



NEW APPLICATION POSSIBILITIES WITH THE METROSEP A SUPP 19 IN CONNECTION WITH THE ANALYSIS OF CONCRETE ADMIXTURES

25.05.2021, H.U. FREI

SIKA TECHNOLOGY AG / CORP. ANALYTICS

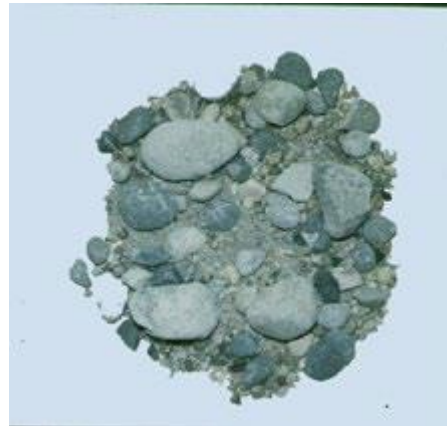
BUILDING TRUST



CONCRETE

Three main constituents are actually enough to produce concrete:

- Binder (Cement)
- Aggregates
- Water



CONCRETE ADMIXTURES

In addition to the three main components of concrete, concrete admixtures and additives are also used in concretes with higher performance specifications again both fresh and hardened.

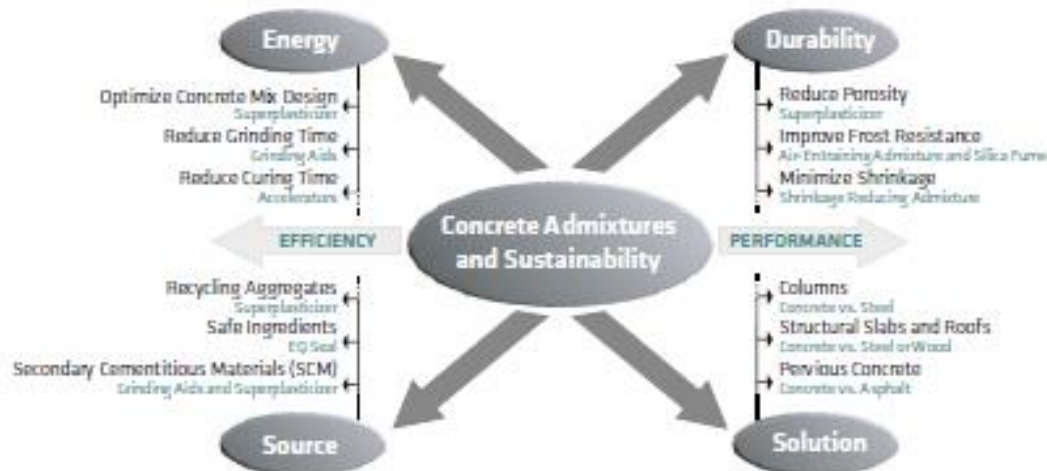
- Plastifiers (water reducers)
- Retarders
- Accelerators
- Viscosity modifying agents
- Air entrainers
- Grinding aids
- Shrinkage reducing admixtures
- Corrosion inhibiting admixtures
- Surface improving admixtures

HISTORY OF ADMIXTURES IN SIKA

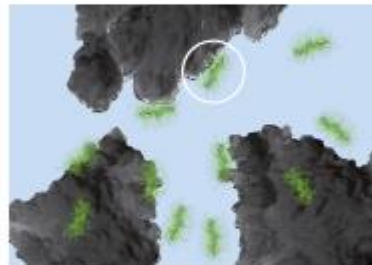
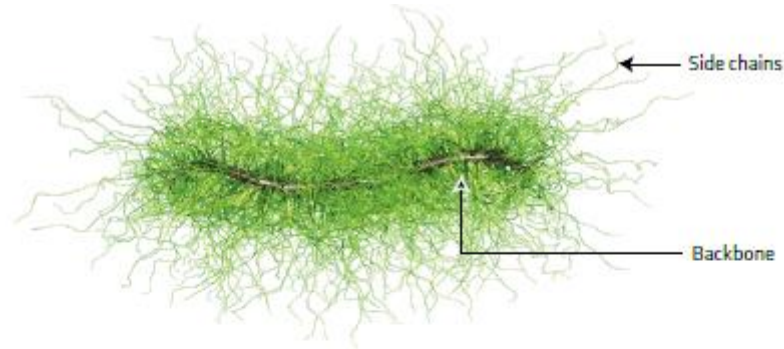
Date	Product base	Typical Sika Product	Main effects
1910	Aqueous alkaline solution	Sika®-1	Waterproofing
1930	Lignosulfonate	Plastocrete®	Water reduction up to 10%
1940	Gluconate	Plastiment®	Water reduction up to 10% plus retardation
1960	Mix of carbohydrate and poly-phosphates	Sika® Retarder	Retardation
	Mix of synthetic surfactant	SikaControl® AER	Traditional air-entrainer
1970	Naphthalene	Sikament®	Water reduction up to 20%
1980	Melamine		Water reduction up to 20%
1990	Vinyl copolymers		Water reduction up to 25%
1990	Mixture of organic and inorganic salt solution	SikaRapid®	Hardening acceleration
1992	Amino alcohols	Sika® FerroGard®-901	Corrosion inhibitor
2000	Modified Polycarboxylates (PCE)	Sika® ViscoCrete®	Water reduction up to 40%
2010	Modified Polycarboxylates (PCE)	Sika ViscoFlow®	Slump retention up to 7 hours
2018	Blend of calcium-carbonate and alloy powder	SikaControl® AER-200 P	Chemical air-entrainer

POWERFUL AND SUSTAINABLE

Concrete admixtures can improve the sustainability of concrete in many different ways. Firstly, they can improve the quality and performance of the concrete significantly, which extends its service life. The addition of stabilizing and special water reducing admixtures also enables recycled aggregates to be used for the production of good quality concrete. Finally, the energy required to obtain high early strengths in precast concrete can be greatly reduced or even completely replaced by water reducing and accelerating admixtures.

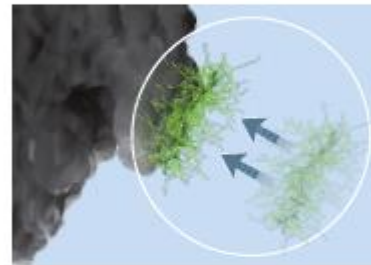


POLYMER STRUCTURE OF A PCE



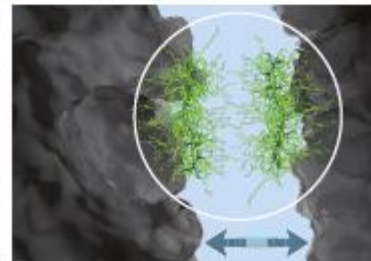
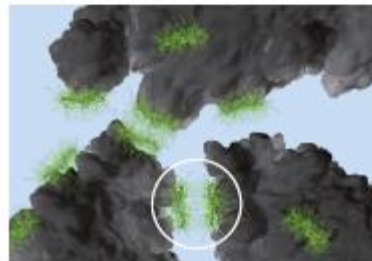
Adsorption of the polymer (backbone) on the cement grain.

Improved workability due to steric hindrance.



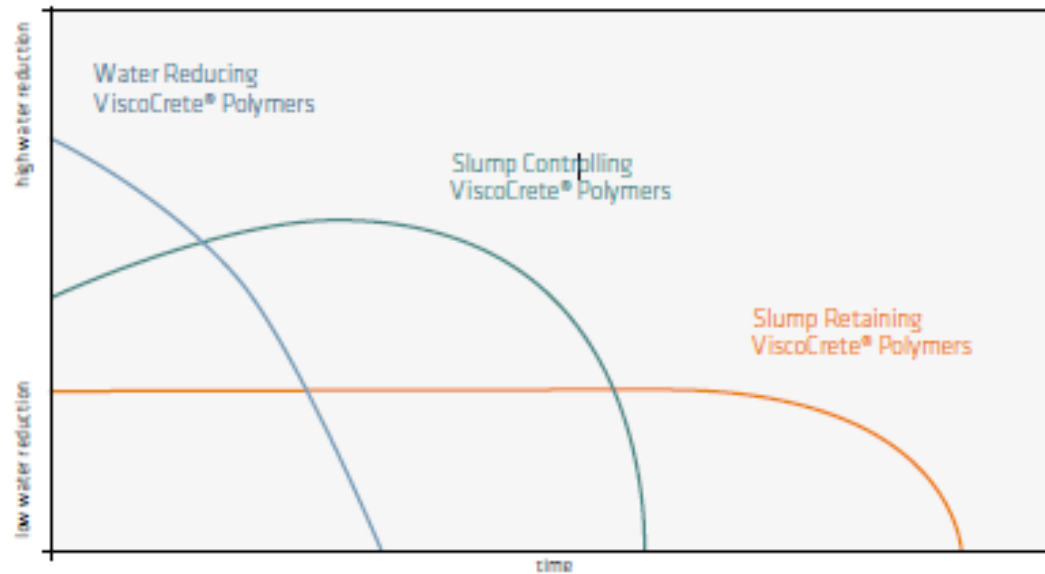
Detail of the adsorption of the polymer (backbone) on the cement grain.

Detail of improved workability due to steric hindrance.



SIKA VISCOCRETE TECHNOLOGY

The Sika ViscoCrete technology offers the possibility to design PCE polymers with specific properties.



EXPERIMENT



ION CHROMATOGRAPHY IN CONNECTION WITH THE ANALYSIS OF CONCRETE ADMIXTURES

- Analysis of anions
- Analysis of alkanolamines
- Analysis of carboxylic acids
- Analysis of glycols and glycerol
- Analysis of surfactants
- Analysis of carbohydrates

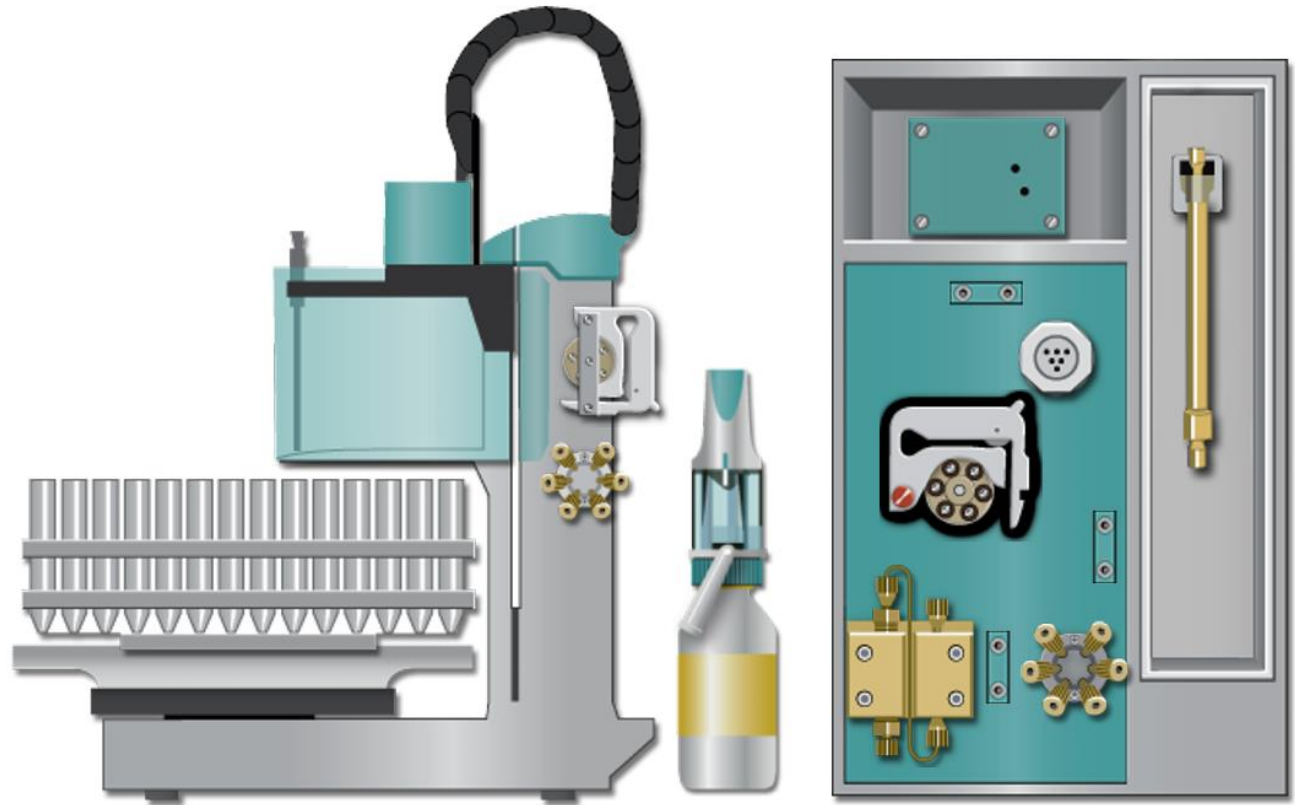
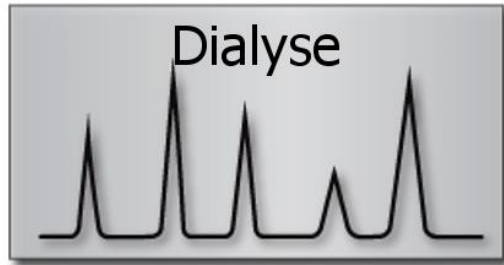
METROSEP A SUPP 19

The Metrosep A Supp 19 column family sets a whole new standard in performance for anion exchange chromatography. The column material consists of a hydrophilized polystyrene divinylbenzene copolymer with quaternary ammonium groups, which leads to exceptional peak shapes. Combined with excellent selectivities, this column can be used to tackle even the most difficult separation challenges.

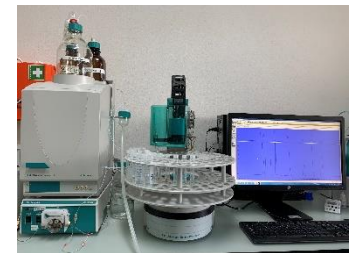
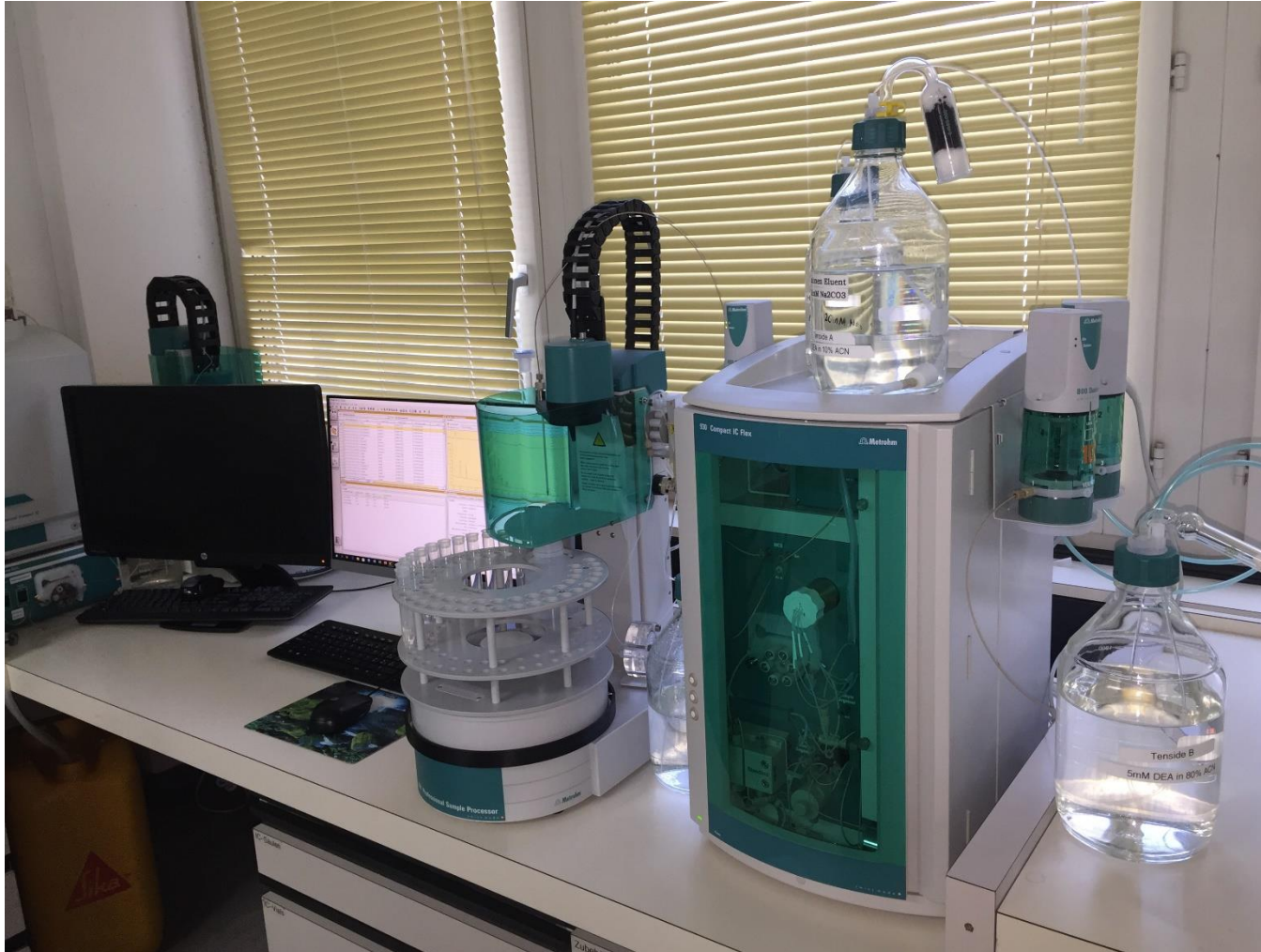


INSTRUMENT

- Instrument: Metrohm 830 Compact IC Flex
- Autosampler: Metrohm 858 Professional Sample Processor
- Detector: Conductivity



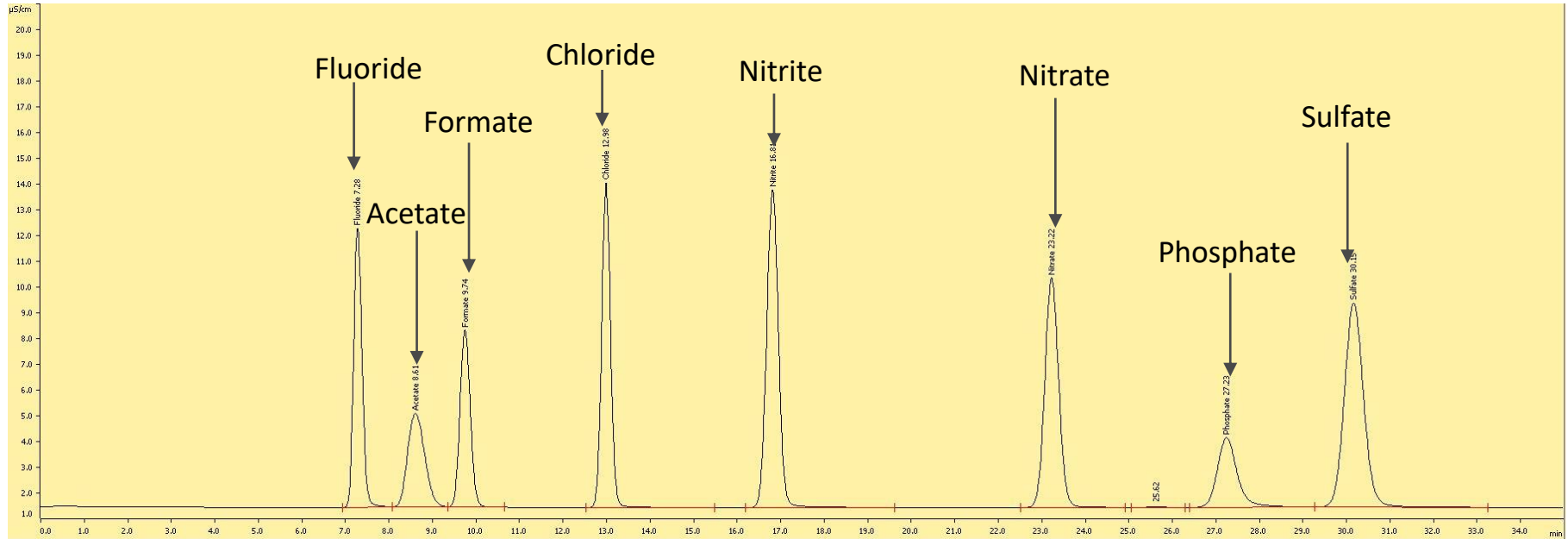
INSTRUMENT



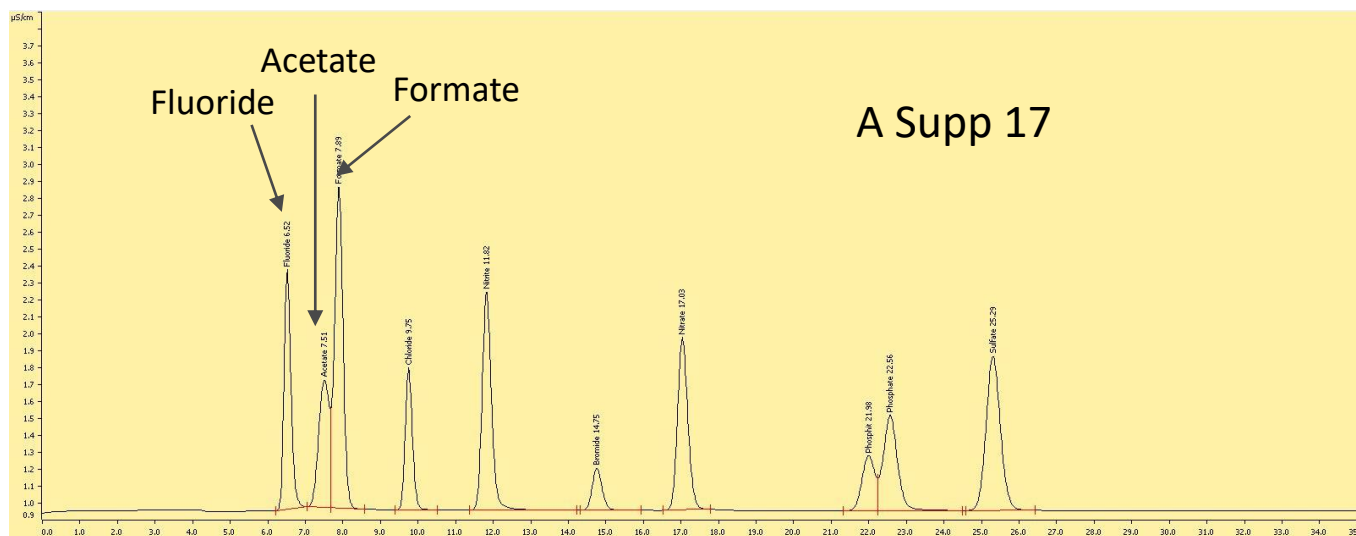
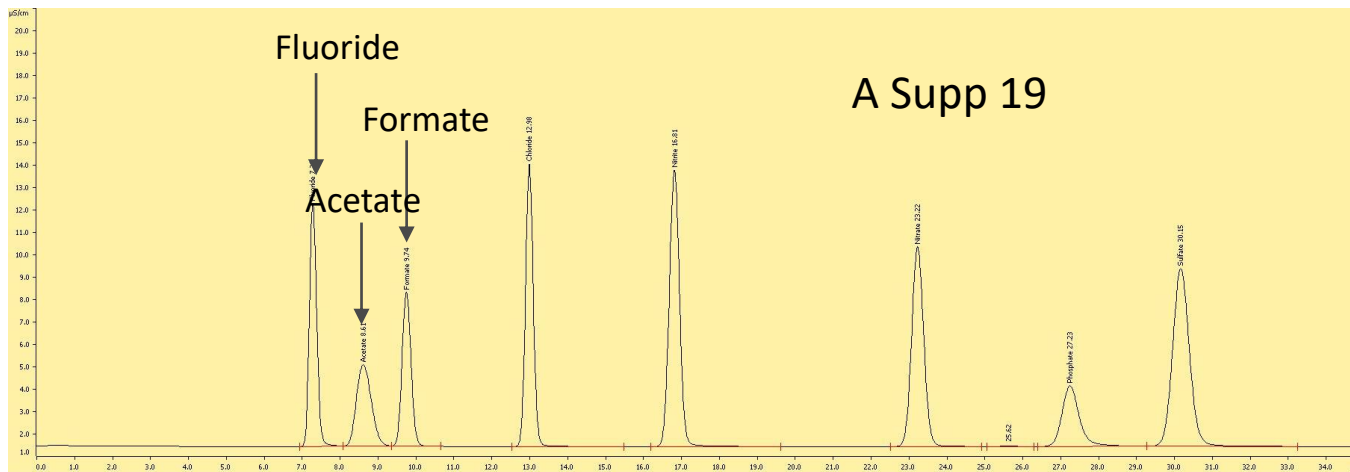
PARAMETERS

- Column: Metrosep A Supp 19 250/4.0
- Guard column: Metrosep A Supp 19 Guard/4.0
- Eluent: 8.00 mmol/l Na_2CO_3 / 0.25 mmol/l NaHCO_3
- Flow rate: 0.7 ml/min.
- Injection volume: 20 μl
- Column temperature: 25°C
- Detection: Surpressed conductivity
- Regenerant: 0.1 mmol/l H_2SO_4
- Dialysis: Yes

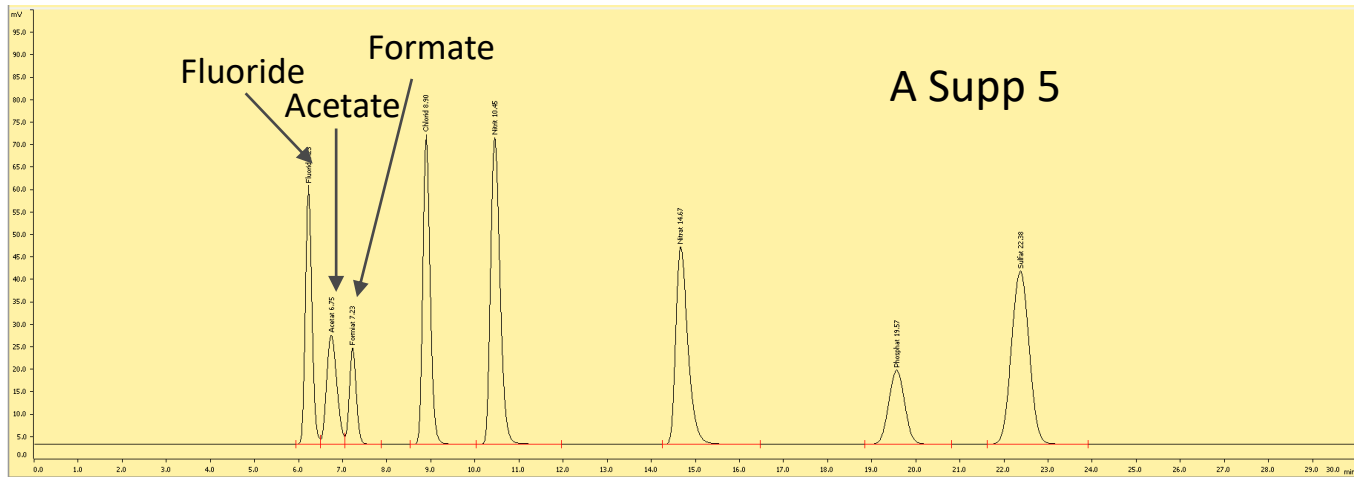
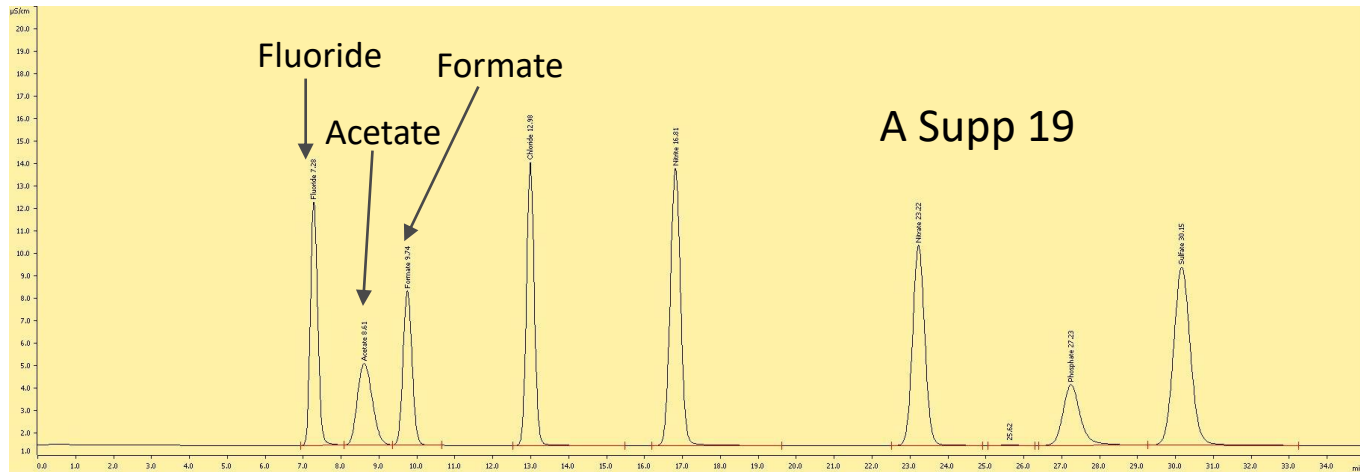
CHROMATOGRAM A SUPP 19



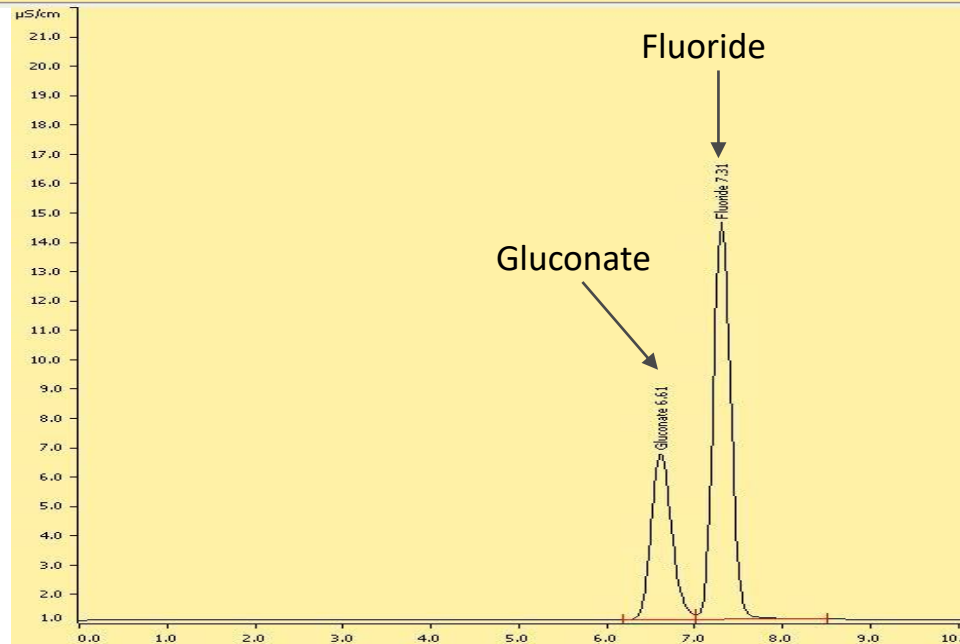
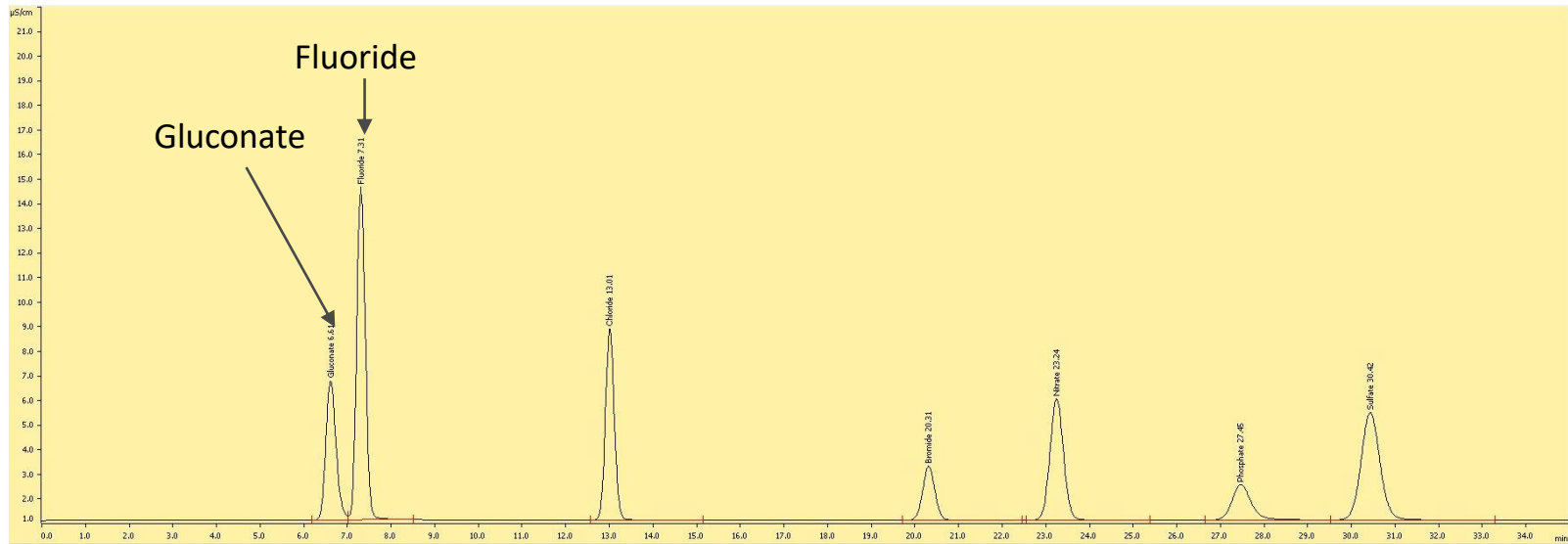
CHROMATOGRAM A SUPP 19 AND A SUPP 17



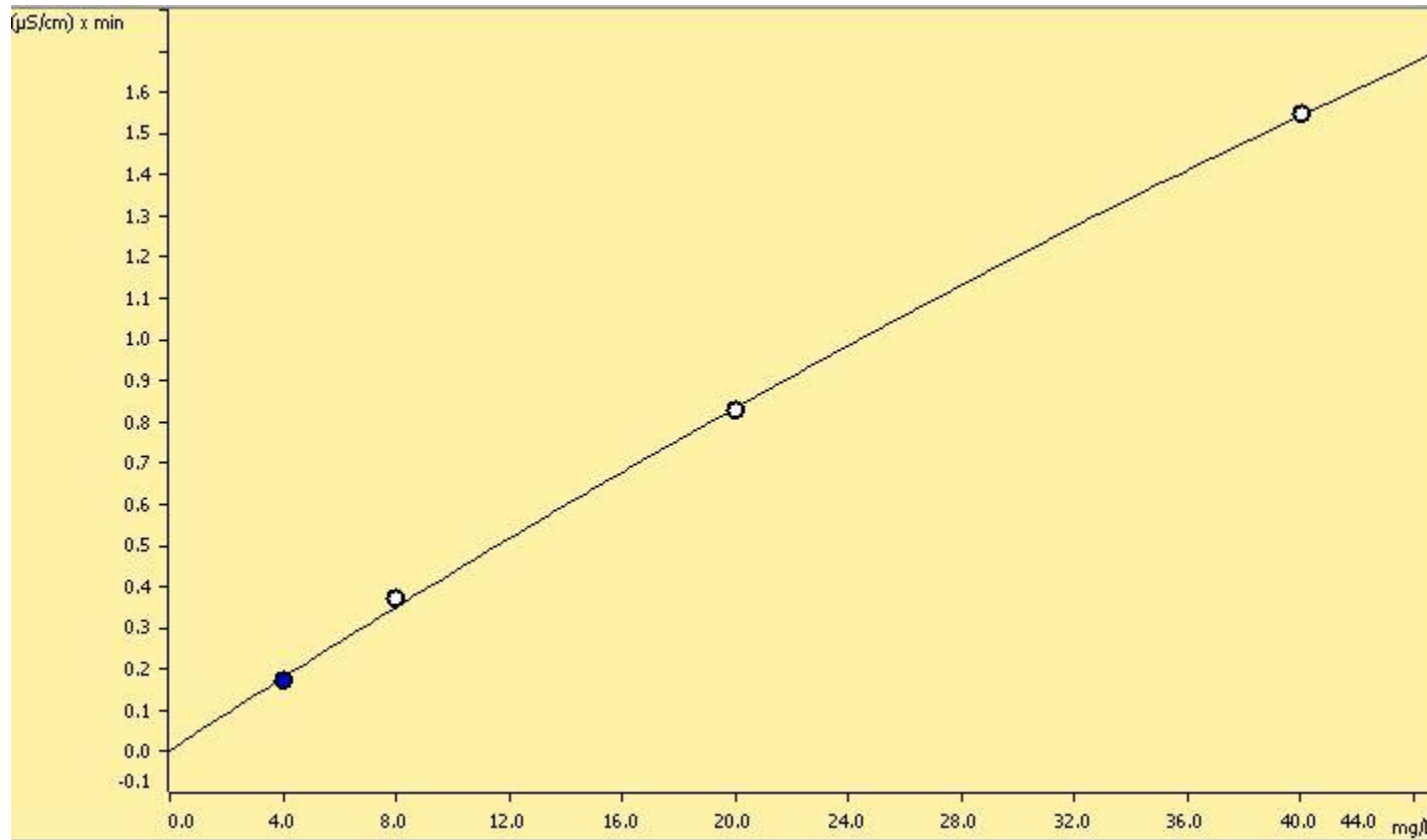
CHROMATOGRAM A SUPP 19 AND A SUPP 5



GLUCONATE ON A SUPP 19



CALIBRATION CURVE



- The recovery of a check standard is between 97 and 103 %

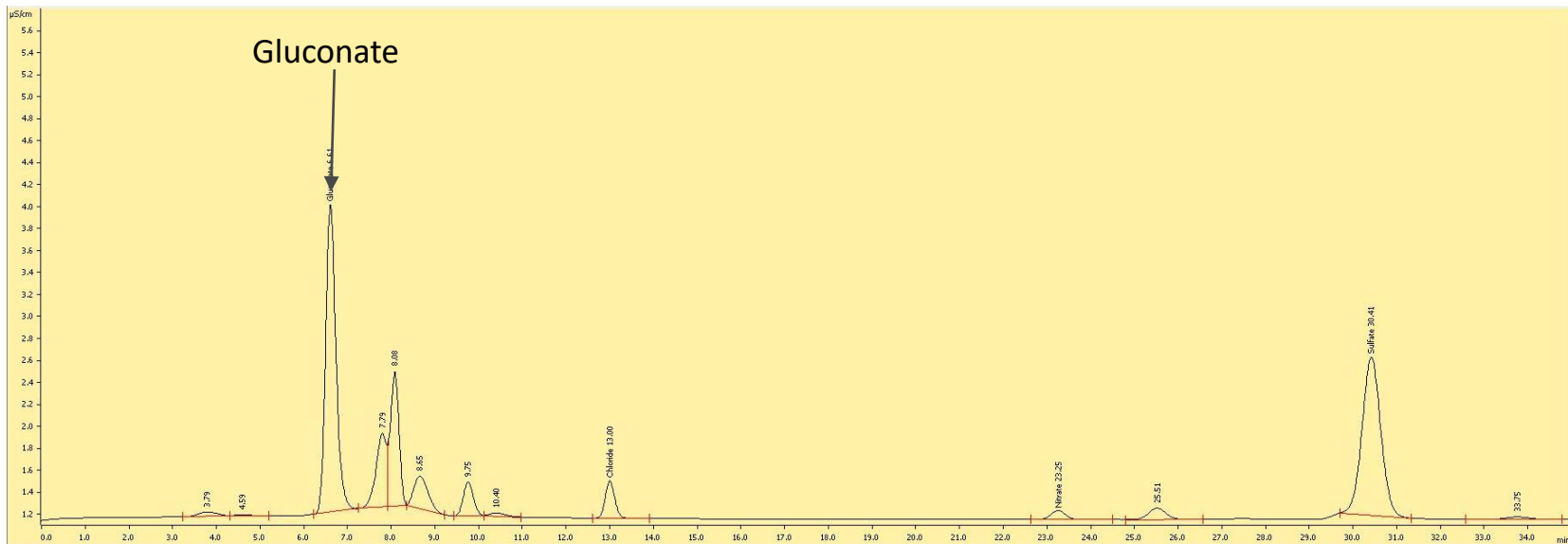
Relative standard deviation	2.916%
Correlation coefficient	0.999799
Curve type	Quadratic
Weighting	1

ANALYSIS OF GLUCONATE IN CONCRETE ADMIXTURES



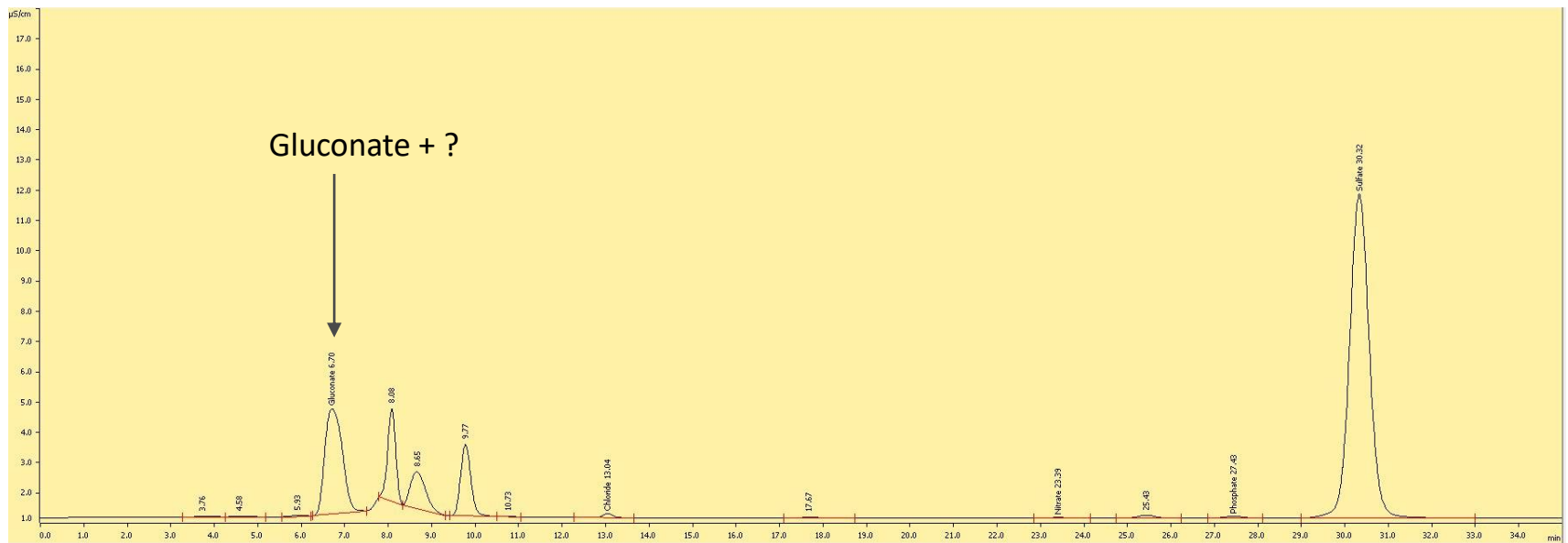
ANALYSIS OF THE YELLOW ADMIXTURE

- The yellow admixture contains a PCE, Gluconate and other additives
- The Gluconate content analysed by IC corresponds with the one of the formulation
- The same gluconate content was also analysed by enzymatic determination

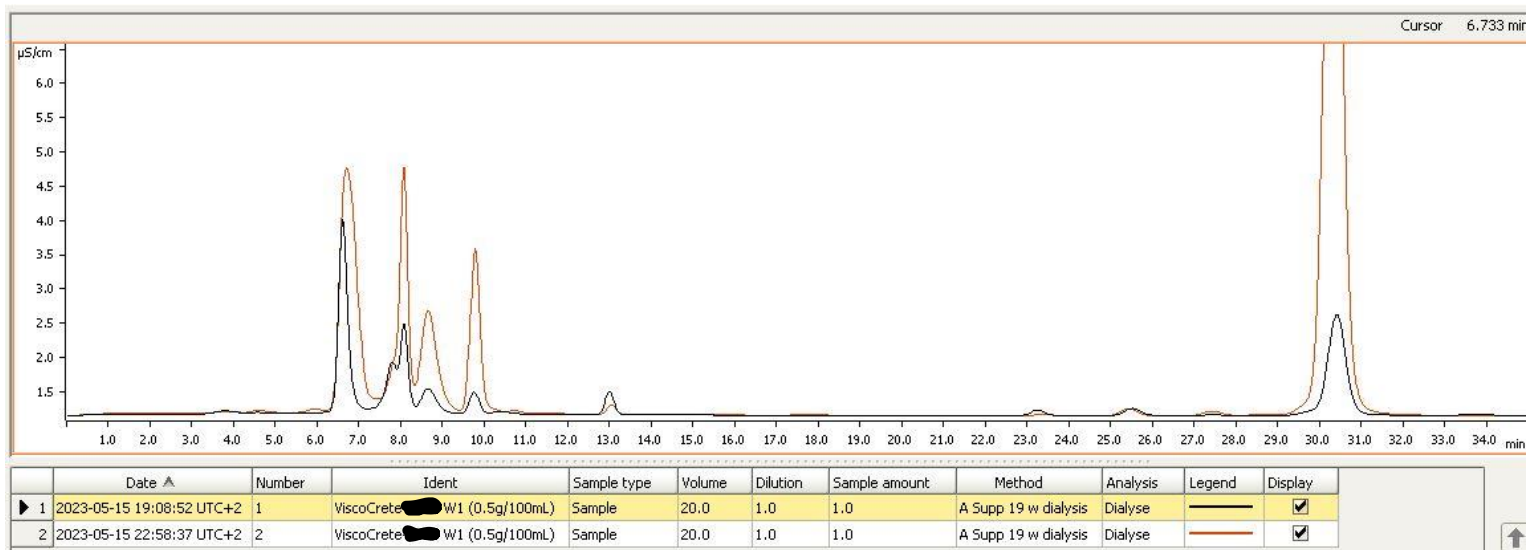
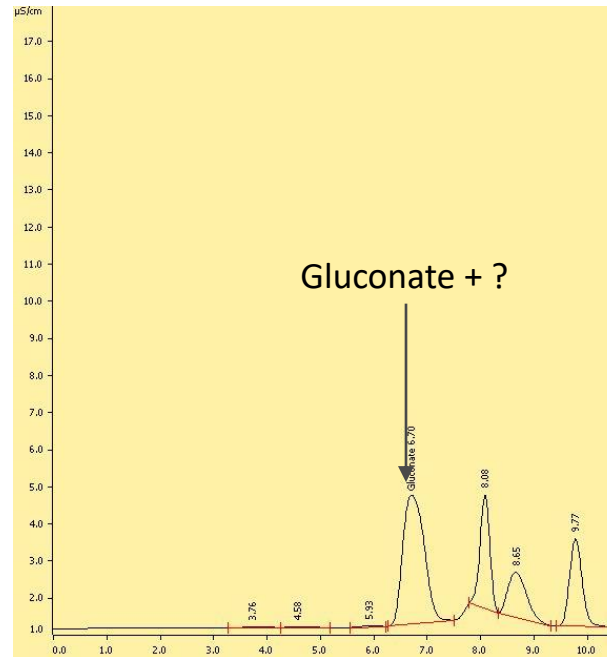


ANALYSIS OF THE BROWN ADMIXTURE

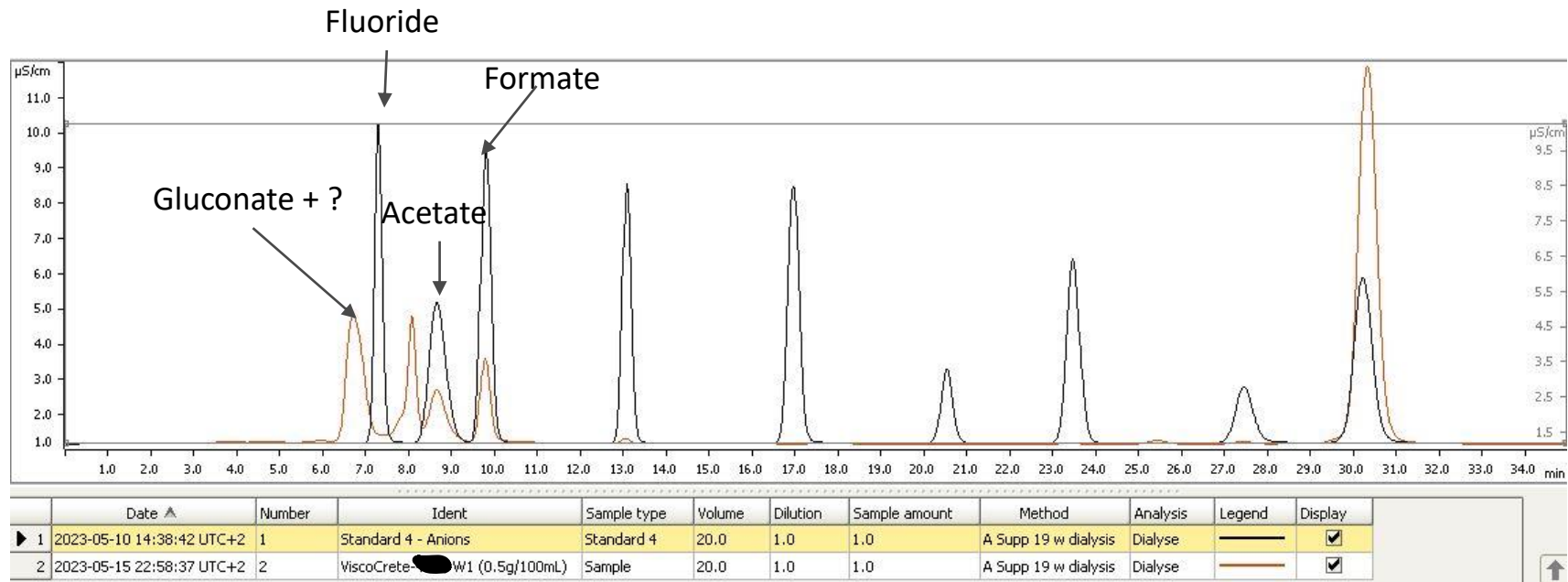
- The brown admixture contains a PCE, Lignosulfonate, Gluconate and other additives
- The Gluconate content analysed by IC **does not** correspond with the one of the formulation. It was found a too high amount of Gluconate.
- The Gluconate content analysed by enzymatic analysis corresponds with the one of the formulation



ANALYSIS OF THE BROWN ADMIXTURE

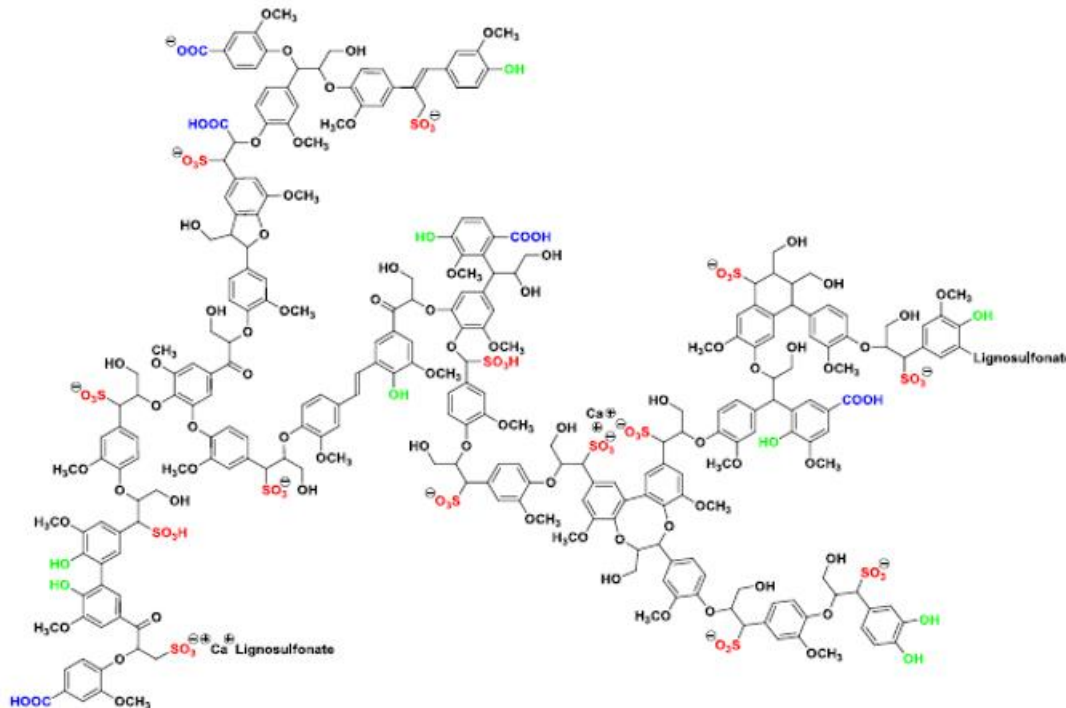


ANALYSIS OF THE BROWN ADMIXTURE



CONCLUSION

- The determination of Gluconate in admixtures might be possible by ion exchange chromatography with a Metrosep A Supp 19, if the samples contain no Lignosulfonate.
- Gluconate in Lignosulfonate containing admixtures might be determined by ion exclusion chromatography e.g. with a Metrosep organic acid



THANKS

- Sophie Sherlaw, Intern, University of Strathclyde
- Christoph Kurz, Sika Schweiz AG





THANK YOU FOR YOUR ATTENTION