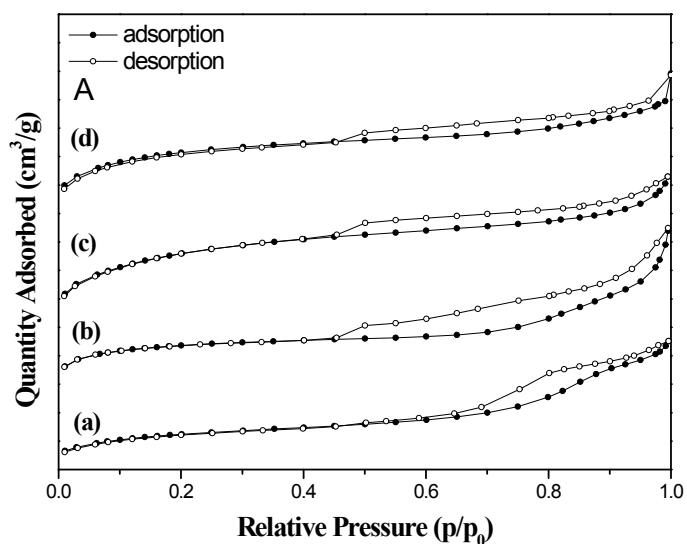


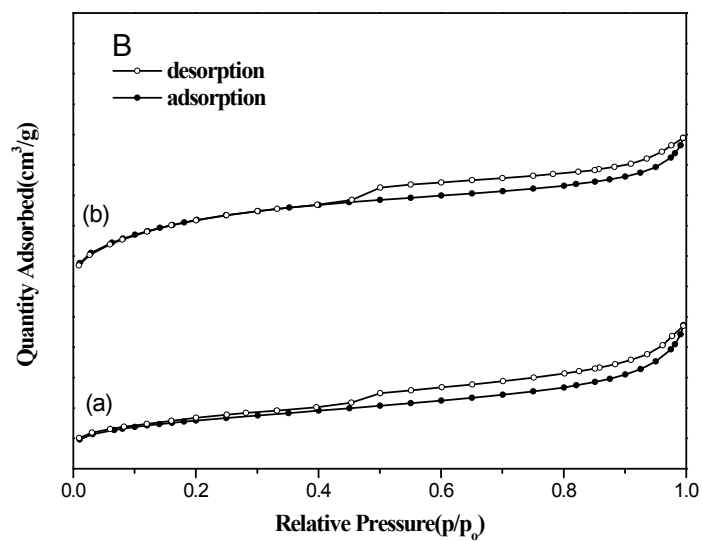
Fig. S1 XRF

Component	result	detection limit	element	intensity	w/o normal	
1	Na2O	1.30 mass%	0.00767	Na-KA	3.5396	0.6573
2	Al2O3	2.11 mass%	0.00382	Al-KA	30.4080	1.0726
3	SiO2	96.4 mass%	0.01045	Si-KA	1152.2334	48.9230
4	SO3	0.103 mass%	0.00290	S -KA	1.2949	0.0520
5	CaO	0.0384 mass%	0.00264	Ca-KA	0.9451	0.0195
6	Fe2O3	0.0206 mass%	0.00288	Fe-KA	1.0907	0.0105
7	NiO	0.0052 mass%	0.00182	Ni-KA	0.6052	0.0026
8	ZnO	0.0037 mass%	0.00138	Zn-KA	0.7734	0.0019

Fig. S2 N₂ adsorption/desorption

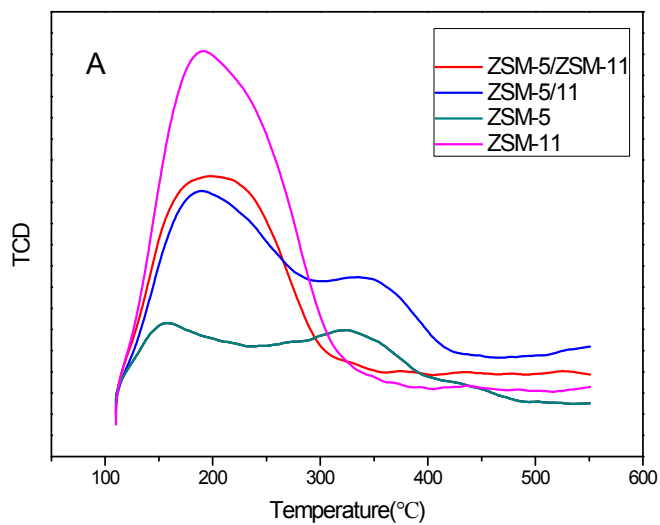


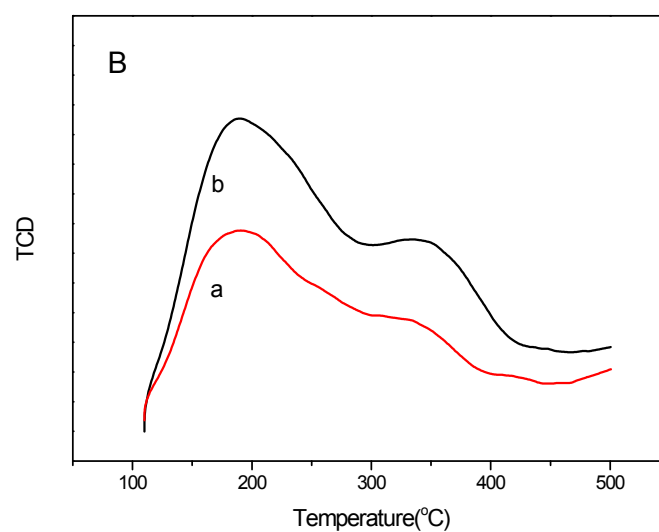
(a) ZSM-5(80) ; (b) ZSM-11(80) ; (c) ZSM-5/11(78) ; (d) ZSM-5(80)/ZSM-11(80)



(a) HZSM-5/11(78)(used); (b) HZSM-5/11(78)(fresh)

Fig. S3 NH₃-TPD





(a) HZSM-5/11(78)(used) ; (b) HZSM-5/11(78)(fresh)

Fig. S4 GC-MS analysis results

Compound report 1

化合物表						
化合物标签	保留时间	名称	分子式	MFG 分子式	DB 分子式	匹配数 (DB)
Cpd 1: Oxygen	0.106	Oxygen	O2	O2	O2	3
Cpd 2: Oxygen	0.456	Oxygen	O2	O2	O2	2
Cpd 3: Carbon dioxide	2.106	Carbon dioxide	CO2	CO2	CO2	10
Cpd 4: Acetaldehyde	2.196	Acetaldehyde	C2H4O	C2H4O	C2H4O	10
Cpd 5: Acetonitrile	2.371	Acetonitrile	C2H3N	C2H3N	C2H3N	10
Cpd 6: 2-Propen-1-ol	2.553	2-Propen-1-ol	C3H6O	C3H6O	C3H6O	10
Cpd 7: Diaziridine, 3,3-dimethyl-	2.613	Diaziridine, 3,3-dimethyl-	C3H8N2	C3H8N2	C3H8N2	10
Cpd 8: Propanenitrile	2.71	Propanenitrile	C3H5N	C3H5N	C3H5N	10
Cpd 9: 2-Butanone	2.813	2-Butanone	C4H8O	C4H8O	C4H8O	10
Cpd 10: Isobutyronitrile	3.018	Isobutyronitrile	C4H7N	C4H7N	C4H7N	10
Cpd 11: Benzene	3.381	Benzene	C6H6	C6H6	C6H6	10
Cpd 12: Acetic acid, hydrazide	3.483	Acetic acid, hydrazide	C2H6N2O	C2H6N2O	C2H6N2O	9
Cpd 13: Pyridine	4.571	Pyridine	C5H5N	C5H5N	C5H5N	10
Cpd 14: Pyridine	4.8	Pyridine	C5H5N	C5H5N	C5H5N	10
Cpd 15: Boron, trihydro(pyridine)-, (T-4)-	5.078	Boron, trihydro(pyridine)-, (T-4)-	C5H8BN	C5H8BN	C5H8BN	10
Cpd 16: Pyridine	5.278	Pyridine	C5H5N	C5H5N	C5H5N	10
Cpd 17: Oxygen	5.846	Oxygen	O2	O2	O2	1
Cpd 18: Pyridine, 2-methyl-	6.359	Pyridine, 2-methyl-	C6H7N	C6H7N	C6H7N	10
Cpd 19: 3-Aminopyridine	6.619	3-Aminopyridine	C5H6N2	C5H6N2	C5H6N2	10

Cpd 20: 1H-Pyrrole, 2-methyl-	7.163	1H-Pyrrole, 2-methyl-	C5H7N	C5H7N	C5H7N	10
Cpd 21: 1H-Pyrrole, 2-methyl-	7.501	1H-Pyrrole, 2-methyl-	C5H7N	C5H7N	C5H7N	10
Cpd 22: Pyridine, 3-methyl-	7.864	Pyridine, 3-methyl-	C6H7N	C6H7N	C6H7N	10
Cpd 23: Pyridine, 3-methyl-	8.262	Pyridine, 3-methyl-	C6H7N	C6H7N	C6H7N	10
Cpd 24: Pyridine, 2,6-dimethyl-	9.145	Pyridine, 2,6-dimethyl-	C7H9N	C7H9N	C7H9N	10
Cpd 25: Pyridine, 2-ethyl-	9.894	Pyridine, 2-ethyl-	C7H9N	C7H9N	C7H9N	10
Cpd 26: Pyrazine, 2,5-dimethyl-	10.111	Pyrazine, 2,5-dimethyl-	C6H8N2	C6H8N2	C6H8N2	10
Cpd 27: Pyrimidine, 4,6-dimethyl-	10.172	Pyrimidine, 4,6-dimethyl-	C6H8N2	C6H8N2	C6H8N2	10

Cpd 28: 1H-Pyrrole, 2,5-dimethyl-	10.812	1H-Pyrrole, 2,5-dimethyl-	C6H9N	C6H9N	C6H9N	10
Cpd 29: Pyridine, 2,5-dimethyl-	11.199	Pyridine, 2,5-dimethyl-	C7H9N	C7H9N	C7H9N	10
Cpd 30: Pyridine, 2,3-dimethyl-	11.876	Pyridine, 2,3-dimethyl-	C7H9N	C7H9N	C7H9N	10
Cpd 31: Oxygen	12.407	Oxygen	O2	O2	O2	3
Cpd 32: Pyridine, 3-ethyl-	12.588	Pyridine, 3-ethyl-	C7H9N	C7H9N	C7H9N	10
Cpd 33: Oxygen	13.12	Oxygen	O2	O2	O2	1
Cpd 34: Pyridine, 2-pentyl-	13.537	Pyridine, 2-pentyl-	C10H15N	C10H15N	C10H15N	10
Cpd 35: Pyridine, 2,6-dimethyl-	13.912	Pyridine, 2,6-dimethyl-	C7H9N	C7H9N	C7H9N	7
Cpd 36: Pyridine, 2-aminomethyl-6-methyl-	14.854	Pyridine, 2-aminomethyl-6-methyl-	C7H10N2	C7H10N2	C7H10N2	10
Cpd 37: Pyridine, 2-aminomethyl-6-methyl-	15.023	Pyridine, 2-aminomethyl-6-methyl-	C7H10N2	C7H10N2	C7H10N2	10
Cpd 38: 4-Pyridinamine, 2,6-dimethyl-	15.15	4-Pyridinamine, 2,6-dimethyl-	C7H10N2	C7H10N2	C7H10N2	10
Cpd 39: Oxygen	15.398	Oxygen	O2	O2	O2	10
Cpd 40: Oxygen	16.147	Oxygen	O2	O2	O2	1
Cpd 41: Oxygen	17.253	Oxygen	O2	O2	O2	1
Cpd 42: Carbamic acid, N-phenyl-, 2-methylphenyl ester	17.948	Carbamic acid, N-phenyl-, 2-methylphenyl ester	C14H13NO2	C14H13NO2	C14H13NO2	10
Cpd 43: Benzenamine, 3-methyl-	18.455	Benzenamine, 3-methyl-	C7H9N	C7H9N	C7H9N	10
Cpd 44: Benzenamine, 3-methyl-	18.63	Benzenamine, 3-methyl-	C7H9N	C7H9N	C7H9N	10
Cpd 45: 5H-1-Pyridine, 6,7-dihydro-	19.555	5H-1-Pyridine, 6,7-dihydro-	C8H9N	C8H9N	C8H9N	10
Cpd 46: 5-Allyl-4-[1-(p-aminophenyl)ethylidenehydrazono]-6-methyl-2-phenylpyrimidine	19.821	5-Allyl-4-[1-(p-aminophenyl)ethylidenehydrazono]-6-methyl-2-phenylpyrimidine	C22H23N5	C22H23N5	C22H23N5	10

Cpd 47: Pyridine, 2-methyl-5-(1-methylethenyl)-	19.972	Pyridine, 2-methyl-5-(1-methylethenyl)-	C9H11N	C9H11N	C9H11N	10
Cpd 48: 10-Hydroxytricyclo[4.2.1.1(2,5)]dec-3-en-9-one	20.056	10-Hydroxytricyclo[4.2.1.1(2,5)]dec-3-en-9-one	C10H12O2	C10H12O2	C10H12O2	10
Cpd 49: 2(1H)-Naphthalenone, 4a,5,8,8a-tetrahydro-1,1,4a-trimethyl-, trans-	20.389	2(1H)-Naphthalenone, 4a,5,8,8a-tetrahydro-1,1,4a-trimethyl-, trans-	C13H18O	C13H18O	C13H18O	10
Cpd 50: 2H-1b,4-Ethanopentaleno[1,2-b]oxirene, hexahydro-, (1a.alpha.,1b.beta.,4.beta.,4a.alpha.,5a.alpha.)-	20.528	2H-1b,4-Ethanopentaleno[1,2-b]oxirene, hexahydro-, (1a.alpha.,1b.beta.,4.beta.,4a.alpha.,5a.alpha.)-	C10H14O	C10H14O	C10H14O	10
Cpd 51: Tetracyclo[4.4.1.1(7,10).0(2,5)]dodec-3-en-11-ol	20.697	Tetracyclo[4.4.1.1(7,10).0(2,5)]dodec-3-en-11-ol	C12H16O	C12H16O	C12H16O	10
Cpd 52: 1,2-Epoxy-5,9-cyclododecadiene	20.896	1,2-Epoxy-5,9-cyclododecadiene	C12H18O	C12H18O	C12H18O	10
Cpd 53: Quinoline	21.434	Quinoline	C9H7N	C9H7N	C9H7N	10
Cpd 54: Paromomycin	21.712	Paromomycin	C23H45N5O14	C23H45N5O14	C23H45N5O14	10
Cpd 55: Paromomycin	21.899	Paromomycin	C23H45N5O14	C23H45N5O14	C23H45N5O14	10
Cpd 56: m-Aminophenylacetylene	22.032	m-Aminophenylacetylene	C8H7N	C8H7N	C8H7N	10
Cpd 57: 1,5-Diphenyl-1,5-hexadiene	22.189	1,5-Diphenyl-1,5-hexadiene	C18H18	C18H18	C18H18	10
Cpd 58: 2,5-Octadecadiynoic acid, methyl ester	22.25	2,5-Octadecadiynoic acid, methyl ester	C19H30O2	C19H30O2	C19H30O2	10
Cpd 59: Acetamide, N-methyl-N-[4-(3-hydroxypyrrolidinyl)-2-butynyl]-	22.376	Acetamide, N-methyl-N-[4-(3-hydroxypyrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	10

Reaction conditions: reaction temperature, 520 °C; molar ratio of NH₃ to glycerol, 12:1; GHSV, 3200 h⁻¹; glycerol concentration, 20%.

Compound report 2

化合物标签	保留时间	名称	分子式	MFG 分子式	DB 分子式	匹配数 (DB)
Cpd 1: Carbon dioxide	2.1	Carbon dioxide	CO2	CO2	CO2	20
Cpd 2: Acetaldehyde	2.19	Acetaldehyde	C2H4O	C2H4O	C2H4O	20
Cpd 3: Ethanamine, N-methylene-	2.323	Ethanamine, N-methylene-	C3H7N	C3H7N	C3H7N	20
Cpd 4: 1-Propene, 3-propoxy-	2.371	1-Propene, 3-propoxy-	C6H12O	C6H12O	C6H12O	20
Cpd 5: 2-Propen-1-ol	2.547	2-Propen-1-ol	C3H6O	C3H6O	C3H6O	20
Cpd 6: Propanenitrile	2.704	Propanenitrile	C3H5N	C3H5N	C3H5N	20
Cpd 7: 2-Butanone	2.806	2-Butanone	C4H8O	C4H8O	C4H8O	20
Cpd 8: Pyrazine	4.389	Pyrazine	C4H4N2	C4H4N2	C4H4N2	20
Cpd 9: Pyridine	4.619	Pyridine	C5H5N	C5H5N	C5H5N	20
Cpd 10: 3-(2-Propenyl)cyclopentene	4.806	3-(2-Propenyl)cyclopentene	C8H12	C8H12	C8H12	20
Cpd 11: Boron, trihydro(pyridine)-, (T-4)-	5.078	Boron, trihydro(pyridine)-, (T-4)-	C5H8BN	C5H8BN	C5H8BN	20
Cpd 12: Trimethylsilyl cyanide	5.241	Trimethylsilyl cyanide	C4H9NSi	C4H9NSi	C4H9NSi	20
Cpd 13: Pyridine, 2-methyl-	6.347	Pyridine, 2-methyl-	C6H7N	C6H7N	C6H7N	20
Cpd 14: Pyrazine, methyl-	6.583	Pyrazine, methyl-	C5H6N2	C5H6N2	C5H6N2	20
Cpd 15: 1H-Pyrrole, 2-methyl-	7.253	1H-Pyrrole, 2-methyl-	C5H7N	C5H7N	C5H7N	20

Cpd 16: Pyridine, 3-methyl-	7.924	Pyridine, 3-methyl-	C6H7N	C6H7N	C6H7N	20
Cpd 17: Pyridine, 2-ethyl-	9.785	Pyridine, 2-ethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 18: Pyrazine, 2,5-dimethyl-	10.033	Pyrazine, 2,5-dimethyl-	C6H8N2	C6H8N2	C6H8N2	20
Cpd 19: 1H-Imidazole, 1-methyl-2-vinyl-	10.323	1H-Imidazole, 1-methyl-2-vinyl-	C6H8N2	C6H8N2	C6H8N2	20
Cpd 20: 1H-Pyrrole, 2,5-dimethyl-	10.818	1H-Pyrrole, 2,5-dimethyl-	C6H9N	C6H9N	C6H9N	20
Cpd 21: Pyridine, 2,5-dimethyl-	10.987	Pyridine, 2,5-dimethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 22: Pyridine, 3,5-dimethyl-	11.187	Pyridine, 3,5-dimethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 23: Pyridine, 2,3-dimethyl-	11.682	Pyridine, 2,3-dimethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 24: Pyridine, 3-ethyl-	12.431	Pyridine, 3-ethyl-	C7H9N	C7H9N	C7H9N	20

Cpd 25: Pyridine, 2,3-dimethyl-	12.891	Pyridine, 2,3-dimethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 26: Silane, chloroethenyldimethyl-	13.005	Silane, chloroethenyldimethyl-	C4H9ClSi	C4H9ClSi	C4H9ClSi	20
Cpd 27: Pyridine, 4-ethyl-	13.525	Pyridine, 4-ethyl-	C7H9N	C7H9N	C7H9N	20
Cpd 28: Phenol	13.918	Phenol	C6H6O	C6H6O	C6H6O	20
Cpd 29: 1,4-Dihydro-4-imino-1-methylaminopyridine	14.492	1,4-Dihydro-4-imino-1-methylaminopyridine	C6H9N3	C6H9N3	C6H9N3	20
Cpd 30: Pyridine, 2-aminomethyl-6-methyl-	14.794	Pyridine, 2-aminomethyl-6-methyl-	C7H10N2	C7H10N2	C7H10N2	20
Cpd 31: 2-Isopropylpyrazine	15.048	2-Isopropylpyrazine	C7H10N2	C7H10N2	C7H10N2	20
Cpd 32: 2,3,4-Trimethylpyrrole	15.978	2,3,4-Trimethylpyrrole	C7H11N	C7H11N	C7H11N	20
Cpd 33: Phenol, 2-methyl-	17.936	Phenol, 2-methyl-	C7H8O	C7H8O	C7H8O	20
Cpd 34: cis-Verbenol	18.195	cis-Verbenol	C10H16O	C10H16O	C10H16O	20
Cpd 35: o-Toluidine	18.443	o-Toluidine	C7H9N	C7H9N	C7H9N	20
Cpd 36: Benzenamine, 3-methyl-	18.624	Benzenamine, 3-methyl-	C7H9N	C7H9N	C7H9N	20
Cpd 37: 9-Oxabicyclo[3.3.1]non-6-en-2-one, oxime	18.926	9-Oxabicyclo[3.3.1]non-6-en-2-one, oxime	C8H11NO2	C8H11NO2	C8H11NO2	20
Cpd 38: Bicyclo[3.1.1]hept-2-en-4-ol, 2,6,6-trimethyl-, acetate	19.392	Bicyclo[3.1.1]hept-2-en-4-ol, 2,6,6-trimethyl-, acetate	C12H18O2	C12H18O2	C12H18O2	20

Cpd 39: 5H-1-Pyridine, 6,7-dihydro-	19.476	5H-1-Pyridine, 6,7-dihydro-	C8H9N	C8H9N	C8H9N	20
Cpd 40: 2,4-Heptadienal, 2,4-dimethyl-	19.875	2,4-Heptadienal, 2,4-dimethyl-	C9H14O	C9H14O	C9H14O	20
Cpd 41: 2,4-Heptadienal, 2,4-dimethyl-	19.996	2,4-Heptadienal, 2,4-dimethyl-	C9H14O	C9H14O	C9H14O	20
Cpd 42: Tricyclo[4.2.2.0(1,5)]decane-7-ol	20.322	Tricyclo[4.2.2.0(1,5)]decane-7-ol	C10H16O	C10H16O	C10H16O	20
Cpd 43: Cyclopentaneacetaldehyde, 2-formyl-3-methyl-.alpha.-methylene-	20.515	Cyclopentaneacetaldehyde, 2-formyl-3-methyl-.alpha.-methylene-	C10H14O2	C10H14O2	C10H14O2	20
Cpd 44: 2,4-Heptadienal, 2,4-dimethyl-	20.648	2,4-Heptadienal, 2,4-dimethyl-	C9H14O	C9H14O	C9H14O	20
Cpd 45: Cyclopentaneacetaldehyde, 2-formyl-3-methyl-.alpha.-methylene-	20.775	Cyclopentaneacetaldehyde, 2-formyl-3-methyl-.alpha.-methylene-	C10H14O2	C10H14O2	C10H14O2	20
Cpd 46: Benzeneacetic acid, 4-(1H-1,2,3,4-tetrazol-1-yl)-	20.848	Benzeneacetic acid, 4-(1H-1,2,3,4-tetrazol-1-yl)-	C9H8N4O2	C9H8N4O2	C9H8N4O2	20
Cpd 47: Bicyclo[2.2.1]heptan-2-ol, 7,7-dimethyl-, acetate	20.975	Bicyclo[2.2.1]heptan-2-ol, 7,7-dimethyl-, acetate	C11H18O2	C11H18O2	C11H18O2	20
Cpd 48: 2,6-Difluoroaniline	21.416	2,6-Difluoroaniline	C6H5F2N	C6H5F2N	C6H5F2N	20
Cpd 49: cis,trans-5,9-Cyclododecadiene-cis-1,2-diol	21.682	cis,trans-5,9-Cyclododecadiene-cis-1,2-diol	C12H20O2	C12H20O2	C12H20O2	20

Cpd 50: cis,trans-5,9-Cyclododecadiene-cis-1,2-diol	21.953	cis,trans-5,9-Cyclododecadiene-cis-1,2-diol	C12H20O2	C12H20O2	C12H20O2	20
Cpd 51: 1H-Indene, 1-hexadecyl-2,3-dihydro-	22.02	1H-Indene, 1-hexadecyl-2,3-dihydro-	C25H42	C25H42	C25H42	20
Cpd 52: 2,5-Octadecadiynoic acid, methyl ester	22.219	2,5-Octadecadiynoic acid, methyl ester	C19H30O2	C19H30O2	C19H30O2	20
Cpd 53: Quinoline, 6-methyl-	22.582	Quinoline, 6-methyl-	C10H9N	C10H9N	C10H9N	20
Cpd 54: 2,5-Octadecadiynoic acid, methyl ester	22.63	2,5-Octadecadiynoic acid, methyl ester	C19H30O2	C19H30O2	C19H30O2	20

Cpd 55: 2-(4-Hydroxy-4-methyl-tetrahydro-pyran-3-ylamino)-3-(1H-indol-2-yl)-propionic acid	22.848	2-(4-Hydroxy-4-methyl-tetrahydro-pyran-3-ylamino)-3-(1H-indol-2-yl)-propionic acid	C17H22N2O4	C17H22N2O4	C17H22N2O4	20
Cpd 56: Paromomycin	23.138	Paromomycin	C23H45N5O14	C23H45N5O14	C23H45N5O14	20
Cpd 57: Paromomycin	23.252	Paromomycin	C23H45N5O14	C23H45N5O14	C23H45N5O14	20
Cpd 58: Paromomycin	23.349	Paromomycin	C23H45N5O14	C23H45N5O14	C23H45N5O14	20
Cpd 59: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	23.681	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20
Cpd 60: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	24.062	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20
Cpd 61: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	24.231	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20
Cpd 62: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	24.31	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20

Cpd 63: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	24.419	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20
Cpd 64: Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	24.515	Acetamide, N-methyl-N-[4-(3-hydroxypyrrrolidinyl)-2-butynyl]-	C11H18N2O2	C11H18N2O2	C11H18N2O2	20
Cpd 65: 1-Hydroxycyclododecanecarbonitrile	24.666	1-Hydroxycyclododecanecarbonitrile	C13H23NO	C13H23NO	C13H23NO	20
Cpd 66: 2-[4-methyl-6-(2,6,6-trimethylcyclohex-1-enyl)hexa-1,3,5-trienyl]cyclohex-1-en-1-carboxaldehyde	25.548	2-[4-methyl-6-(2,6,6-trimethylcyclohex-1-enyl)hexa-1,3,5-trienyl]cyclohex-1-en-1-carboxaldehyde	C23H32O	C23H32O	C23H32O	20
Cpd 67: 2-[4-methyl-6-(2,6,6-trimethylcyclohex-1-enyl)hexa-1,3,5-trienyl]cyclohex-1-en-1-carboxaldehyde	27.349	2-[4-methyl-6-(2,6,6-trimethylcyclohex-1-enyl)hexa-1,3,5-trienyl]cyclohex-1-en-1-carboxaldehyde	C23H32O	C23H32O	C23H32O	20

Reaction conditions: reaction temperature, 520 °C; molar ratio of NH₃ to glycerol, 8:1; GHSV, 3200 h⁻¹; glycerol concentration, 20%.