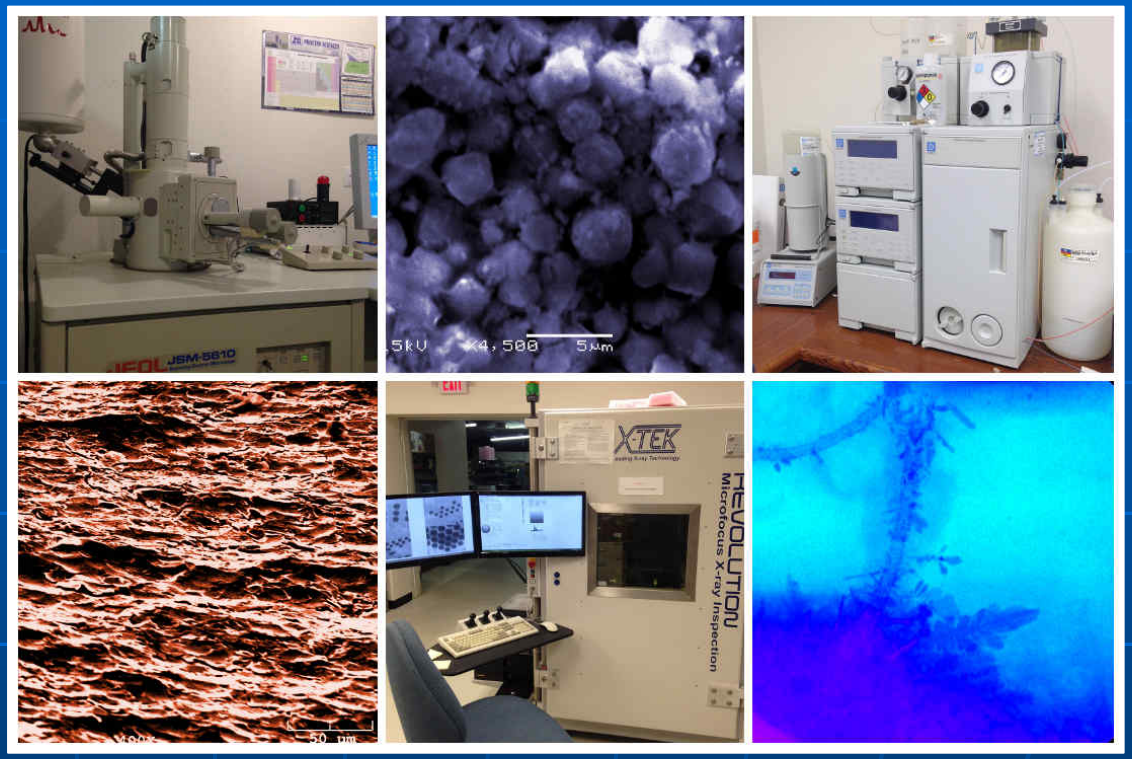
Laboratory Services

Process Sciences, Inc.
310 S. Brushy Street
Leander, TX 78641
512-259-7070
www.process-sciences.com



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Confidential Analytical Report & Summary

- Prepared For: Customer Name
- Company: PSI Client
- Analysis Report Number: Sample-010
- Date of Analytical Summary: 01/01/2015
- Participating Analyst: Analyst

Analyst:	Reviewed by:
PSI Team Member	PSI Team Member

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Sample Received:

- Two (2) bare PCBs were received for Ion contamination testing.

Statement of Work:

- The PCBs will be referred to as Sample 1 and Sample 2.
- Both samples will be test per IPC-TM-650 for Ion Chromatography analysis using test method 2.3.28 with the following extraction Steps:
  - Using clean gloves, place samples in an extraction bag.
  - Prepare a 75/25 IPA/DI water solution for extraction.
  - Add 200 mls of IPA/DI water solution to each extraction bag. Also add 30 mls to an empty extraction bag to used as a Blank sample.
  - Heat sealed the extraction bags and placed them in a hot water bath at 75 C +/- 5 C for 1 hour.
  - Set up IC unit to test for Anions.
  - Prepare a fresh 2% Anion standard and calibrate the IC unit.
  - Cut open an extraction bag, remove the sample piece using clean SS tweezers, extract 1 ml of solution using a clean syringe and inject it into the IC unit for analysis. Re-seal the extraction bag. Repeat this step until all the test samples have been analyzed.
  - Cut open the Blank extraction bag and analyze a 1 ml sample to establish any back-ground noise from the IPA/DI water solution.
  - Record area of each sample. General rule (length X width X 2) = square inches of the PCB surface area.
- Compile all data and images into a formal report for the customer.

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Conclusions:

- Both samples passed the Ion Contamination test with Anion results that were less than the maximum acceptable limits.

Testing Equipment

- Dionex DX 500 Ion Chromatograph

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PSI Client – PCB Sample - Overview

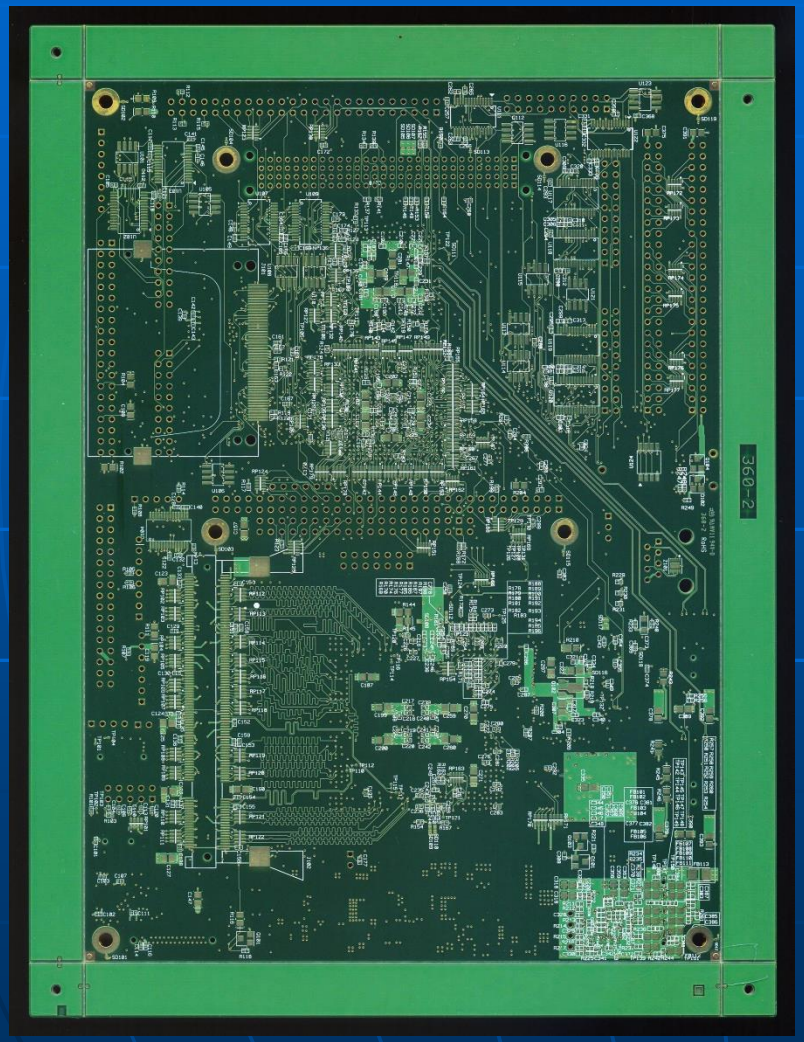

Figure 1
View of Side 1

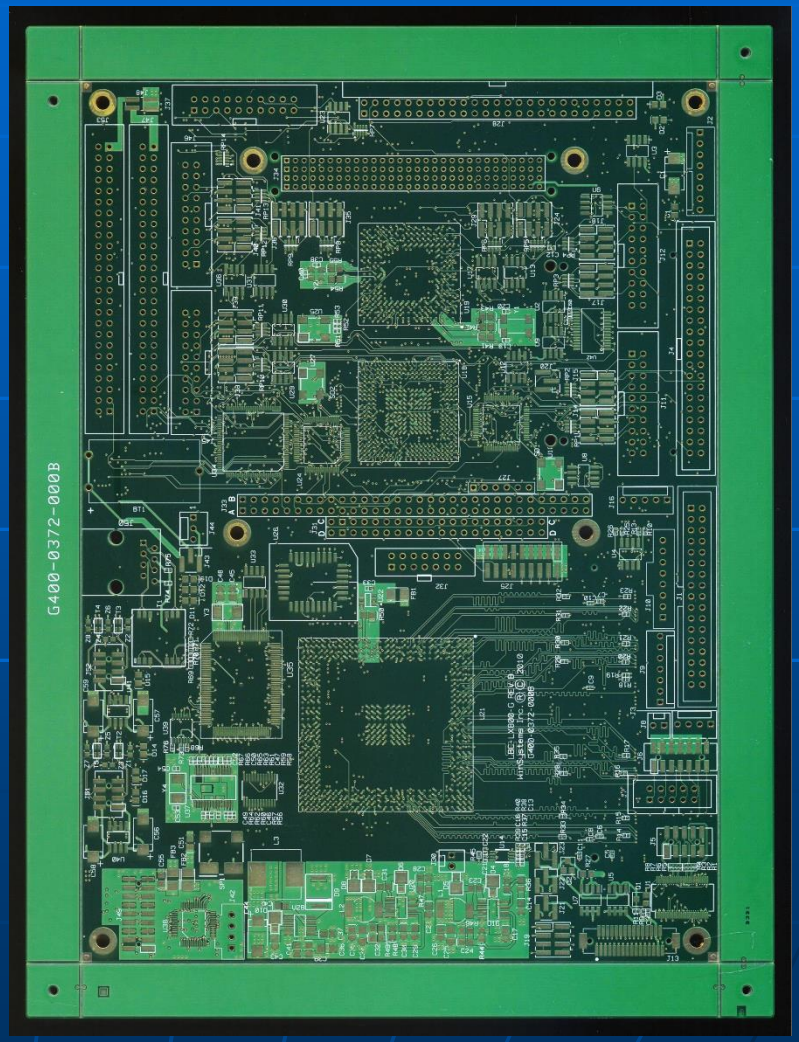

Figure 2
View of Side 2

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PSI Client – IC Analysis – Anion Summary Table

			Fluoride		Chloride		Nitrite		Bromide		Nitrate		Sulfate		Phosphate	
Sample	(sqin)	Vol	ppm	ug/in2	ppm	ug/in2	ppm	ug/in2	ppm	ug/in2	ppm	ug/in2	ppm	ug/in2	ppm	ug/in2
IPA/H20 Blank	NA	1 ml	0.000	ND	0.133	ND	0.000	ND	0.000	ND	0.036	ND	0.000	ND	0.000	ND
Sample 1	121.50	200	0.000	**0.00**	0.273	**0.23**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**
Sample 2	121.50	200	0.000	**0.00**	1.023	**1.47**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.385	**0.63**	0.000	**0.00**
	0.00	0	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**
	0.00	0	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**	0.000	**0.00**

Figure 3
Anion IC Results

Table of Acceptable Limits

Fluoride	< 2 ug/sqin
Bromide	<15 ug/sqin
Chloride	< 9 ug/sqin
Sulfate	<10 ug/sqin
Phosphate	< 1 ug/sqin
Nitrate	< 1 ug/sqin
Nitrite	< 1 ug/sqin

The background noise from those peaks found in the Blank sample have been subtracted out of the final results.

Both samples past the test for ion contamination as indicated by the table to the left.

Note: The “Table of Acceptable Limits” for the 7 common anions has been developed over the years in conjunction with our customers inputs based on their quality requirements.

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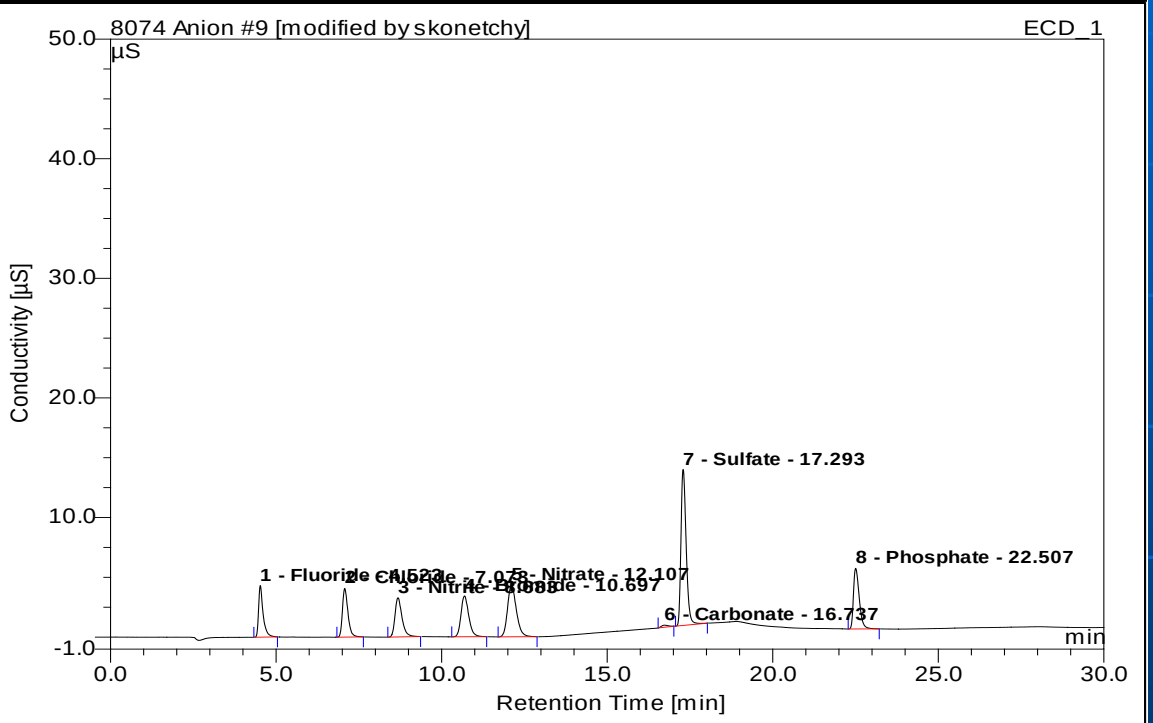
IC Analysis - Anion Calibration Standard

Sample Name:	**Cal. Standard**			*Injection Volume:*	**1.0ml**
Vial Number:	**9**			*Channel:*	**ECD_1**
Sample Type:	**standard**			*Wavelength:*	**n.a.**
Control Program:	**Anion Program**			*Bandwidth:*	**n.a.**
Quantif. Method:	**7-Anions Method**			*Dilution Factor:*	**1.0000**
Recording Time:	**4/6/2015 15:15**			*Sample Weight:*	**1.0000**
Run Time (min):	**30.00**			*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min	Rel.Area %	Amount ppm	Type
1	4.52	Fluoride	4.311	0.682	8.55	0.400	BMB*
2	7.07	Chloride	4.068	0.782	9.81	0.600	BMB
3	8.68	Nitrite	3.271	0.806	10.12	2.000	BMB
4	10.70	Bromide	3.412	0.924	11.60	2.000	BMB
5	12.11	Nitrate	4.321	1.334	16.74	2.000	BMB
6	16.74	Carbonate	0.170	0.041	0.51	n.a.	BMB*
7	17.29	Sulfate	13.034	2.377	29.82	3.000	BMB
8	22.51	Phosphate	5.064	1.024	12.85	3.000	BMB
Total:			37.653	7.971	100.00	13.000	

Figure 4:

Shows the calibration curve for the 7 common Anions that the samples were tested for.

Please note that a Carbonate peak is identified but is not measured. The standard does not list its concentration.

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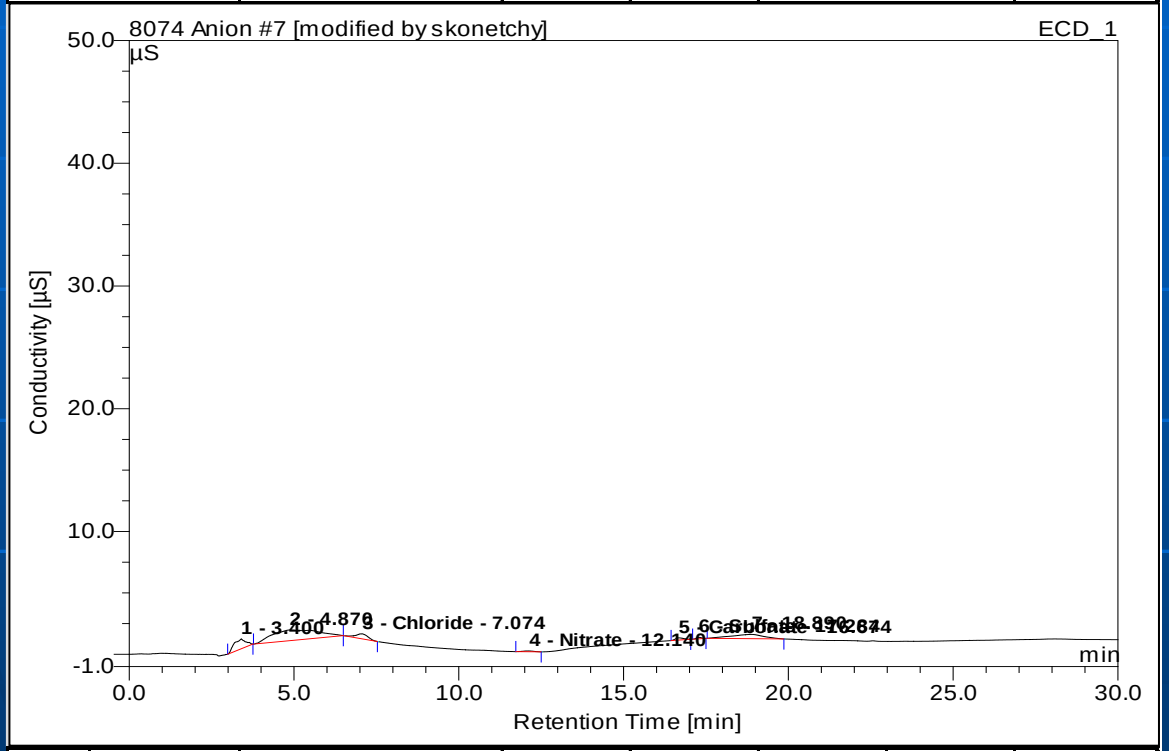
IC Analysis - Anion Blank IPA / DI Mixture

Sample Name:	**Blank IPA/H2O**			*Injection Volume:*	**1.0ml**
Vial Number:	**13**			*Channel:*	**ECD_1**
Sample Type:	**blank**			*Wavelength:*	**n.a.**
Control Program:	**Anion Program**			*Bandwidth:*	**n.a.**
Quantif. Method:	**7-Anions Method**			*Dilution Factor:*	**1.0000**
Recording Time:	**4/6/2015 16:48**			*Sample Weight:*	**1.0000**
Run Time (min):	**30.00**			*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min	Rel.Area %	Amount ppm	Type
1	3.40	n.a.	0.790	0.342	14.40	n.a.	BMB*
2	4.87	n.a.	0.868	1.363	57.39	n.a.	BMb*
3	7.07	Chloride	0.412	0.173	7.29	0.133	bMB
4	12.14	Nitrate	0.066	0.024	1.02	0.036	BMB*
5	16.67	Carbonate	0.177	0.051	2.15	n.a.	BMB*
6	17.28	Sulfate	0.119	0.021	0.88	0.026	BMB*
7	18.89	n.a.	0.344	0.401	16.86	n.a.	BMB*
Total:			2.774	2.375	100.00	0.196	

Figure 5:

Shows the blank IPA / DI mixture used for sample preparation.

The Blank sample had peaks of Chloride, Nitrate, Carbonate, and Sulfate along with several other unidentified peaks.

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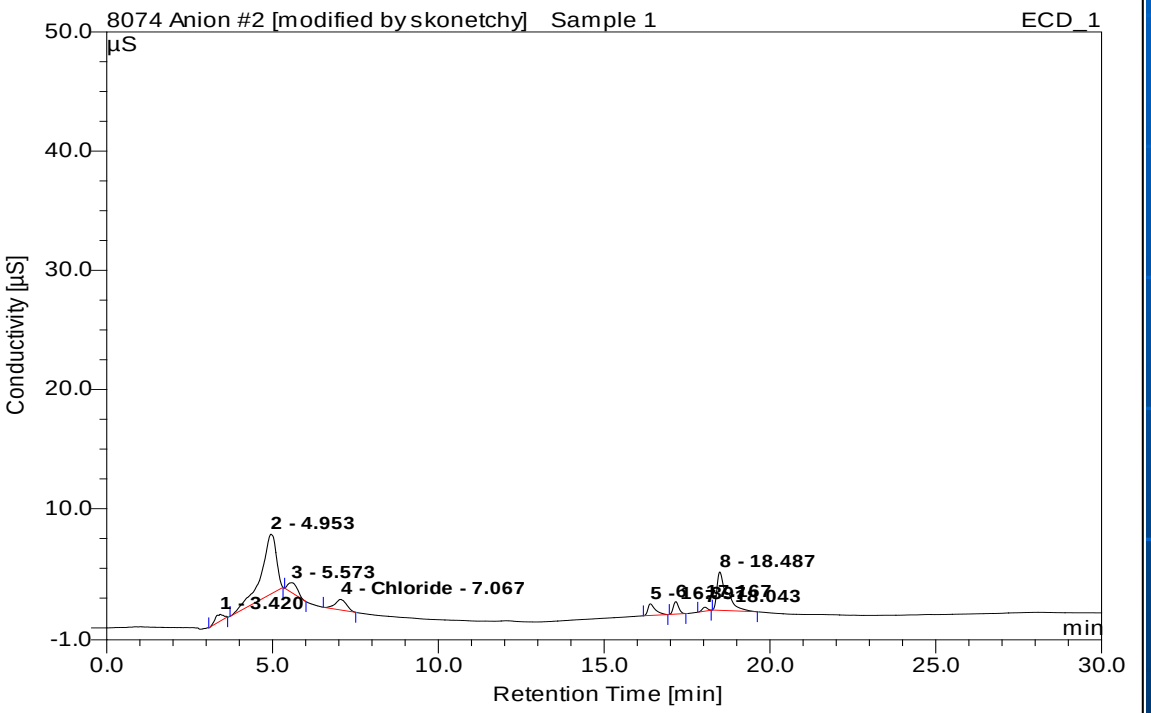
IC Analysis – Sample 1

Sample Name:	**Sample 1**			*Injection Volume:*	**1.0ml**
Vial Number:	**18**			*Channel:*	**ECD_1**
Sample Type:	**unknown**			*Wavelength:*	**n.a.**
Control Program:	**Anion Program**			*Bandwidth:*	**n.a.**
Quantif. Method:	**7-Anions Method**			*Dilution Factor:*	**1.0000**
Recording Time:	**4/7/2015 11:25**			*Sample Weight:*	**1.0000**
Run Time (min):	**30.00**			*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min	Rel.Area %	Amount ppm	Type
1	3.42	n.a.	0.571	0.172	3.36	n.a.	BMB*
2	4.95	n.a.	5.017	2.672	52.02	n.a.	BMB*
3	5.57	n.a.	0.816	0.281	5.46	n.a.	BMB*
4	7.07	Chloride	0.895	0.356	6.93	0.273	BMB*
5	16.40	n.a.	0.967	0.255	4.97	n.a.	BMB*
6	17.17	n.a.	1.041	0.197	3.84	n.a.	BMB*
7	18.04	n.a.	0.328	0.061	1.19	n.a.	BMB*
8	18.49	n.a.	3.216	1.143	22.25	n.a.	BMB*
Total:			12.850	5.137	100.00	0.273	

Figure 6:

Shows the IC results for sample 1.

The results show an Anion peak for Chloride.

Peaks #1, and #2 are unknown but they do match with similar peaks from the Blank sample.

Peaks #3, #5, #6, #7 and #8 are unknown. These peaks may be other Anions that were not calibrated for or they may be associated with Weak Organic acids that are commonly used in the PCB industry.

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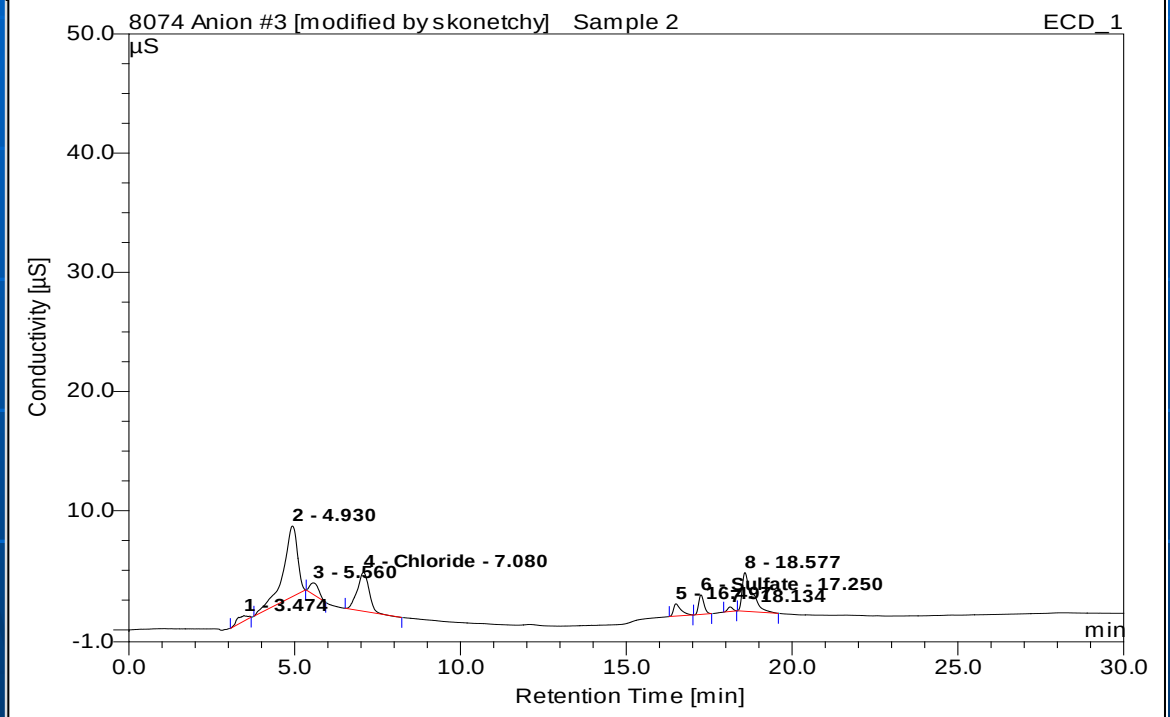
IC Analysis – Sample 2

Sample Name:	**Sample 2**			*Injection Volume:*	**1.0ml**
Vial Number:	**19**			*Channel:*	**ECD_1**
Sample Type:	**unknown**			*Wavelength:*	**n.a.**
Control Program:	**Anion Program**			*Bandwidth:*	**n.a.**
Quantif. Method:	**7-Anions Method**			*Dilution Factor:*	**1.0000**
Recording Time:	**4/7/2015 12:43**			*Sample Weight:*	**1.0000**
Run Time (min):	**30.00**			*Sample Amount:*	**1.0000**



No.	Ret.Time min	Peak Name	Height µS	Area µS*min	Rel.Area %	Amount ppm	Type
1	3.47	n.a.	0.458	0.187	2.85	n.a.	BMB*
2	4.93	n.a.	5.921	2.967	45.32	n.a.	BMB*
3	5.56	n.a.	0.967	0.309	4.72	n.a.	BMB*
4	7.08	Chloride	3.257	1.334	20.38	1.023	BMB*
5	16.50	n.a.	1.025	0.270	4.12	n.a.	BMB*
6	17.25	Sulfate	1.636	0.305	4.66	0.385	BMB*
7	18.13	n.a.	0.377	0.067	1.02	n.a.	BMB*
8	18.58	n.a.	3.243	1.108	16.93	n.a.	BMB*
Total:			16.884	6.547	100.00	1.408	

Figure 7:

Shows the IC results for sample 2.

The results show Anion peaks for Chloride, and Sulfate.

Peaks #1, and #2 are unknown but they do match with similar peaks from the Blank sample.

Peaks #3, #5, #7, and #8 are unknown. These peaks may be other Anions that were not calibrated for or they may be associated with Weak Organic acids that are commonly used in the PCB industry.