TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.*

No.	Name	Boiling point, °C	Melting point, °C	n_D^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv. (Dimedone deriv.)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
1	**Formaldehyde** (Methanal)	−21	−91	.....	169	167, yel., al.	181–2, yel., bz.	145	oil	189, al.; 191.4	.....	.....	pa. yel.	or. br.	50
2	**Trifluoroacetaldehyde**	−20	.....	.....	.....	151	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	**Acetaldehyde** (Ethanal)	20.2	−123.5	1.3392[18]; 1.3316	162–3	stable: 168, al.; unstable: 157; mixture: 148	128.5	57; 99	47	139, al.	175–6, al.	Thiosemicarbazone, 146	or.	dk. br.	30
4	**Propionaldehyde** (Propanal)	48–9	−81	1.364	89, bz.-lgr.; 154, w.	148, or.; 150, red; 155	125, yel., 50% al.	oil	40	154–6, al.	143	Picrate, 156–7	dk. ol. gn.	red	20
5	**Glyoxal**	50	15	.....	270	328	311	180	178	*mono*: 186; *di*: 228	*mono*: 224	Phenylosazone, 169–70	.....	.....	.....
6	**Acrolein** (Acraldehyde)	52.4	−87.7	1.4025	171, w.	165	150–1	50–1, hot lgr., pyrazoline	.....	192, 50% al.	163, al.	.....	red br.	vlt. br.	0.1
7	**Propynal** (Propargyl aldehyde)	55	.....	.....	.....	.....	.....	.....	.....	.....	.....	Cu deriv., 160	.....	.....	.....
8	**2,2,2-Trifluoropropionaldehyde**	56[745]	.....	.....	.....	151	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	**Isobutyraldehyde**	64	−65.9	1.3730	125.6	187, or.-yel., al.; 182	130–1, or.-yel., al.	oil	oil	154	144	.....	.....	.....	.....
10	**2-Methyl-2-propenal** (Methacrolein)	73.5	.....	1.4191	198	206	.....	74, pyrazoline	.....	.....	.....	.....	.....	.....	.....
11	***n*-Butyraldehyde** (Butanal)	74.7	−97.1	1.38433	95.5, lgr.; 106	123, al.	87, yel., al.; 93–5, red	93–5	b.p. 152[715]	134; 142	141	.....	.....	.....	.....
12	**Trimethylacetaldehyde** (Pivaldehyde)	75	3; 6	1.3791	190	210, yel.	.....	.....	41	.....	.....	.....	.....	.....	.....
13	**Chloroacetaldehyde**	85–6	.....	.....	134–5d; 148, al.	.....	.....	.....	oil	.....	.....	.....	.....	.....	.....
14	**2-Chloropropionaldehyde**	86	.....	1.431[17]	.....	.....	.....	.....	.....	.....	.....	Hydrate, b.p. 80.5–81	.....	.....	.....
15	**Dichloroacetaldehyde**	89.5–90.5	.....	.....	155–6, using only 1 equivalent of reagent	.....	.....	.....	b.p.: 67–9[17], using only 1 equivalent of reagent	.....	.....	.....	.....	.....	.....

*Derivative data given in order: m.p., crystal color, solvent from which crystallized.

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No.	Name	Boiling point, °C	Melting point, °C	n_D^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv. (Dimedone deriv.)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
16	**Methoxyacetaldehyde**	92	.....	1.3950	.....	124–5	115	.....	.....	.....	.....	.....	.....	.....	.....
17	**3-Methylbutanal** (Isovaleraldehyde)	92.5	−51	1.39225	107	123, yel.-or., al.	110–1, al.	oil	48.5	154–5, al.	173 (cor.)	Thiosemicarbazone, 52–3	.....	.....	.....
18	**2-Methyl-1-butanal** (α-Methylbutyraldehyde)	92–3	20, tri-	1.3942	103–5, bz.-pet. eth.	120	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	**Trichloroethanal** (Chloral; Trichloroacetaldehyde)	98	−57.5	1.45572	90d.	131	131, yel.	.....	56	.....	.....	Hydrate, 51.7	.....	.....	.....
20	**Pentanal** (Valeraldehyde)	103.4	−91.5	1.3947	.....	98, yel., al.; 107	.....	.....	52, pet. eth.	104.5	113	Thiosemicarbazone, 65	.....	.....	.....
21	***tert*-Butylacetaldehyde**	103	.....	1.4150	.....	147	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	**2-Butenal** (Crotonaldehyde)	104	−69	$1.4362^{20.5}$	199	190, crim., bz.-lt. pet.	184–5	56	119	183	163, sint.; 167	Phenylsemicarbazone, 126–7	dk. red	dk. br.-red	2
23	**Dimethylethylacetaldehyde**	104	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	**Ethoxyacetaldehyde**	106	.....	1.3956	.....	116–7, me. al.	113–4, al.	.....	.....	.....	.....	.....	.....	.....	.....
25	**2-Isopropylacrolein**	107–9	.....	1.4223	.....	165	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	**2-Butynal**	105–110[755]	.....	1.446^{19}	.....	136	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	**Methylisopropylacetaldehyde**	114	.....	1.3998^{25}	.....	124	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	**2-Bromoisobutyraldehyde**	115	.....	1.4518^{25}	.....	.....	.....	.....	.....	.....	.....	Decomposes in w.	.....	.....	.....
29	**Diethylacetaldehyde** (2-Ethylbutyraldehyde)	116; 117	.....	1.4025	99, bz.-lt. pet.	95, pa.-or., lt. pet.; 129–30, al.	.....	.....	.....	102, me. al.	.....	.....	.....	.....	.....
30	**Methyl-*n*-propylacetaldehyde**	116^{737}	.....	.....	102	103	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	**2-Methyl-2-butenal**	116–9	.....	.....	216	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
32	***n*-Propoxyacetaldehyde**	119^{748}	.....	.....	.....	86	.....	.....	.....	.....	.....	.....	.....	.....	.....
33	**Isobutylacetaldehyde** (Isocaproaldehyde)	121^{743}	.....	.....	127	99	.....	.....	b.p. 103^{35}	.....	.....	.....	.....	.....	.....
34	**Paraldehyde** (Acetaldehyde trimer)	124.4^{752}	12.6	1.4049	.....	.....	.....	.....	.....	.....	.....	Dilute acid → Acetaldehyde, b.p. 20.2	dk. ol. grn.	dk. red br.	4
35	**2-Pentenal**	125	.....	.....	180	.....	123	.....	.....	.....	.....	.....	.....	.....	.....
36	**3-Methoxyisobutyraldehyde**	129	.....	1.4030^{27}	.....	102	.....	.....	.....	.....	.....	.....	.....	.....	.....

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TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No.	Name	Boiling point, °C	Melting point, °C	n_D^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv. (Dimedone deriv.)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
37	**3-Chloropropionaldehyde**	130–1	.....	1.475^{15}	.....	.....	.....	.....	.....	.....	.....	Trimer, 35.5, dil. HCl-abs. al.; b.p. 170–5^{12-5}	.....	.....	.....
38	**Hexanal** (Caproaldehyde)	131	.....	1.4068	106, bz.-pet. eth.	104, or.-yel.	.....	.....	51, pet. eth.-me. al.	108.5, dil. al.	.....	Phenylsemicarbazone, 135–6	.....	.....	.....
39	**Ethylisopropylacetaldehyde**	133.5	.....	1.4086^{25}	.....	121	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	**3,3-Dimethylpentanal**	134	.....	1.4292	.....	102	.....	.....	.....	.....	.....	.....	.....	.....	.....
41	**3-Methyl-2-butenal** (3-Methylcrotonaldehyde)	135	.....	1.4526	223	182	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	**Cyclopentanecarboxaldehyde**	136	.....	.....	124	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
43	**2-Methylpenten-2-al-1** (3-Ethyl-2-methylacrolein)	136.8	.....	1.4488	207	159, red, al.	.....	58–60	48–48.8	.....	.....	.....	.....	.....	.....
44	**Tetrahydrofurfural**	$142–3^{779}$	.....	1.4473; 1.43658	166	134	.....	.....	.....	.....	.....	Conc. HCl → brt. red col.; α-Benzyl-α-phenylhydrazone, 67, me. al.	.....	.....	.....
45	**5-Methylhexanal**	144^{750}	.....	1.4114	117	117	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	**3-Furaldehyde**	144^{732}	.....	1.4945	211	.....	.....	149.5	.....	.....	.....	.....	.....	.....	.....
47	**1-Cyclopentenylformaldehyde**	146	.....	1.4828^{21}	208	.....	188	.....	.....	.....	.....	.....	.....	.....	.....
49	**2-Chloro-2-butenal** (2-Chlorocrotonaldehyde)	147–50	.....	1.478^{23}	.....	.....	.....	.....	.....	.....	.....	Cyanohydrin, b.p. $137–8^{26}$, n_D^{21}: 1.4762	.....	.....	.....
50	**2-Hexenal**	150	.....	1.4470^{13}	176	.....	139	.....	.....	.....	.....	.....	.....	.....	.....
51	**3-Hexenal**	150	.....	.....	147	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
52	**Heptanal** (Enanthaldehyde)	155	−45	1.4125	109, al.	108, yel., al.	73	.....	57	135	112	.....	red-br.	red	9
53	**Ethylisobutylacetaldehyde**	155	.....	.....	98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
54	**Di-*n*-propylacetaldehyde**	161	.....	1.4142^{15}	101	.....	.....	.....	b.p. 126^{47}	.....	.....	.....	.....	.....	.....

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													Cold	Hot	Limit, γ
55	**2-Furancarboxaldehyde** (Furfural)	161.7	−36.5	1.52608	202	212–4, yel.; 230 (cor.); red; mixture: 185	54	97	α: 75–6, pet. eth.; β: 91–2, al.	160d.	162–5	Phenylsemicarbazone, 180–1	dk. red-vlt.	dk. bl.-vlt.	0.02
56	**Hexahydrobenzaldehyde**	162	.....	1.4495[19]	173; 176, w.	172	.....	.....	90–1, pet. eth.	.....	.....	Oxime-HCl, 107–8d.	.....	.....	.....
57	**2-Ethylhexanal-1** (*n*-Butylethylacetaldehyde)	163	.....	1.4150	254d.	114–5, dil. al.; 120–1, yel., al.	.....	.....	.....	.....	.....	.....	.....	.....	.....
58	**2,2,3-Trichloro-*n*-butyraldehyde** (*n*-Butylchloral; Crotonchloral)	164.5–5.5	.....	1.47554	.....	.....	.....	.....	65	.....	.....	NH_3 → Butylchloral ammonia, 62	.....	.....	.....
59	**Butanedial** (Succinaldehyde)	169–70d	.....	1.4254	.....	280	.....	.....	*di*: 172	.....	.....	Polymer, 65	.....	.....	.....
60	**Octanal** (*n*-Octaldehyde; Caprylaldehyde)	171	.....	1.42167	98, dil. me. al.; 101	106, yel., al.; 96	80, brt. yel.	.....	60, me. al.	90, dil. al.	101	Thiosemicarbazone, 94–94.5	.....	.....	.....
61	**2-Ethyl-3-*n*-propylacrolein**	173	.....	1.4518[22]	150–1; 153	124–5; 122	.....	.....	.....	.....	.....	.....	.....	.....	.....
62	**3-Fluorobenzaldehyde**	173	.....	.....	.....	.....	202	114	63	.....	.....	.....	.....	.....	.....
63	**2,2,2-Tribromoethanal** (Bromal)	174, yel.	.....	.....	.....	.....	.....	.....	115	.....	.....	Monohydrate, 53.5	no reac.	dk. grn.	40
64	**4-Fluorobenzaldehyde**	174.5[752]	.....	.....	.....	.....	212	147	*syn*: 116–7; *anti*: 86	.....	.....	.....	.....	.....	.....
65	**2-Fluorobenzaldehyde**	175	−44.5	.....	.....	.....	205	90	63	.....	.....	.....	.....	.....	.....
66	**Benzaldehyde**	179	−26; f.p.: −55.6	1.5446	222; 233–5, r. htng.	237, or, al.	190, red, al.; 234–6; 262	158; 154–5	α: 35 (stable); β: 130, eth.	193	200	Phenylsemicarbazone, 180–1	or.	red-or.	3
67	**Nonanal** (Pelargonaldehyde)	185	.....	1.4273	100; 84, me. al.	100 (cor.), yel., al.	.....	.....	64, pet. eth.	86	.....	Phenylsemicarbazone, 131–2	.....	.....	.....
68	**5-Methylfurfural**	187	.....	1.5147[25]	211°	212 (cor.)	130, red	147–8	*syn*: 112; *anti*: 51–2	.....	.....	.....	.....	.....	.....
69	**Glutaraldehyde**	187–9d.	.....	1.4330[25]	.....	.....	169	.....	*di*: 175; 178, w.	.....	.....	.....	.....	.....	.....
70	**Phenylethanal** (Phenylacetaldehyde)	194	33	1.53191	153, dil. al.; 156	121, grn.-yel., al.; 110	.....	58, lgr.; 62–3	97–8, eth.; 100	165	126	.....	dk. br.-red	dk. br.	polym.

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													Cold	Hot	Limit, γ
71	**2-Hydroxybenzaldehyde** (Salicylaldehyde)	197 (cor.)	−7; f.p.: 1.6	1.574	231	248, red, abs. al.; 252d., lt. red, ac. a.	227, red-br., al.	142	57; 63	.....	208, 70% al.	*p*-Nitrobenzoate, 128	or.	or.	5
72	**2-Thiophenecarboxaldehyde**	198	.....	1.5950^{16}	.....	242	.....	119; 139	.....	.....	.....	.....	.....	.....	.....
73	**3-Methylbenzaldehyde** (3-Tolualdehyde)	199	.....	1.5413^{21}	204; 223–4	212; 194	157	91, lgr.; 84	60, lgr.	172	206	.....	dk. or.-red	ch. red	5
74	**2-Methylbenzaldehyde** (2-Tolualdehyde)	200	.....	1.5481	209, al.; 212; 218	193–4, red, ac. a.	222, red, al.	101; 105–6; 111	49	167	215	.....	dk. or.-red	ch. red	5
75	**4-Methylbenzaldehyde** (4-Tolualdehyde)	204–5	.....	1.5454	234, al.; 215	232.5–4.5 (cor.), or.-yel. al., $PhNO_2$	200.5 (cor.), dk. red, ac. a.	112–3, al.; 121	79–80; 110	.....	.....	.....	dk. or.-red	ch. red	5
76	*d*-**Citronellal** (*d*-Rhodinal)	207	.....	1.4485	83–4, chl., ppt. by lgr; 91–2	78, yel., al.	.....	.....	oil	77–9, dil. al.	173	.....	dk. grn.	brt. red	10
77	**Decanal** (Capraldehyde)	207–9	.....	1.4287	102	104, yel.	.....	.....	69, dil. me. al.	91.7, dil. al.	.....	Thiosemicarbazone, 99–100	pa. ol.	dk. br.	200
78	**2-Chlorobenzaldehyde**	213–4	11	1.56708	146, yel.; 225, pyr.; 229–30, me. al.	213.6 (cor.); 209, or. red, xyl.	237–8, red, al.; 241, br.-red; 249, or.	86	α: 75–6, al.; β: 101–3	205d., al.	224–6 (cor.), al.	.....	.....	.....	.....
79	**Phenoxyethanal** (Phenoxyacetaldehyde; Glycolaldehyde phenyl ether)	215d.	.....	1.5380^{21}	145	.....	.....	86, pa. yel., al.	95, pet. eth.	.....	.....	.....	.....	.....	.....
80	**3,5-Dimethylbenzaldehyde**	220–2	9	1.5385	201–2	.....	.....	.....	.....	.....	.....	Oxid. → acid, 170, al.	.....	.....	.....
81	**3-Phenylpropionaldehyde** (Hydrocinnamaldehyde)	224	.....	.....	127, al.	149, yel., al.	122–3, yel., dil. al.	.....	93–4.5, dil. al.; 97 (cor.)	.....	.....	.....	.....	.....	.....
82	**Citral a.** (Geranial)	228d.	.....	1.48752	164, me. al.	108–10, red-or., al.; 116	.....	.....	143–5	.....	.....	.....	dk. red	red blk	0.1
83	**Citral b.** (Neral)	228d.	.....	1.4900	HCl: 171; mixture: 132, NaOAc	96, red-or., al.	.....	.....	.....	.....	.....	.....	dk. red	red blk	0.1

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