

Biodegradation of Ionic Liquids – A critical review

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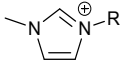
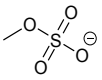

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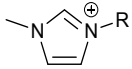



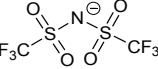

Email: nicholas.gathergood@ttu.ee

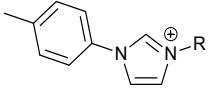
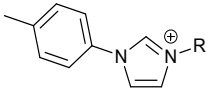
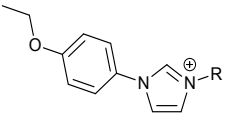
Appendix - IL biodegradation under aerobic biodegradation conditions

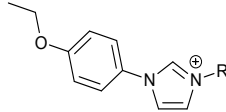
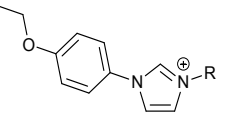
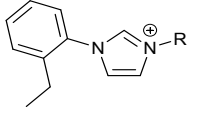
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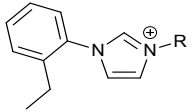
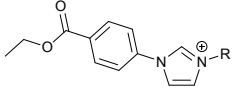
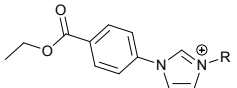
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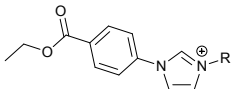
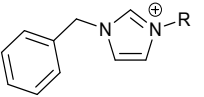
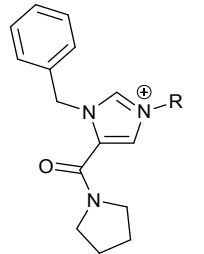
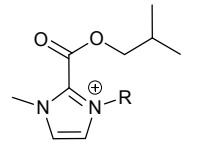
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Imidazolium</i>											
68		C ₂ H ₅		10	Not readily biodegradable	Respirometric BOD (OxiDirect® by Lovibond)	Waste-water organisms	100 mg/L	10 d	BOD	1
8	“	C ₂ H ₅		0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μM	28 d		2

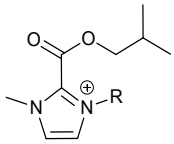

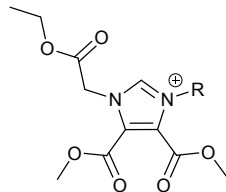

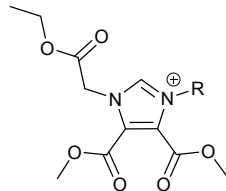

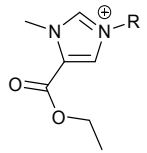

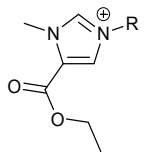

8		C ₂ H ₅		<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
9	“	C ₄ H ₉		03	Not readily biodegradable	Respirometric BOD (OxiDirect® by Lovibond)	Waste-water organisms	100 mg/L	10 d	BOD	1
4	“	C ₄ H ₉		0	Not readily biodegradable	BOD ₅	Activated sludge	10 g/L	30 d	BOD	3
29	“	C ₄ H ₉		0	Not readily biodegradable	BOD ₅	Activated sludge	10 g/L	30 d	BOD	3
12	“	C ₆ H ₁₃		02	Not readily biodegradable	Respirometric BOD (OxiDirect® by Lovibond)	Waste-water organisms	100 mg/L	10 d	BOD	1

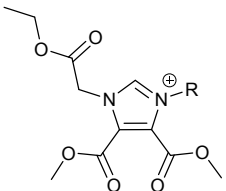

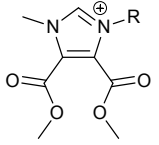

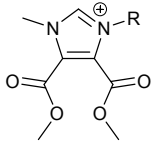

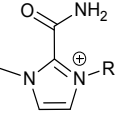

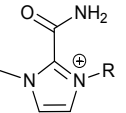

69		C ₃ H ₇	\ominus Br	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μ M	28 d		2
69	“	“	“	<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
70		C ₄ H ₉	\ominus Br	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μ M	28 d		2
70	“	“	“	0	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
71		C ₄ H ₉	\ominus Br	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μ M	28 d		2

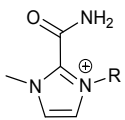

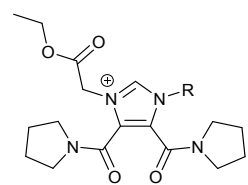

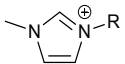

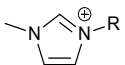

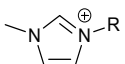

71		C ₄ H ₉	\ominus Br	<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120- 150 mg/L	28 d	BOD	2
72		C ₅ H ₁₁	\ominus Br	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μ M	28 d		2
72	“	“	“	<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120- 150 mg/L	28 d	BOD	2
73		C ₄ H ₉	\ominus Br	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μ M	28 d		2
73	“	“	“	<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120- 150 mg/L	28 d	BOD	2

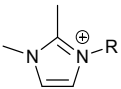
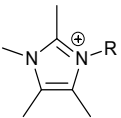
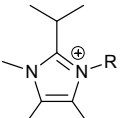
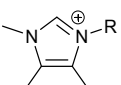
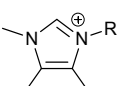
74		C ₄ H ₉	I [⊖]	0	Not primarily biodegradable	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μM	28 d		2
74	“	“	“	<i>n.d.</i>	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
75		C ₆ H ₁₃	Br [⊖]	100	<u>primarily biodegradable</u>	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μM	28 d		2
75	“	“	“	8	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
76		C ₄ H ₉	Br [⊖]	100	<u>primarily biodegradable</u>	Primary Biodegradation by HPLC from modified OECD 301	Activated Sludge	200 μM	28 d		2

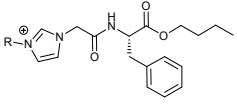
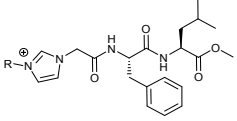
76		C_4H_9	\ominus Br	7	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	2
78		$CH_2CONC_4H_8$	\ominus Br	0	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
79		CH_2COOCH_3	\ominus Br	2	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
80		CH_3	\ominus I	30	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4

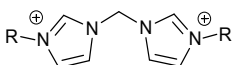
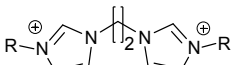
81		CH ₃		35	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
82		CH ₂ C ₆ H ₅		24	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
83		CH ₃		31	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
84		CH ₂ COOCH ₃		10	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
85		CH ₂ COOCH ₃		5	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4

86		$\text{CH}_2\text{C}_6\text{H}_5$		6	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4
87		CH_3		12	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4
88		CH_3		3	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4
89		$\text{CH}_2\text{COOCH}_3$		17	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4
90		$\text{CH}_2\text{CONC}_4\text{H}_8$		12	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4

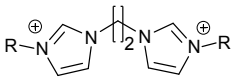
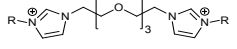
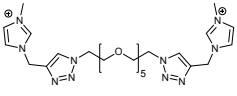
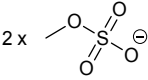
91		$\text{CH}_2\text{CONC}_4\text{H}_8$		14	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
92		$\text{CH}_2\text{C}_6\text{H}_5$		2	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
93		$\text{CH}_2\text{COOCH}_3$		10	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
94		$\text{CH}_2\text{COOCH}_3$		14	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4
95		$\text{CH}_2\text{CONC}_4\text{H}_8$		3	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	4

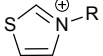
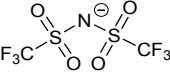
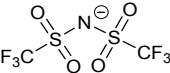
96		$\text{CH}_2\text{CONC}_4\text{H}_8$	\ominus Br	3	Not readily biodegradable	CO_2 Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO_2	4
97		C_2H_5	\ominus I	2.11	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	5 mg/L	28 d	BOD	5
98		C_2H_5	\ominus I	6.64	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	5 mg/L	28 d	BOD	5
99		C_2H_5	\ominus I	6.23	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	5 mg/L	28 d	BOD	5
100		C_6H_{13}	\ominus I	9.07	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	5 mg/L	28 d	BOD	5

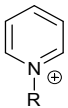
101		CH ₃	⊖ Br	61	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg C L ⁻¹	28 d	ThCO ₂	6
102		CH ₃	⊖ Br	64	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg C L ⁻¹	28 d	ThCO ₂	6

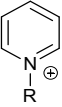




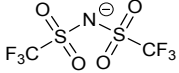
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Bis-Imidazolium</i>											
217		CH ₃	2 x I [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
218		CH ₃	2 x Br [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7

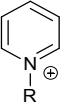



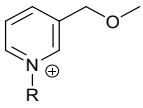
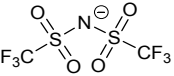
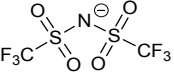
219		CH ₃	2 x Br [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
220		CH ₃	2 x Br [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
220	“	CH ₃	2 x Br [⊖]	0 ± 0.5	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	7
221		C ₄ H ₉	2 x Br [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
222		C ₆ H ₁₃	2 x Br [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7

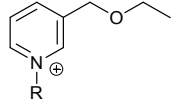
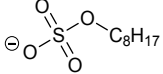
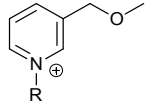
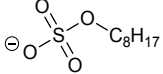
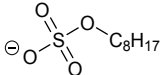
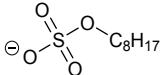
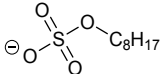
222		C ₆ H ₁₃	2 x Br [⊖]	2 ± 2.5	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	7
223		CH ₃	2 x Cl [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
224		CH ₃	2 x 	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7

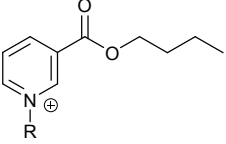

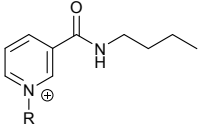
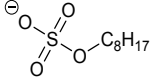
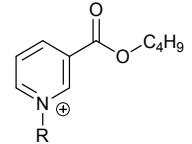
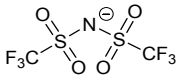
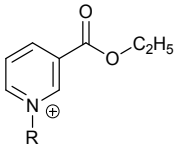

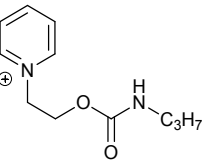
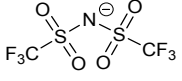
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Thiazolium</i>											
103		C ₂ H ₅		03	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
104	“	C ₂ H ₄ OH		07	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

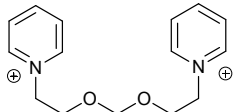
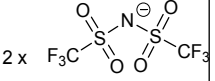
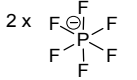
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Pyridinium</i>											
16		C ₂ H ₅	Cl [⊖]	0	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9, 10
105	“	CH ₂ CN	Cl [⊖]	<i>Not reported</i>	Hydrolysis of cyano group detected	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
105	“	CH ₂ CN	Cl [⊖]	-2 ± 0	<u>Inherently</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9

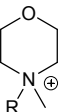
106		C ₄ H ₉		2	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9, 11
107	“	C ₃ H ₇		1 ± 0	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
108	“	CH ₂ C ₆ H ₅		2	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)		20 mg/L	28 d	THCO ₂	4
109	“	C ₂ H ₄ OH		65	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
110	“	C ₂ H ₄ OH		62	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

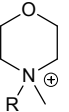
111		C ₂ H ₄ OH		100	<u>Inherently, ultimately biodegradable</u>	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
111	“	C ₂ H ₄ OH		65 ± 10	<u>Inherently</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
112	“	C ₂ H ₄ OH		51 ± 0	<u>Inherently</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
113		C ₂ H ₄ OH		6	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
114	“	C ₄ H ₉		01	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

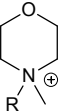
115		C ₄ H ₉		36	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
116		C ₄ H ₉		32	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
117	“	C ₈ H ₁₇		31	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
118	“	CH ₂ C(O)OC ₂ H ₅		47	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
119	“	CH ₂ C(O)OC ₃ H ₇		51	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

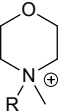
120		CH ₃		74	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593, OECD 310)	Waste-water organisms	40 mg/L	28 d	THCO ₂	11
121		C ₄ H ₉		30	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Waste-water organisms	40 mg/L	28 d	THCO ₂	11
122		C ₂ H ₄ OH		71	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	8
123		CH ₂ C ₆ H ₅		25	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	4
124		N/A		03	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

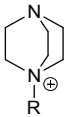
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Bis-Pyridinium</i>											
214		N/A	2 x Cl [⊖]	05	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
215	“	N/A	2 x 	04	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8
216	“	N/A	2 x 	03	Not readily biodegradable	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	8

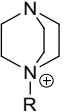
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Morpholinium</i>											
125		C ₂ H ₅	Br [⊖]	30	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
126	“	C ₄ H ₉	Br [⊖]	10	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
126	“	C ₄ H ₉	Br [⊖]	-3±4	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9

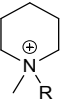
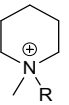
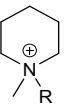
127		C ₆ H ₁₃	⊖ Br	04	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
128	“	C ₈ H ₁₇	⊖ Br	06	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
129	“	C ₁₀ H ₂₁	⊖ Br	07	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
130	“	C ₂ H ₄ OH	⊖ I	17 ± 1		Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
130	“	C ₂ H ₄ OH	⊖ I	-1 ± 1 4 ± 1	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 60 d	BOD	9

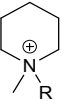
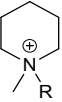
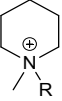
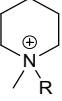
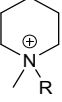
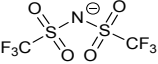
131		C ₃ H ₆ OH	\ominus Cl	12 ± 8		Primary Biodegradation	Activated sludge	50 μ mol /L	28 d		9
131	“	C ₃ H ₆ OH	\ominus Cl	31 ± 16 59 ± 10	<u>Inherently</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 41 d	BOD	9
132	“	CH ₂ CN	\ominus Cl	54 ± 13	Hydrolysis of cyano group detected	Primary Biodegradation	Activated sludge	50 μ mol /L	28 d		9
132	“	CH ₂ CN	\ominus Cl	0	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
133	“	CH ₂ C ₆ H ₅	\ominus Cl	0	Not readily biodegradable	Primary Biodegradation Modified OECD 301 D	Activated sludge	45 mg/L	28 d		13



133		$\text{CH}_2\text{C}_6\text{H}_5$	\ominus Cl	0	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge	20 mg/L 100 mg/L	28 d	BOD	13
134	“	$\text{C}_2\text{H}_4\text{OCH}_3$	\ominus Cl	-1 ± 4	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
135	“	$\text{CH}_2\text{OC}_2\text{H}_5$	\ominus Cl	-3 ± 4	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
136	“	$\text{C}_2\text{H}_4\text{OC}_2\text{H}_5$	\ominus Cl	0 ± 8	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9


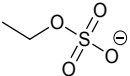
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<p><i>1,4-Diazabicyclo[2.2.2]octanium</i></p> <p><i>(DABCO)</i></p>											
137		C ₂ H ₅	Br [⊖]	40	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
138	“	C ₄ H ₉	Br [⊖]	36	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
139	“	C ₆ H ₁₃	Br [⊖]	23	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12


140		C ₈ H ₁₇	⊖ Br	34	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12
141	“	C ₁₀ H ₂₁	⊖ Br	34	Not readily biodegradable	CO ₂ Headspace test (ISO 14593)	Activated sludge	20 mg/L	28 d	THCO ₂	12


IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Piperidinium</i>											
142		C ₂ H ₄ OH	\ominus Cl	29 ± 3 85 ± 1	<u>Inherently biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 60 d	BOD	9
143		C ₃ H ₆ OH	\ominus Cl	79 ± 2	<u>Inherently, ultimately biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
144		CH ₂ CN	\ominus Cl	<i>Not reported</i>	Hydrolysis of cyano group detected	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9

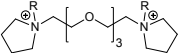
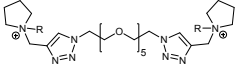
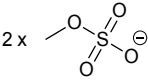
144		CH ₂ CN	\ominus Cl	5 ± 2	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
145		CH ₂ OC ₂ H ₅	\ominus Cl	-2 ± 2	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d	BOD	9
146		C ₂ H ₄ OCH ₃	\ominus Cl	1 ± 4	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d	BOD	9
147		C ₄ H ₉	\ominus Br	-4 ± 3	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9, 11
148		C ₃ H ₇		3 ± 2	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9

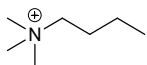

IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Pyrrolidinium</i>											
149		C ₄ H ₉		6/9	Not readily biodegradable	CO ₂ evolution test (OECD 301B)	Waste-water organisms	40 mg/L	28 d	CO ₂ Evolution	14
149	“	“	“	2/4	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms	75 mg/L	28 d	BOD	14
149	“	“	“	0	Not readily biodegradable	Primary Biodegradation by ion chromatography (samples taken from OECD 301B test)			28 d		14

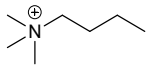

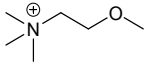

150		C ₄ H ₉	\ominus Br	14 ± 13 70 ± 18	<u>Inherently, ultimately biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 42 d	BOD	9
151	“	C ₃ H ₆ OH	\ominus Cl	100	<u>Primarily biodegradable</u>	Primary Biodegradation	Activated sludge	50 μmol /L	28 d		9
151	“	C ₃ H ₆ OH	\ominus Cl	67 ± 3	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
152	“	C ₂ H ₅		-2 ± 3 -3 ± 8	Not readily biodegradable	Primary Biodegradation	Activated sludge	50 μmol /L	28 d 40 d		9
153	“	C ₂ H ₄ OH	\ominus I	8 ± 5 25 ± 21	Not readily biodegradable, potentially inherently	Primary Biodegradation	Activated sludge	50 μmol /L	28 d 43 d		9

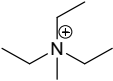
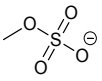
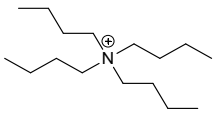
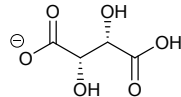
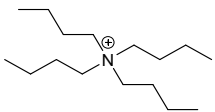
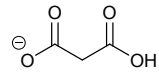
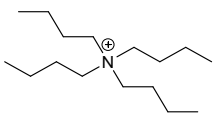
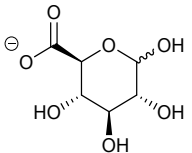
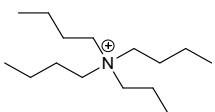
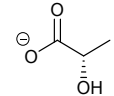
153		C ₂ H ₄ OH	\ominus I	6 ± 9 42 ± 39	Not readily biodegradable, potentially inherently	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 60 d	BOD	9
154	“	CH ₂ CN	\ominus Cl	<i>Not reported</i>	Hydrolysis of cyano group detected	Primary Biodegradation	Activated sludge	50 μ mol /L	28 d		9
154	“	CH ₂ CN	\ominus Cl	2 ± 2	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9
155	“	CH ₂ CO-OCH ₂ CH ₃	\ominus Br	<i>100</i>	<u>Inherently, Ultimately Biodegradable</u>	Primary Biodegradation	Activated sludge	50 μ mol /L	28 d		9
155	“	CH ₂ CO-OCH ₂ CH ₃	\ominus Br	34 ± 11 74 ± 0.1	<u>Inherently, Ultimately Biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d 38 d	BOD	9

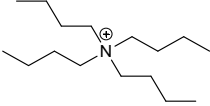
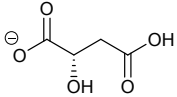
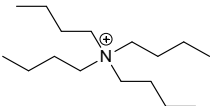
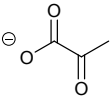
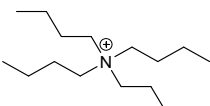
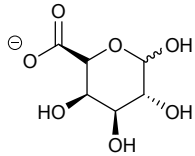
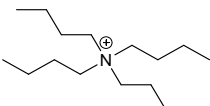
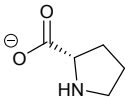
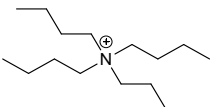
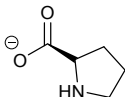
156		C ₈ H ₁₇	\ominus Cl	100	<u>Primarily biodegradable</u>	Primary Biodegradation	Activated sludge	50 μ mol /L	28 d		9
156	“	C ₈ H ₁₇	\ominus Cl	69 ± 1	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated sludge		28 d	BOD	9

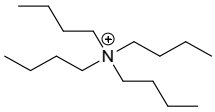
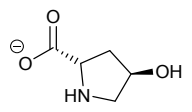
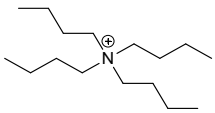
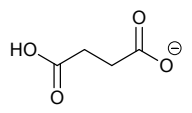
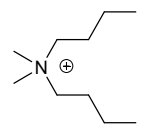
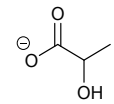


IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Bis-Pyrrolidinium</i>											
225		CH ₃	2 x Cl [⊖]	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
226		CH ₃	2 x 	<5	Not readily biodegradable	Primary Biodegradation by IC from modified OECD 301 D	Activated Sludge	60-100 mg/L	28 d		7
226	“	“	“	2 ± 2.5	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	120-150 mg/L	28 d	BOD	7

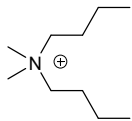
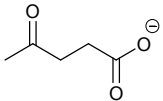
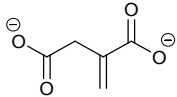
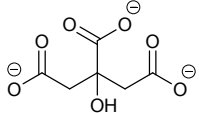
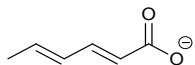
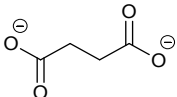
IL	Head Group (Cation)	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Tetraalkyl Ammonium</i>										
158			59/62	<u>Readily biodegradable</u>	CO ₂ evolution test (OECD 301B)	Waste-water organisms	40 mg/L	28 d	CO ₂ Evolution	14
158	“	“	87/88	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms	75 mg/L	28 d	BOD	14

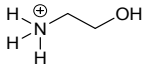

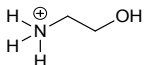
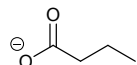
158			100±3	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301B test)			9 d		14
159			17/18	Not readily biodegradable	CO2 evolution test (OECD 301B)	Waste-water organisms	40 mg/L	28 d	CO ₂ Evolution	14
159	“	“	27/29	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms	75 mg/L	28 d	BOD	14
159	“	“	4±1		Primary Biodegradation by ion chromatography (samples taken from OECD 301B test)			28 d		14

173			4/5	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms	75 mg/L	28 d	BOD	14
56			15.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
57			9.9	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
58			18.6	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
59			15.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15

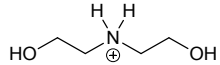

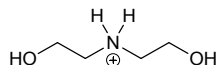
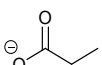
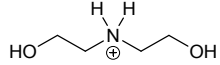
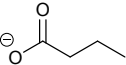
168			14.2	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
169			12.2	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
170			22.8	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
67			15-20	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	16
171			15-20	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	16

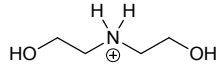
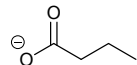
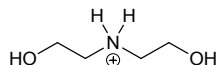
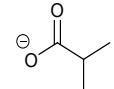
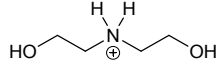
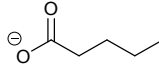
172			20-25	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	16
323			<i>Nd</i>	Not determined	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	15
60			72	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
174	“		5	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
175	“		77	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17

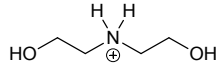
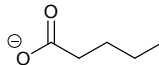
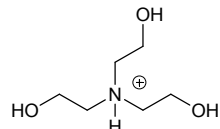
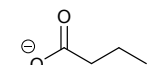
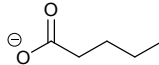
176			66	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
177	“		45	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
178	“		69	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
179	“		54	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17
180	“		69	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms		28 d	BOD	17

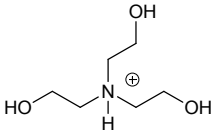
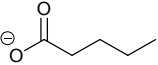
IL	Cation	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Protic ILs – Ethanolaminium</i>										
54			86	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301 F)	Activated Sludge	100 mg/L	28 d	BOD	18
54	“	“	100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d		18
55			95	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18

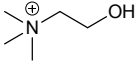

55			100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d		18
160			13	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18
160	“	“	100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d		18
161			69	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18

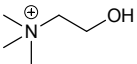
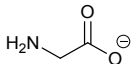
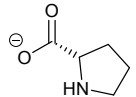
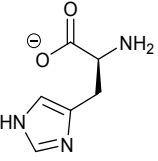
161			65/ 100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5d/ 28 d		18
162			68	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18
162	“	“	100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d		18
163			78	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18

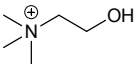
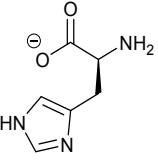
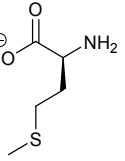
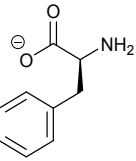
163			21/ 100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d/ 28 d		18
164			79	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18
164	“	“	70/ 100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d/ 28d		18
165			69	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18

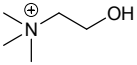
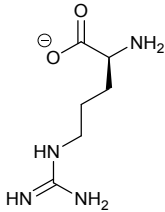
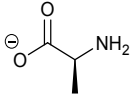
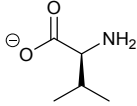
165			16/ 62	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d/ 28 d		18
166			59	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18
166	“	“	34/ 100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d/ 28 d		18
167	“		57	Not readily biodegradable	Manometric Respirometry (OECD 301F)	Activated Sludge	100 mg/L	28 d	BOD	18

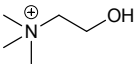
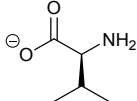
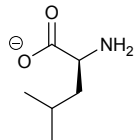
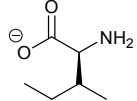
167			33/ 100	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301 F test)			5 d/ 28 d		18
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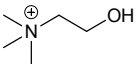
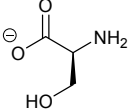
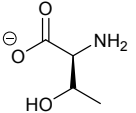
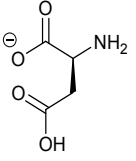
IL	Cation	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Cholinium</i>										
157			84/88	<u>Readily biodegradable</u>	CO2 evolution test (OECD 301B)	Waste-water organisms	40 mg/L	28 d	CO ₂ Evolution	14
157	“	“	88/90	<u>Readily biodegradable</u>	Manometric Respirometry (OECD 301F)	Waste-water organisms	75 mg/L	28 d	BOD	14
157	“	“	100±2	<u>Primarily biodegradable</u>	Primary Biodegradation by ion chromatography (samples taken from OECD 301B test)			5 d		14

61			76.4 ± 1.1	<u>Readily biodegradable</u>	CO ₂ Headspace test (ISO 14593, OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
61	“	“	82.6 ± 1.1	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
62	“		70.5 ± 3.0	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
62	“	“	71.3 ± 0.1	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
63	“		63.3 ± 1.2	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19

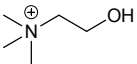
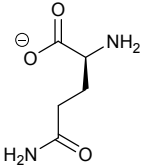
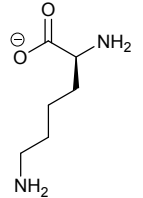
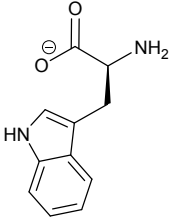
63			65.3 ± 1.3	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
64	“		63.6 ± 1.2	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
64	“	“	66.1 ± 0.9	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
65	“		72.5 ± 0.3	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
65	“	“	70.8 ± 0.1	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19

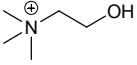
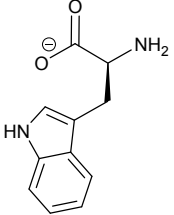

66			65.5 ± 1.2	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
66	“	“	67.6 ± 0.2	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
310	“		76.2 ± 0.8	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
310	“	“	80.0 ± 0.4	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
311	“		67.5 ± 0.6	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19

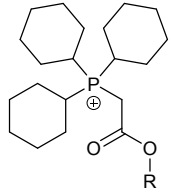
311			69.4 ± 0.6	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
312	“		71.4 ± 1.0	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
312	“	“	72.4 ± 0.1	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
313	“		70.5 ± 0.3	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
313	“	“	71.6 ± 0.8	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19

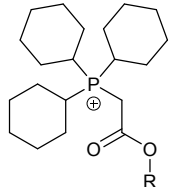
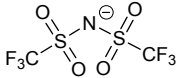
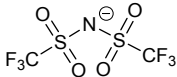
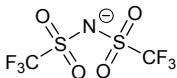
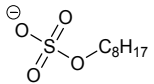
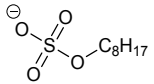
314			74.7 ± 0.3	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
314	“	“	80.6 ± 1.5	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
315	“		71.5 ± 0.8	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
315	“	“	74.3 ± 1.5	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
316	“		82.4 ± 0.7	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19

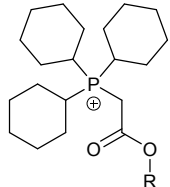
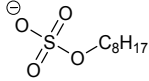
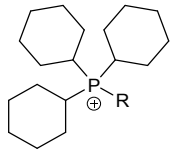
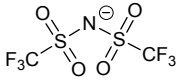
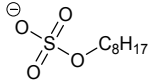
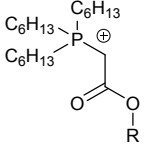
316			87.1 ± 0.6	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
317	“		80.8 ± 0.5	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
317	“	“	86.3 ± 0.2	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
318	“		85.2 ± 0.1	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
318	“	“	87.1 ± 1.2	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19

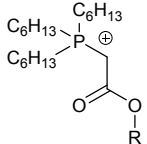


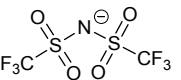
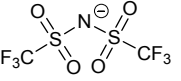
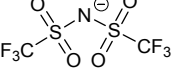
319			81.4 ± 0.1	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
319	“	“	86.6 ± 1.4	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
320	“		64.7 ± 0.5	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
320	“	“	67.7 ± 1.0	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
321	“		62.1 ± 0.3	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19

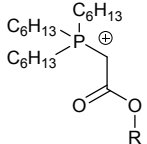
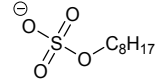
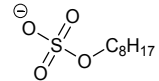
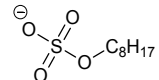
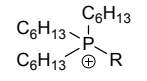
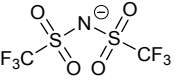
321			65.9 ± 0.2	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19
322	“		65.3 ± 0.1	<u>Readily biodegradable</u>	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	19
322	“	“	68.1 ± 1.9	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	3 mg/L	28 d	BOD	19

IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Phosphonium</i>											
181		C ₃ H ₇	Br [⊖]	4	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
182	“	C ₅ H ₁₁	Br [⊖]	3	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
183	“	C ₇ H ₁₅	Br [⊖]	2	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20

184		C ₃ H ₇		7	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
185	“	C ₅ H ₁₁		2	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
186	“	C ₇ H ₁₅		3	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
187	“	C ₃ H ₇		18	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
188	“	C ₅ H ₁₁		22	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20

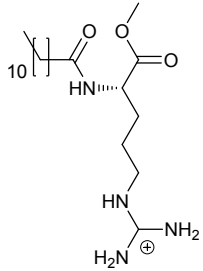
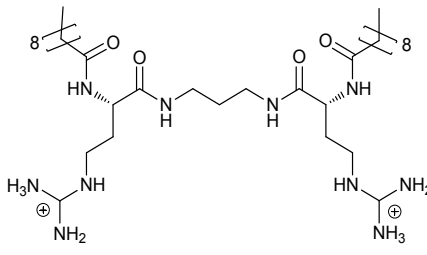
189		C_7H_{15}		21	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
190		$(CH_2)_4O-C(O)CH_3$	I^-	9	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
191	“	“		9	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
192	“	“		22	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	20 mg/L	28 d	THCO ₂	20
193		C_3H_7	Br^-	12	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20

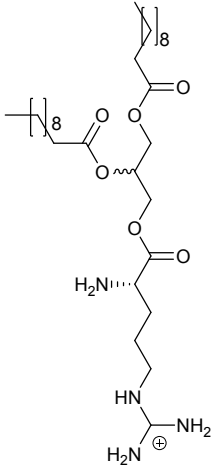
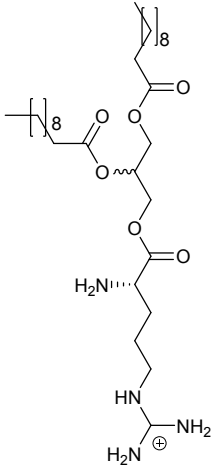
194		C ₅ H ₁₁		4	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
195	“	C ₇ H ₁₅		10	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
196	“	C ₃ H ₇		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
197	“	C ₅ H ₁₁		2	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
198	“	C ₇ H ₁₅		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20

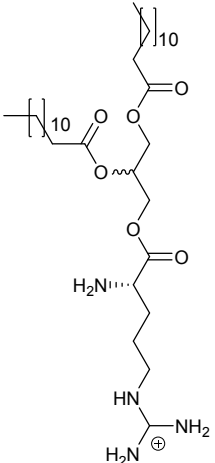
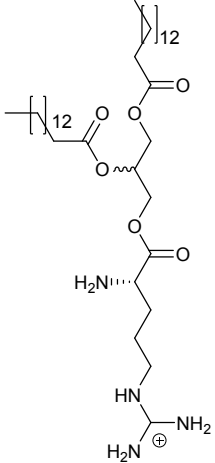
199		C ₃ H ₇		15	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
200	“	C ₅ H ₁₁		20	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
201	“	C ₇ H ₁₅		30	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
202		(CH ₂) ₄ O-C(O)CH ₃	I [⊖]	0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
203	“	“		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20

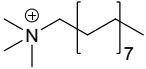
204		$(\text{CH}_2)_4\text{O}-\text{C}(\text{O})\text{CH}_3$		5	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
205		CH ₂ CHCH ₂		8	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
206	“	“		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
207	“	“		18	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
208		CH ₂ OCH ₃		2	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20

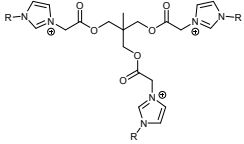
209		CH ₂ OCH ₃		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
210	“	“		11	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
211		CH ₂ CH ₂ OH		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
212	“	“		0	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20
213		CH ₂ CH ₂ OH		9	Not readily biodegradable	CO ₂ Headspace test (OECD 310)	Activated sludge	15 mg/L	28 d	THCO ₂	20

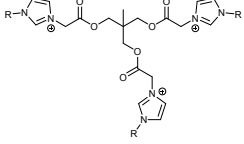
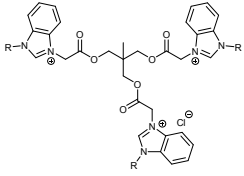
Surfactant	Head Group	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Surfactants</i>										
LAM		\ominus Cl	90	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	21
C3(CA)2		\ominus 2 x Cl	87	<u>Ultimately Biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	21

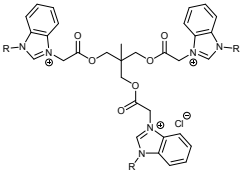
1010R(4)		Cl [⊖]	79	<u>Ultimately biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms		BOD	21
1010R(4)		Cl [⊖]	20	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	28 d	BOD	22

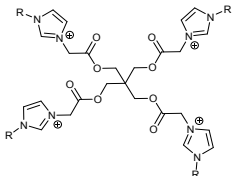
1212R	 <p>The structure shows a polymer chain with a repeating unit of 10 units. The side chain consists of a methylene group, a carbonyl group, an ether linkage, a methylene group, another carbonyl group, a primary amine group (H₂N), a propyl chain, a secondary amine group (HN), and a protonated primary amine group (NH₂⁺).</p>	Cl [⊖]	82	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	28 d	BOD	22
1414R	 <p>The structure shows a polymer chain with a repeating unit of 12 units. The side chain consists of a methylene group, a carbonyl group, an ether linkage, a methylene group, another carbonyl group, a primary amine group (H₂N), a propyl chain, a secondary amine group (HN), and a protonated primary amine group (NH₂⁺).</p>	Cl [⊖]	61	<u>Readily biodegradable</u>	Closed Bottle Test (TG 301 D)	Waste-water organisms	28 d	BOD	22

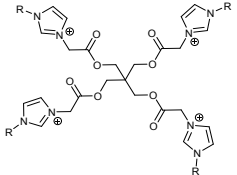
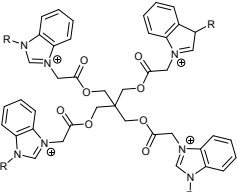
HTAB		Br [⊖]	0.36	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms		28 d	BOD	22

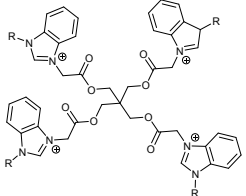
IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Tris-Imidazolium Surfactants</i>											
286		C ₄ H ₉	3 x Cl [⊖]	27	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
287	“	C ₆ H ₁₃	3 x Cl [⊖]	36	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
288	“	C ₈ H ₁₇	3 x Cl [⊖]	47	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23

289		C ₁₀ H ₂₁	3 x Cl [⊖]	45	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
290	“	C ₁₂ H ₂₅	3 x Cl [⊖]	51	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
291	“	CH ₂ C ₆ H ₅	3 x Cl [⊖]	20	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
292		C ₄ H ₉	3 x Cl [⊖]	22	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
293	“	C ₆ H ₁₃	3 x Cl [⊖]	27	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23

294		C_8H_{17}	$3 \times Cl^-$	35.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
295	“	$C_{10}H_{21}$	$3 \times Cl^-$	40	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
296	“	$C_{12}H_{25}$	$3 \times Cl^-$	45	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23
297	“	$CH_2C_6H_5$	$3 \times Cl^-$	16	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	23

IL	Head Group	Side Chain R	Anion	Biodegradation %	Classification	Test Method	Inoculum	IL Conc.	Test Duration	Measured Parameter	Ref
<i>Tetrakis-Imidazolium Surfactants</i>											
298		C ₄ H ₉	4 x Cl [⊖]	35	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
299	“	C ₆ H ₁₃	4 x Cl [⊖]	39	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
300	“	C ₈ H ₁₇	4 x Cl [⊖]	49	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24

301		$C_{10}H_{21}$	$4 \times Cl^{\ominus}$	51.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
302	“	$C_{12}H_{25}$	$4 \times Cl^{\ominus}$	56	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
303	“	$CH_2C_6H_5$	$4 \times Cl^{\ominus}$	22	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
304		C_4H_9	$4 \times Cl^{\ominus}$	28	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
305	“	C_6H_{13}	$4 \times Cl^{\ominus}$	33.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24

306		C_8H_{17}	4 x Cl [⊖]	42	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
307	“	$C_{10}H_{21}$	4 x Cl [⊖]	44	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
308	“	$C_{12}H_{25}$	4 x Cl [⊖]	47	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24
309	“	$CH_2C_6H_5$	4 x Cl [⊖]	21.5	Not readily biodegradable	Closed Bottle Test (TG 301 D)	Waste-water organisms	100 mg/L	16 d	BOD	24

References for Appendix

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