

Status report spring 2016

Hans Vigeland Lerum

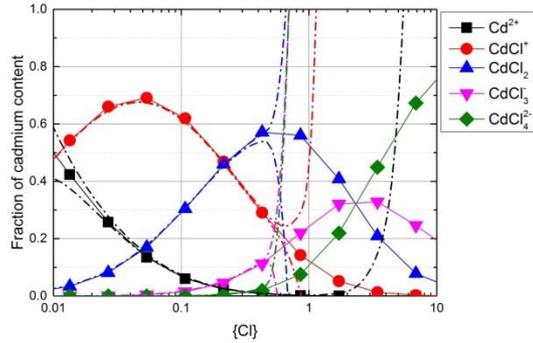
Department of Chemistry

UIO

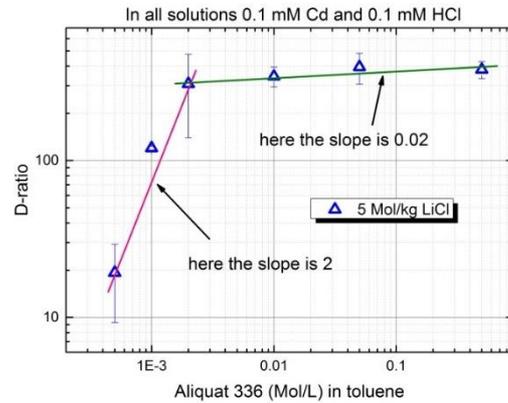
05.10.2016



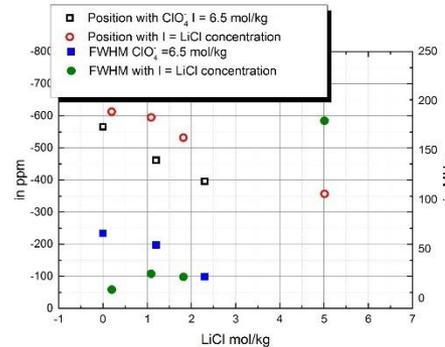
Outline of my presentation



What I planned

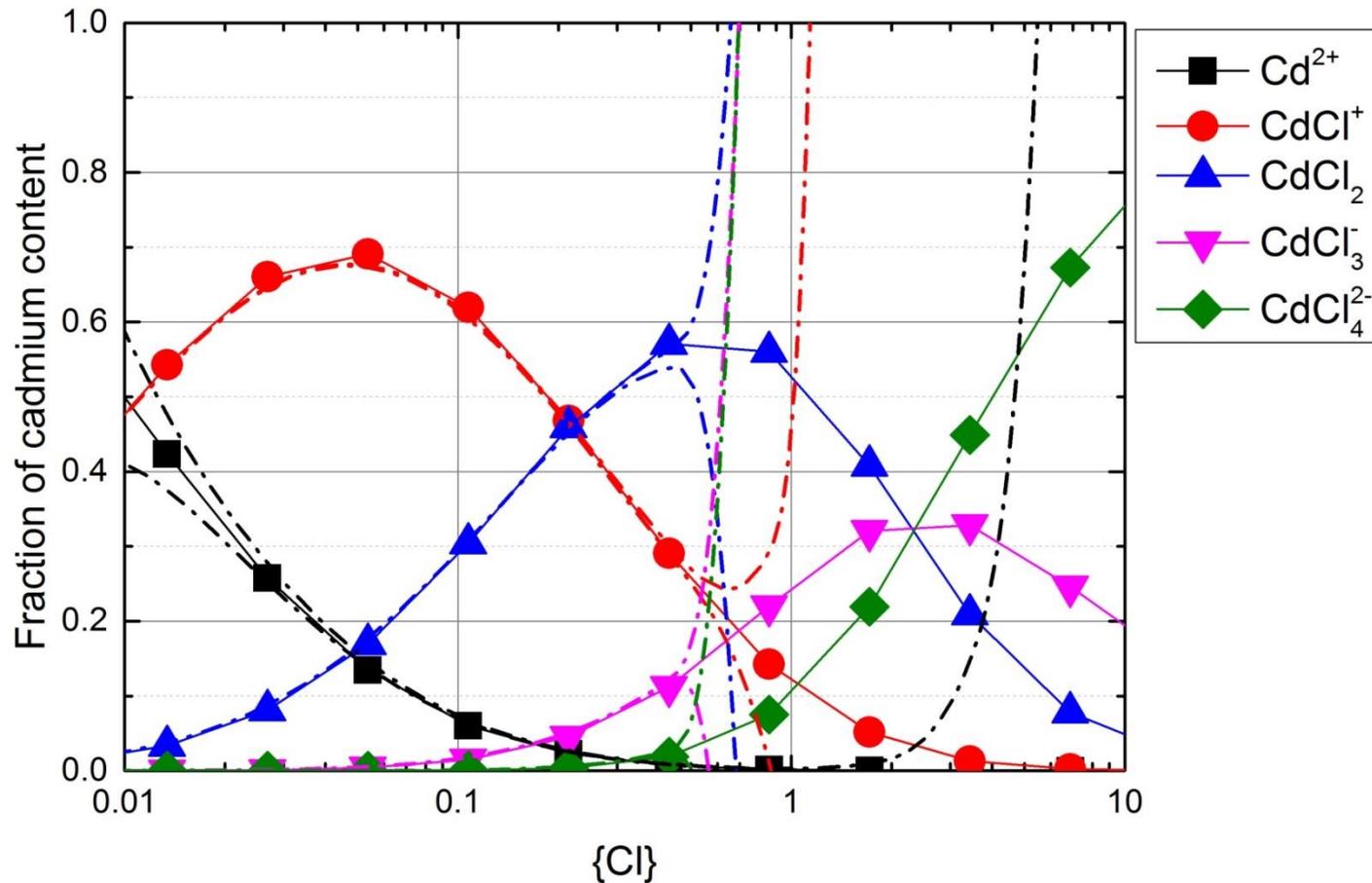


What I have done



What I plan

Prediction ion behavior in highly saline environment is difficult



(1) Kipton J. Powell, P. L. B., Robert H. Byrne, Tamas Gajda, Glenn Hefte, Ann-kathrin Leuz, Staffan Sjöberg, Hans Wanner. Chemical Speciation of Environmentally Significant metals with inorganic Ligands. Part 4 : The $Cd^{2+} + OH^-$, Cl^- , CO_3^{2-} , and PO_4^{3-} Systems (IUPAC Technical Report). *Pure and applied chemistry* 2011, 83 (5), 1163.

Studying how this metal behaved was then to be performed using Liquid-liquid extraction with supplemental information from other techniques

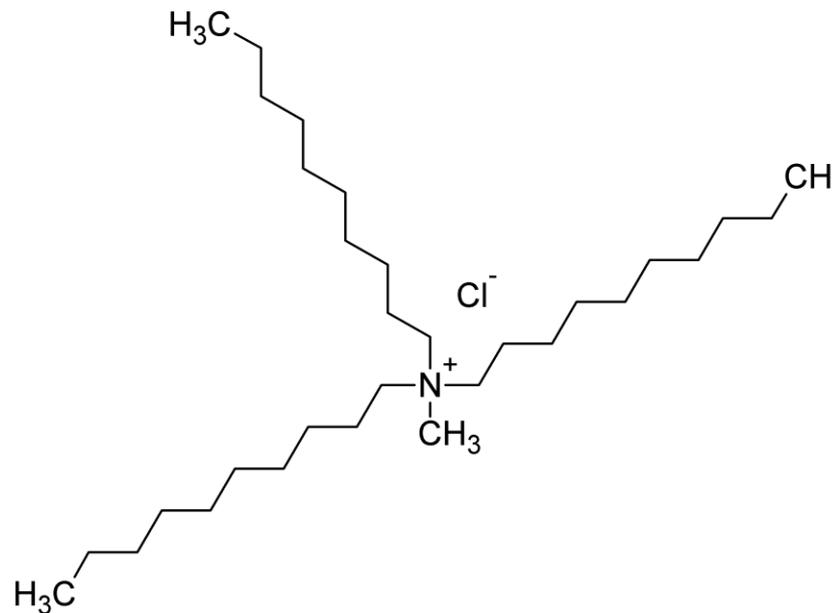
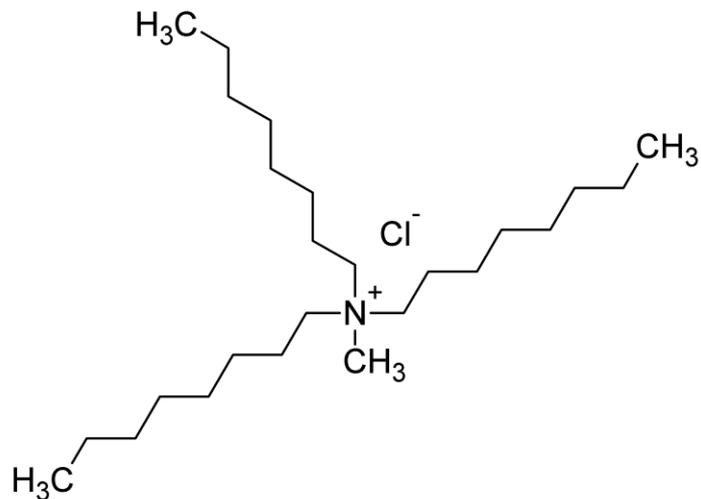
Liquid-liquid extraction

NMR

Ir/raman

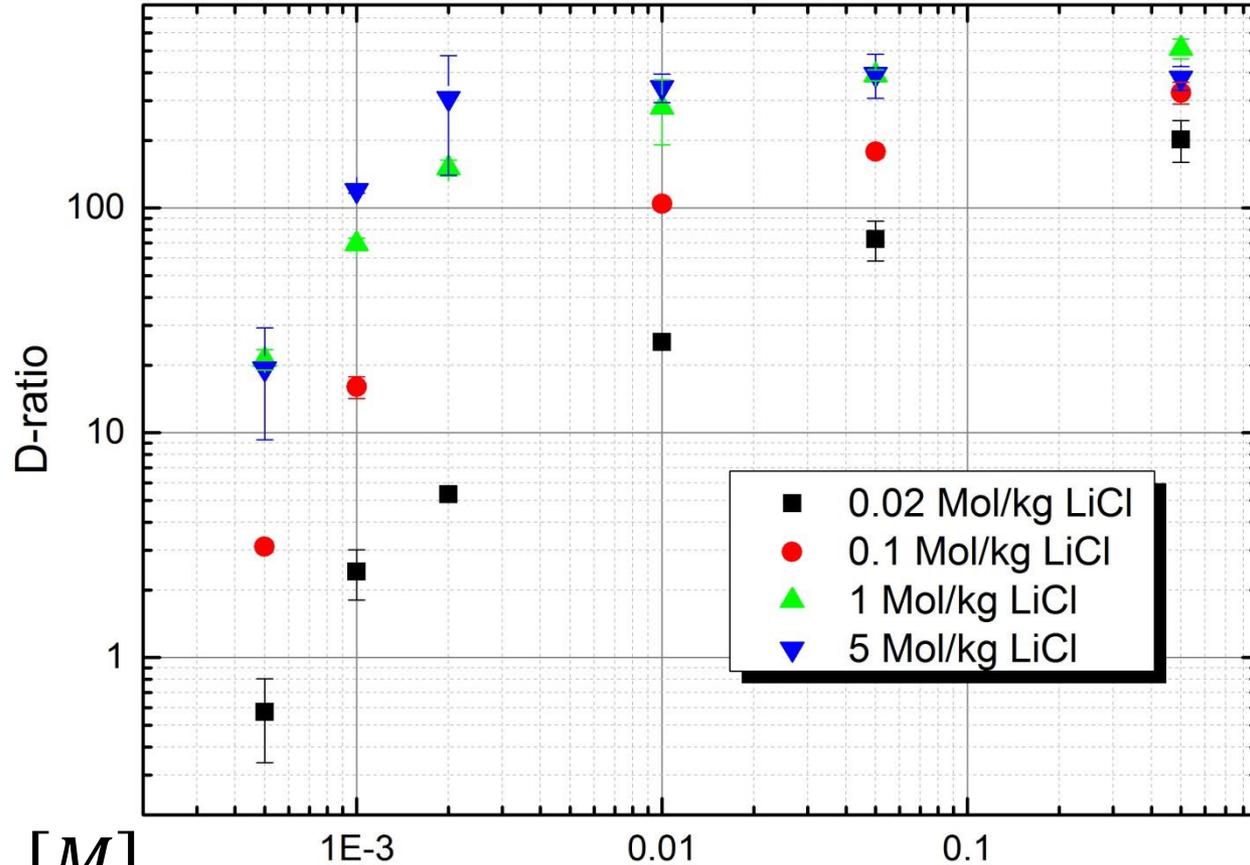
ICP-MS

Aliquat 336 is dominated by these two molecules with a slight difference in chain length



Aliquat 336 extracts Cd efficiently into toluene

In all solutions 0.1 mM Cd and 0.1 mM HCl



$$D = \frac{[M]_{org}}{[M]_{aq}}$$

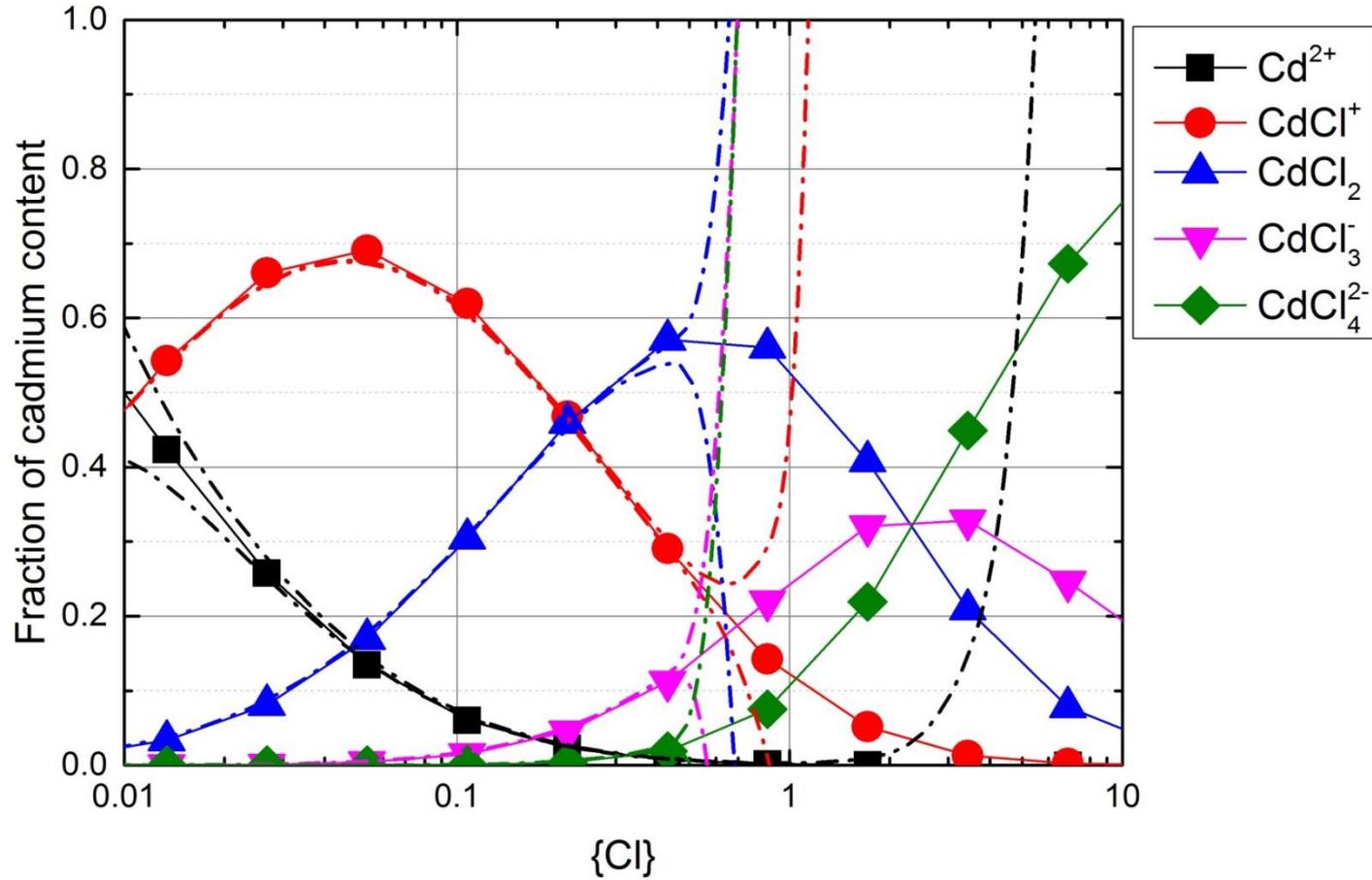
A336 mol/L in toluene

99% extracted

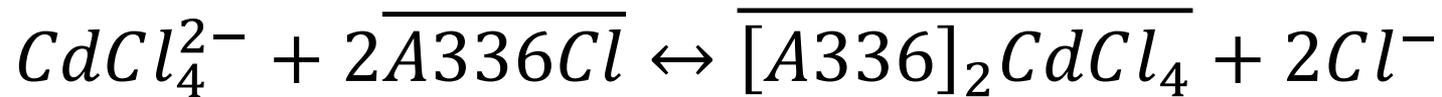
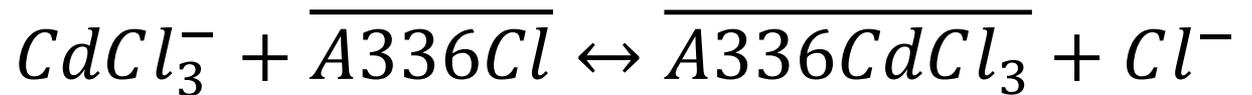
90% extracted

50% extracted

Cd has several species and can be extracted by several different mechanisms

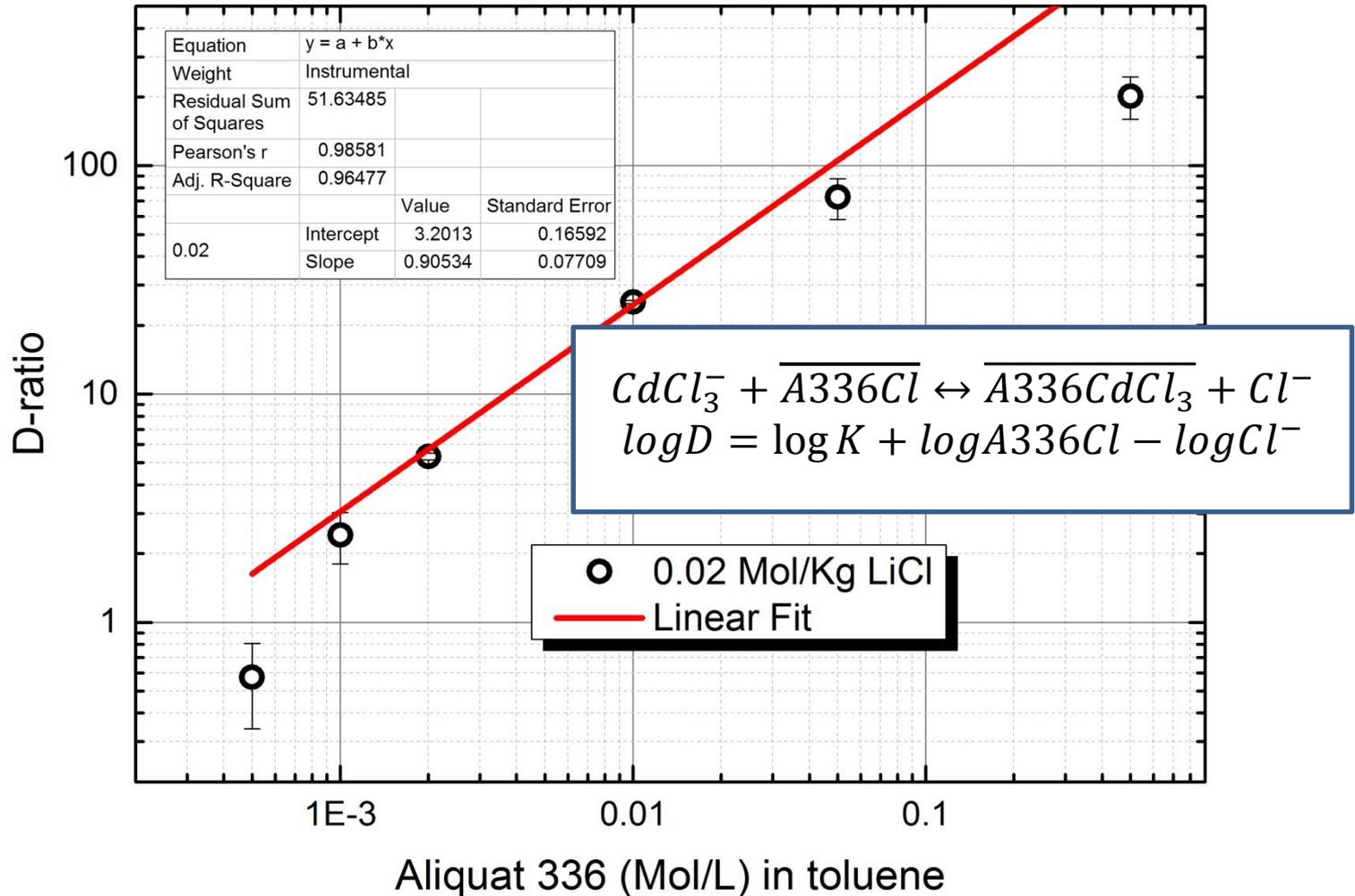


Cd has several species and can be extracted by several different mechanisms



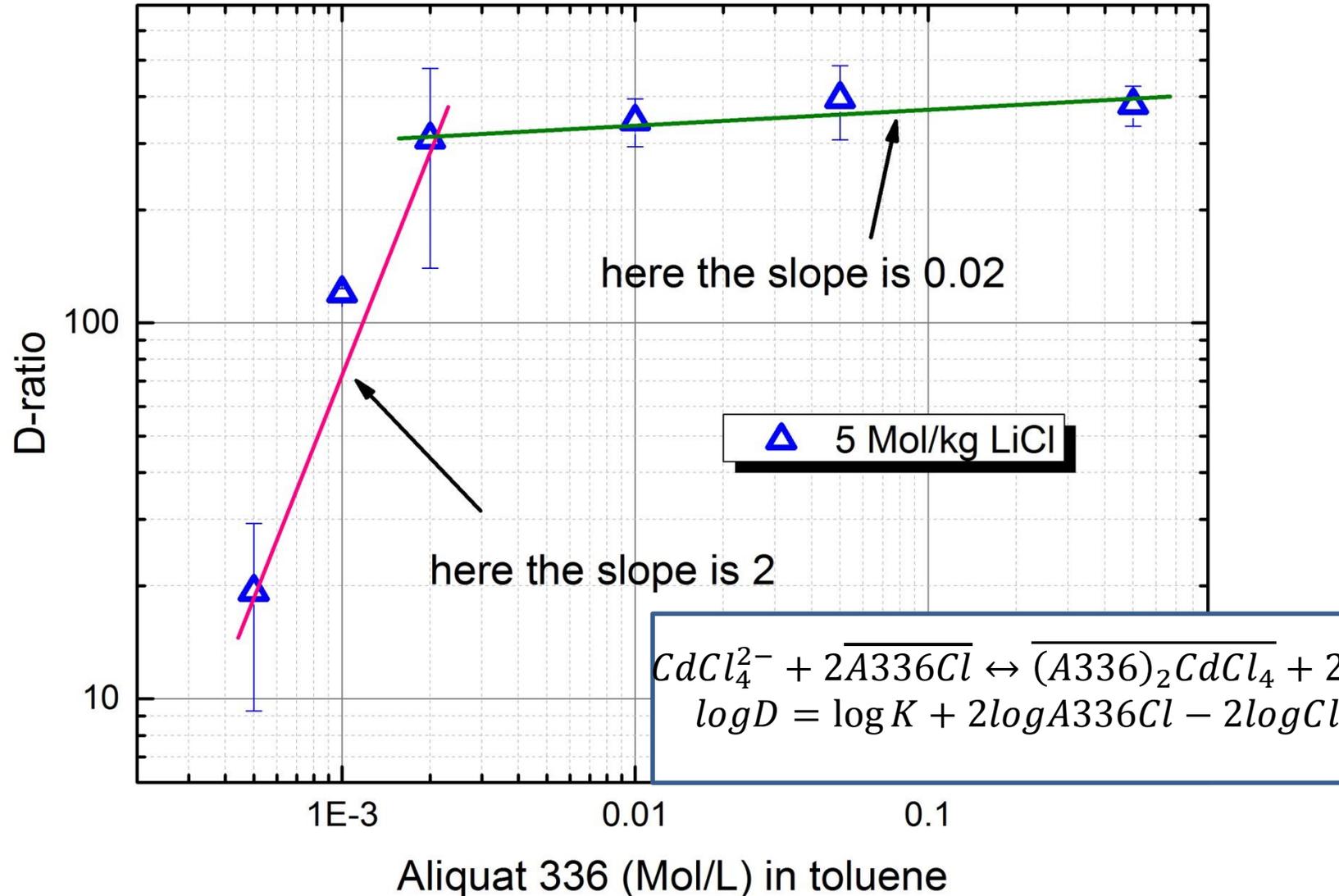
Approximately a straight line for the lowest concentration gives a slope of roughly 1

In all solutions 0.1 mM Cd and 0.1 mM HCl

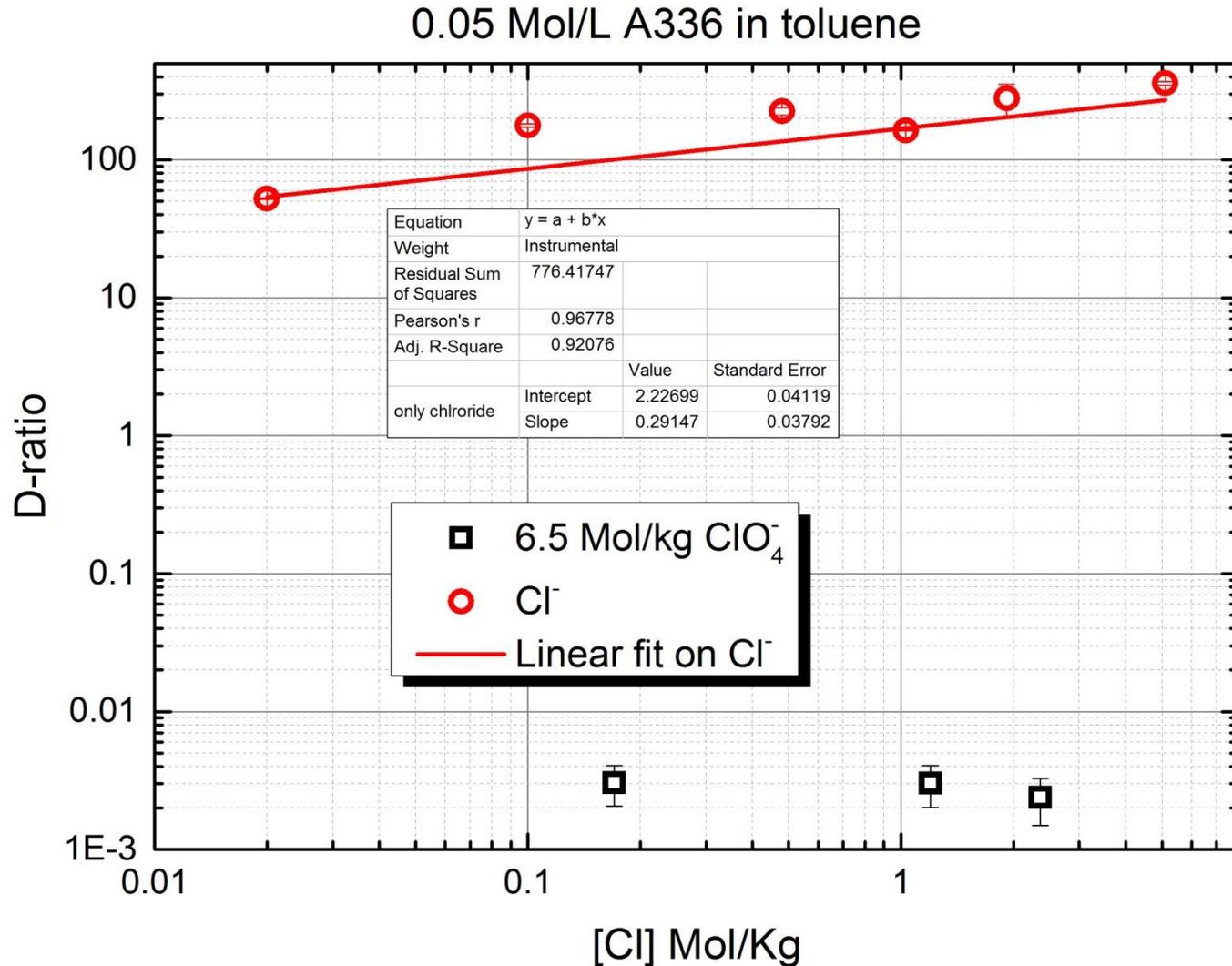


When the chloride concentration is increased a slope of 2 is supported

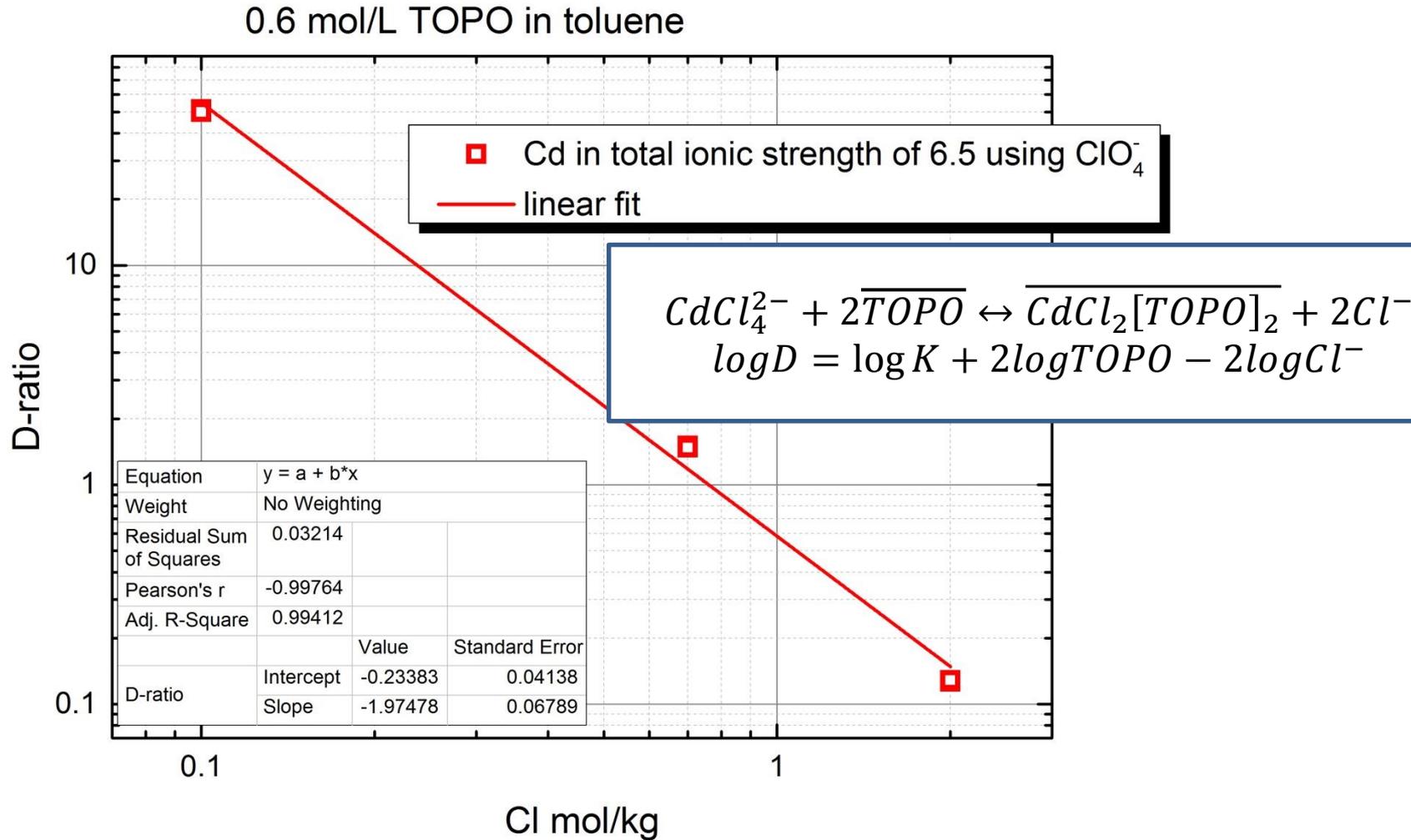
In all solutions 0.1 mM Cd and 0.1 mM HCl



Plotting the D-ratio as a function of the chloride concentration should then yield a decrease in the D-ratio

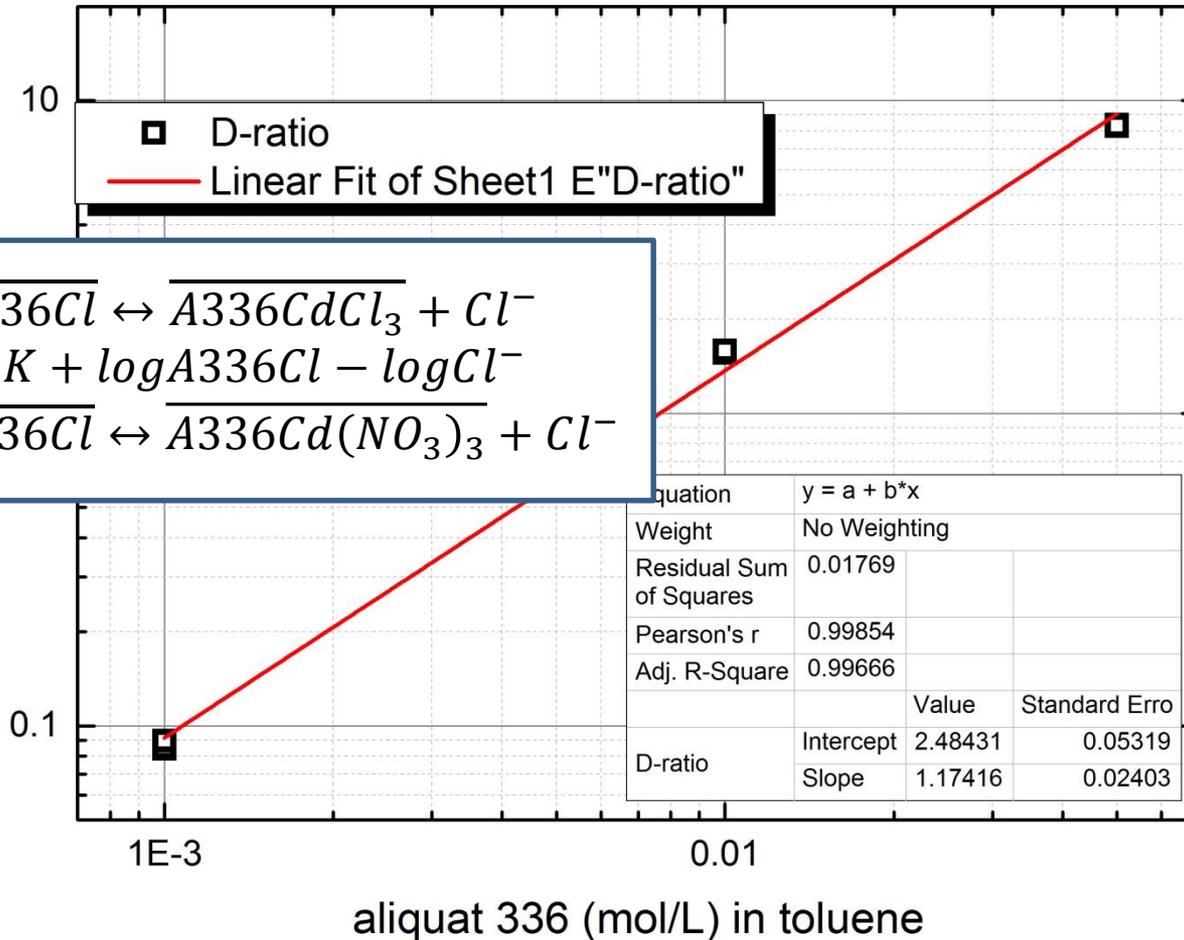


To check the interaction between perchlorate and Cd TOPO was used as an extractant



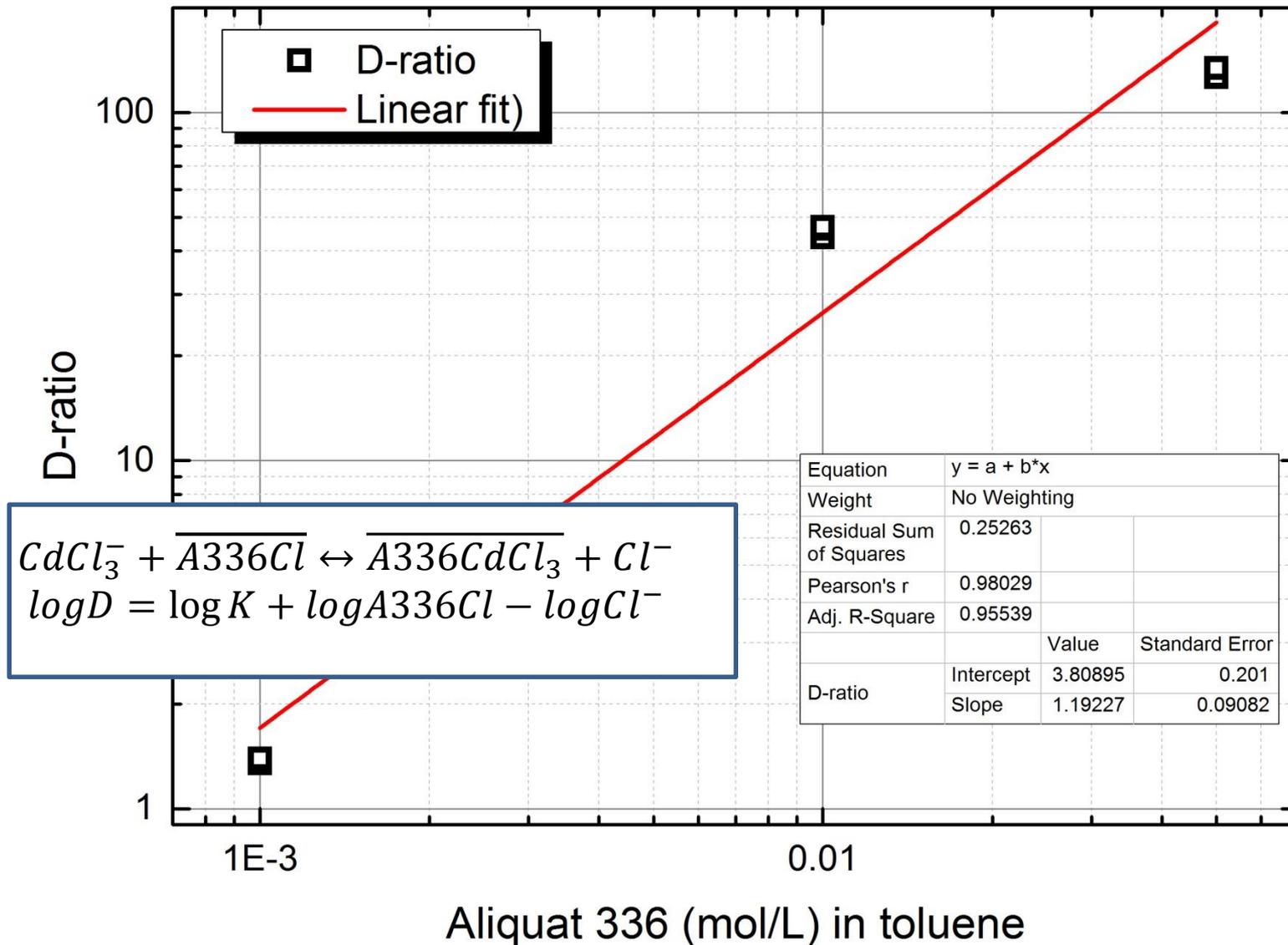
Nitrate does not seem to hinder extraction even with high concentrations

12 mol/kg LiNO₃ 0.1 mM Cd 0.3 mM Cl⁻ 0.1mM H⁺

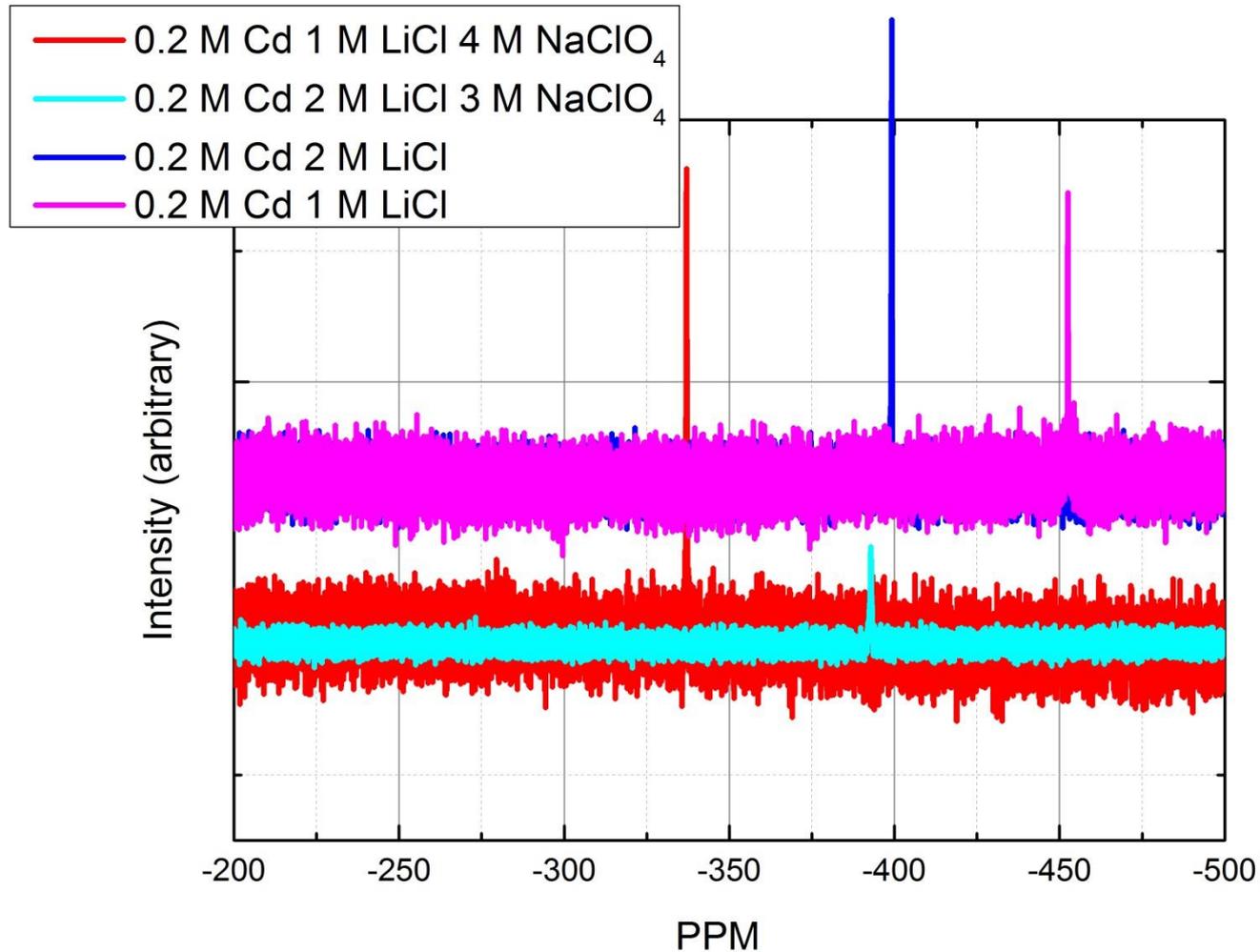


However it does seem to drop the D-ratio by a factor compared to solutions with only Cl⁻

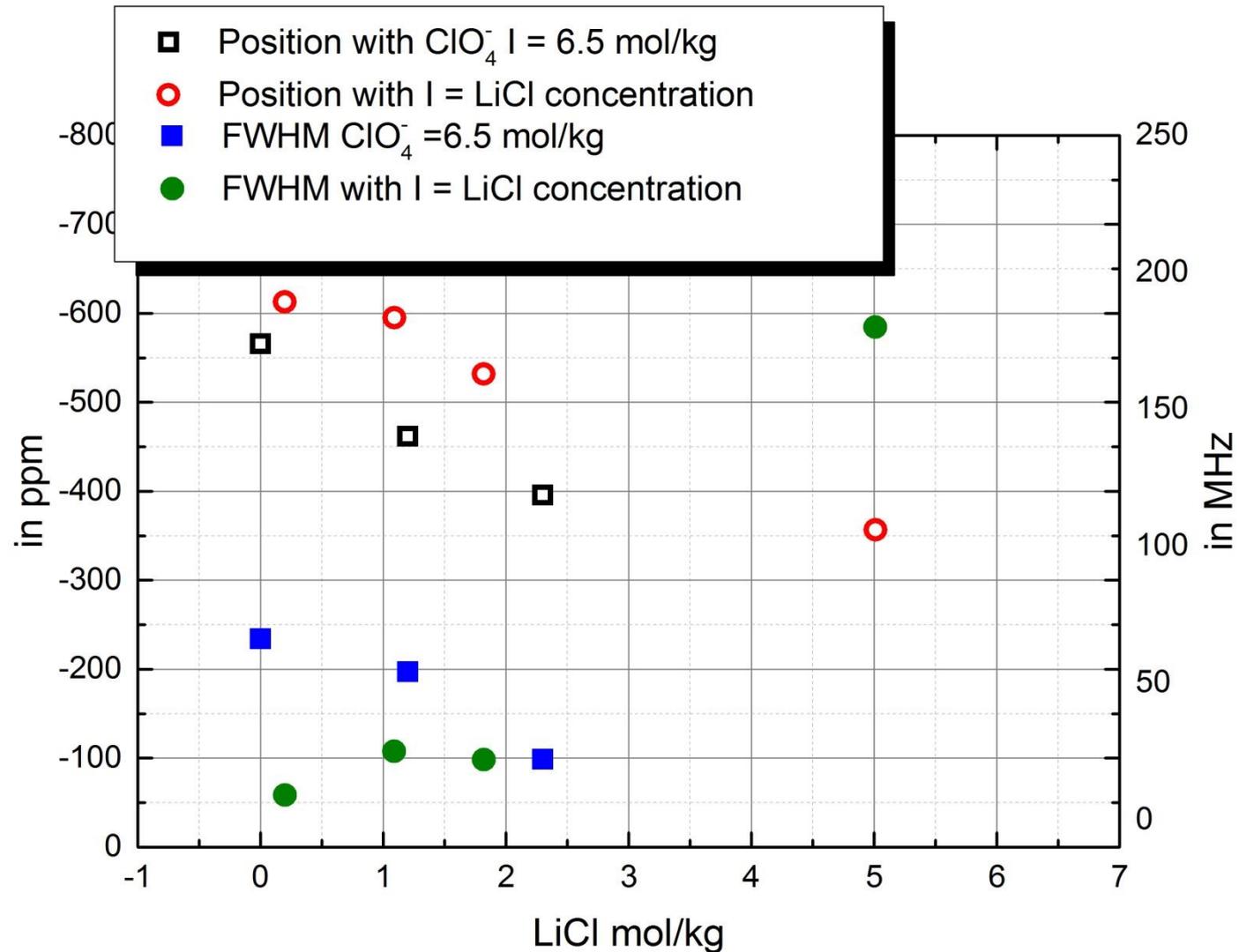
1.5 mol/kg KNO₃ 3.5 mol/kg LiCl 0.1 mM Cd 0.1 mM HCl



Using slope analysis is a quick way to gather a lot of data, however when concentrations vary a good scheme can be difficult to propose



NMR sees the electron density surrounding the nuclei, however chemical shifts are not well known for Cd



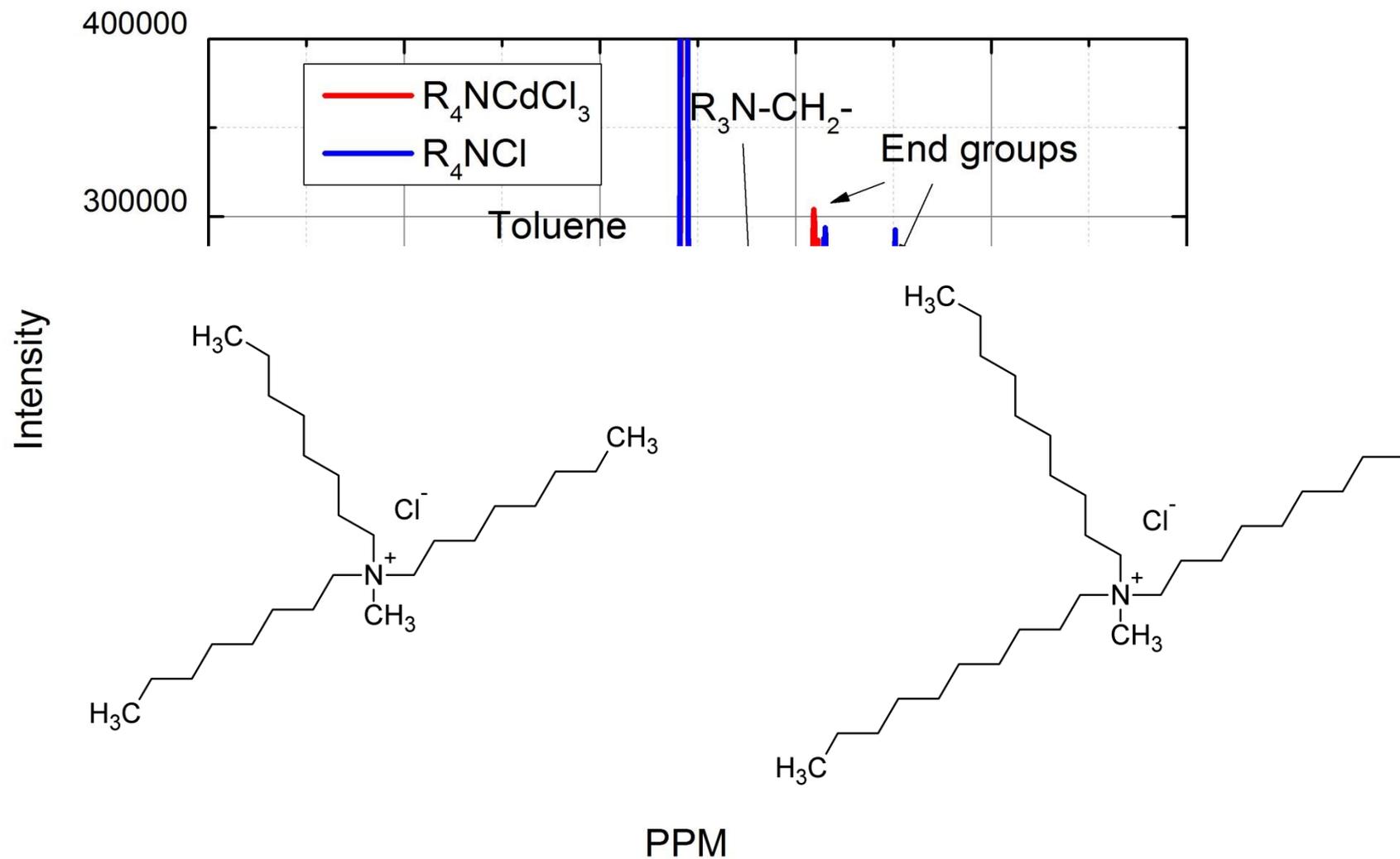
For the future

Will perform ir and raman spectroscopy on Monday. Will see how much it can ad to the study.

NMR will need to repeat some of the experiments. Will perform isothermal NMR cooling down the samples would make it possible to separate the peaks of the different species. Thereby giving a ratio of the distribution of the species.

ICP-MS will be used to check the separation factor between several elements. The separation will be supported by selected radioactive nuclei.

NMR looks at the area surrounding the atom



Cd extracted to organic

