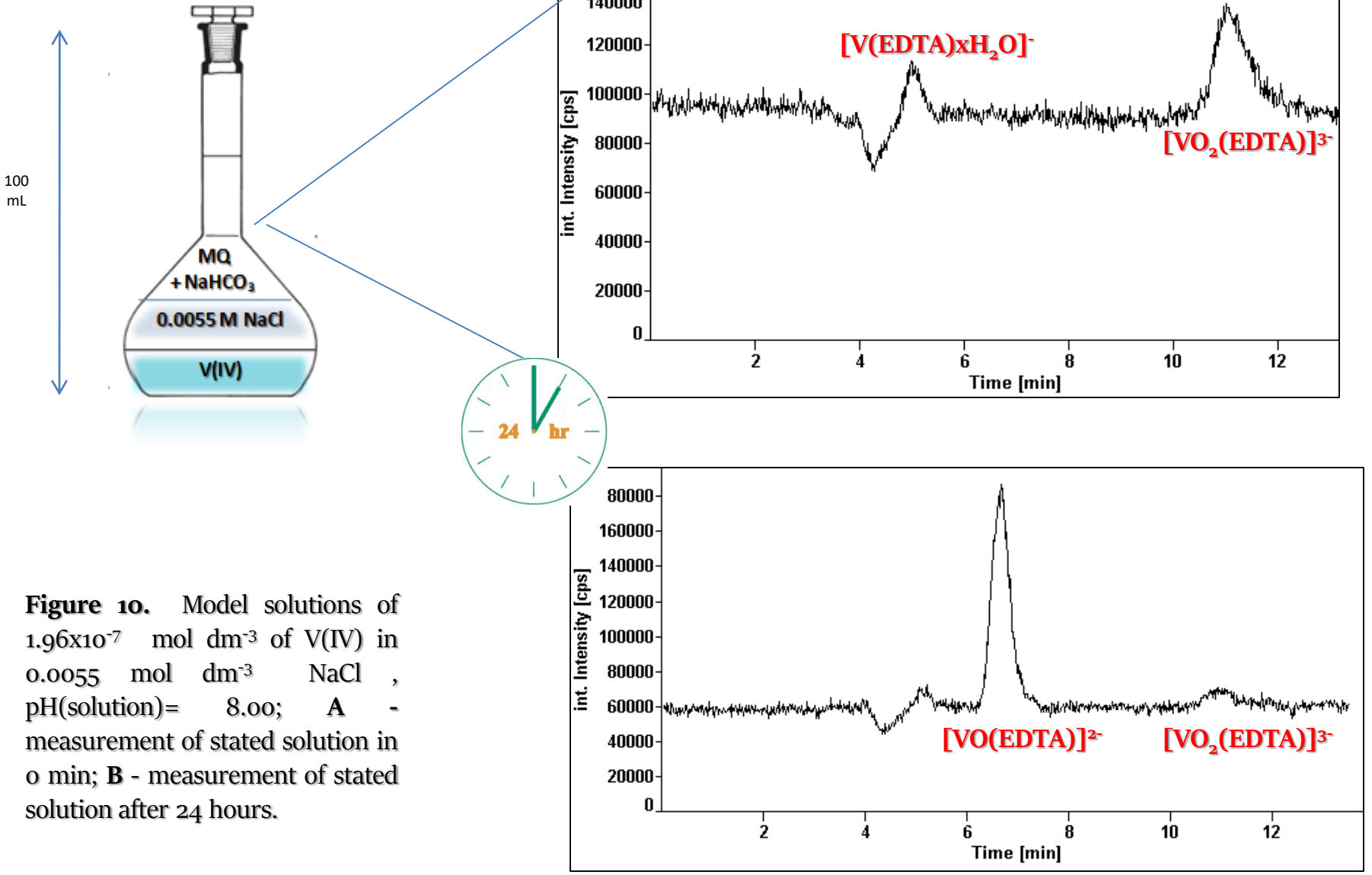
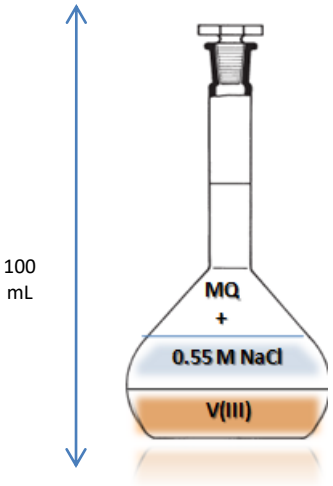


Figure 10. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(IV) in 0.0055 mol dm^{-3} NaCl , pH(solution)= 8.00; **A** - measurement of stated solution in 0 min; **B** - measurement of stated solution after 24 hours.



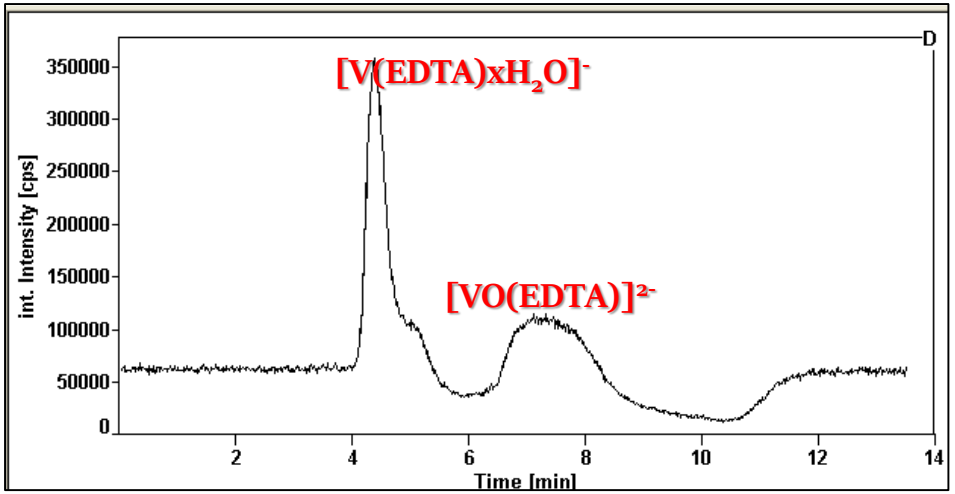
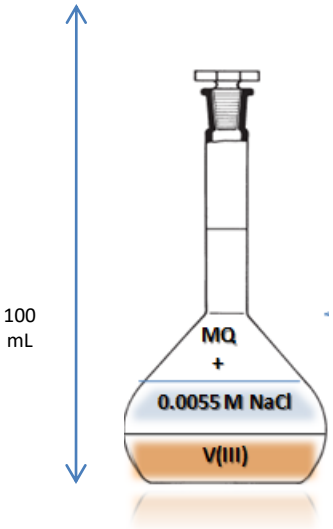


Figure 11. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(III) in 0.55 mol dm^{-3} NaCl , pH(solution)= 2.00.



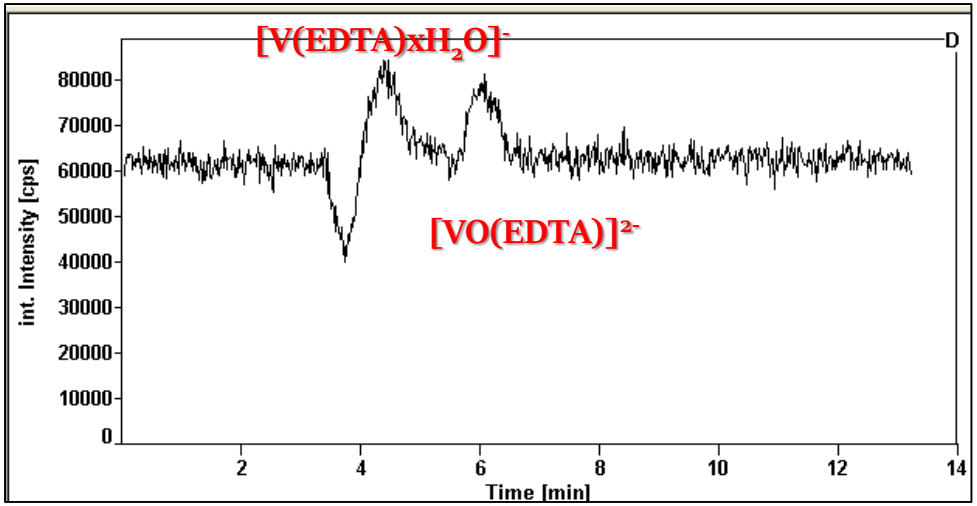
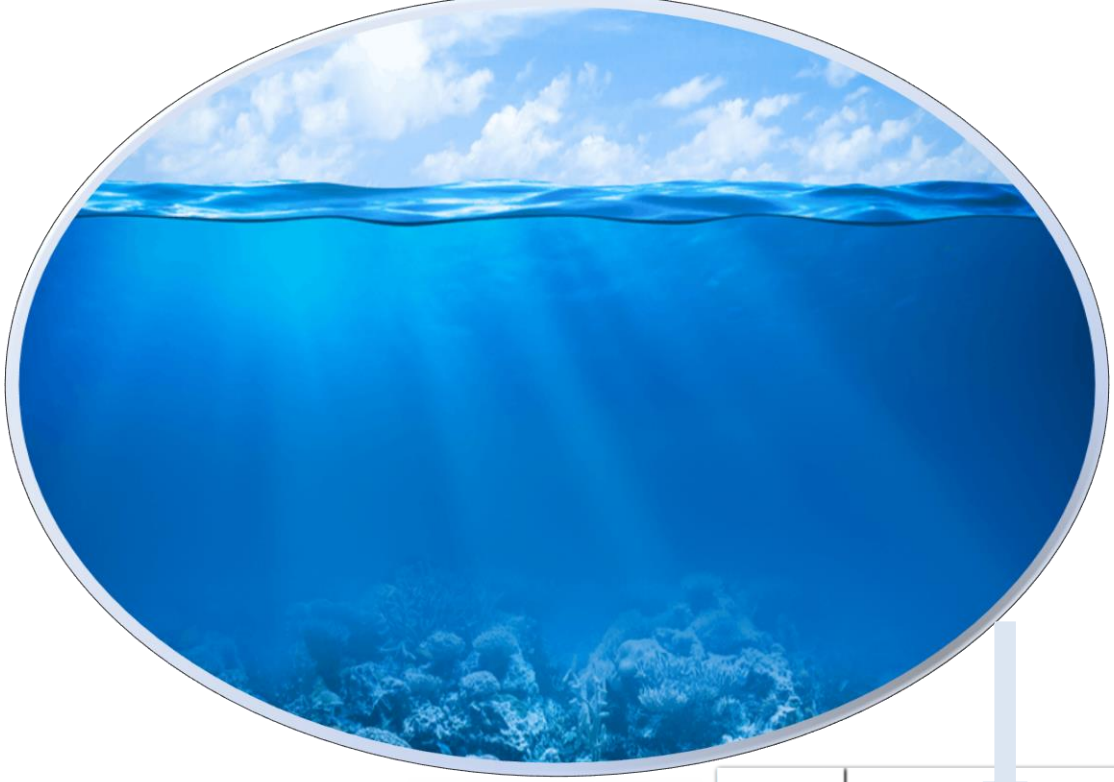


Figure 12. Model solutions of 1.96×10^{-7} mol dm^{-3} of V(III) in 0.0055 mol dm^{-3} NaCl , pH(solution)= 2.00.



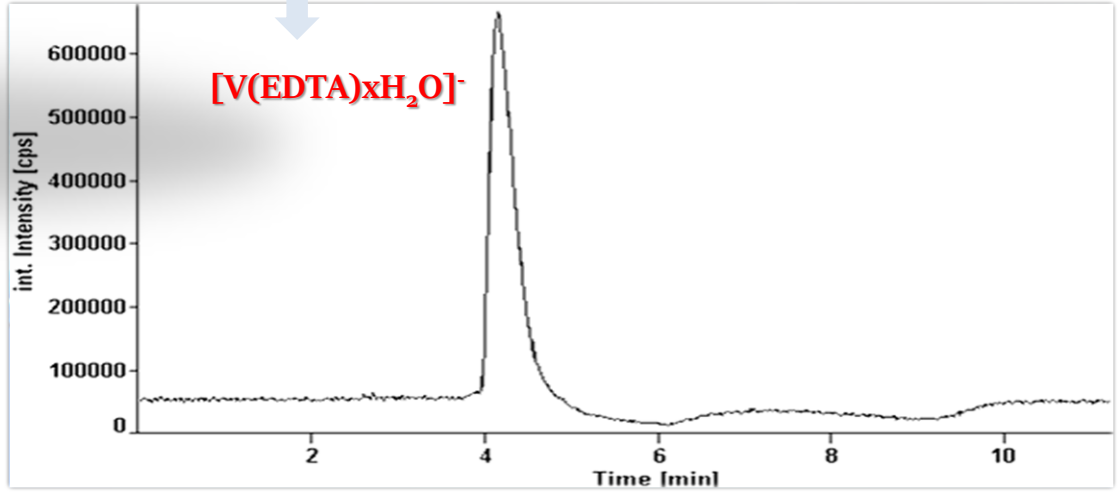


Figure 13. Vanadium species determined with IC-ICP MS system; samples taken from Martinska, Šibenik

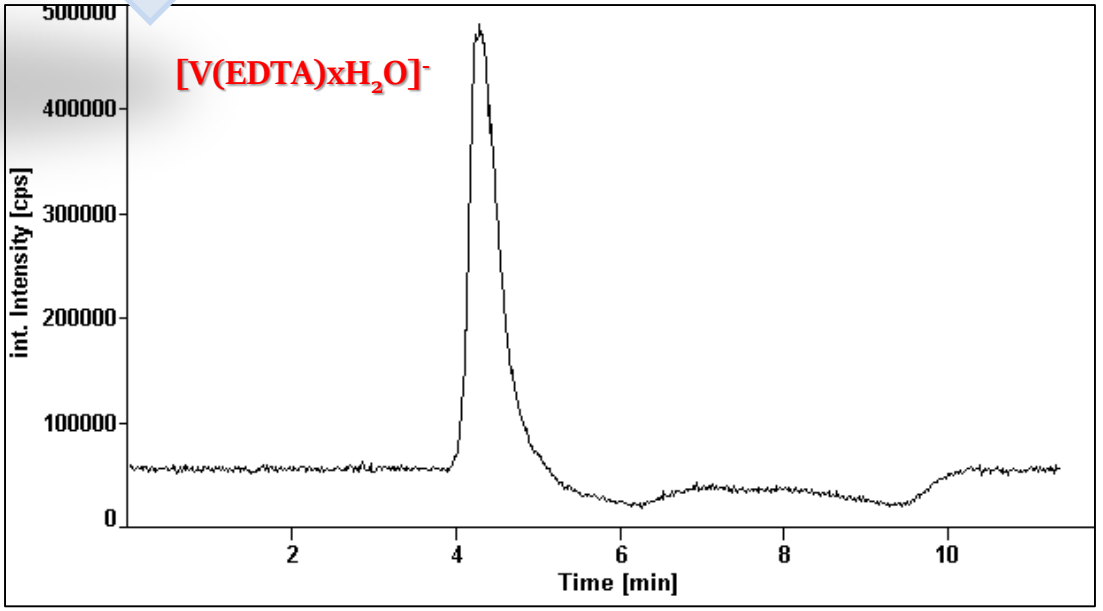


Figure 14. Vanadium species determined with IC-ICP MS system; samples taken from "Zmajevo oko", Rogoznica.

Conclusions:

- Kinetics of the reaction of vanadium species shows strong pH dependence.
- Reduction of V(V) is taking place in the solution, not on the column.
- In model seawater solutions V(V) and V(IV) species are being reduced to V(III) with chloride ions.
- Mesaured vanadium species in natural seawater samples and Lake Rogoznica sample are mainly found as V(III) species.

Acknowledgments…

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IP-2018-01-7813, "REDOX"

Thank you for the attention!

Literature:

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