N-Formylmorpholine

Other names:	4-Morpholinecarboxaldehyde
	4-formylmorpholine
	4-morpholinecarbaldehyde
	Morpholine, 4-formyl-
	N-Formylmorfolin
	N-formyltetrahydro-1,4-oxazine
	morpholine-4-carbaldehyde
Inchi:	InChI=1S/C5H9NO2/c7-5-6-1-3-8-4-2-6/h5H,1-4H2
InchiKey:	LCEDQNDDFOCWGG-UHFFFAOYSA-N
Formula:	C5H9NO2
SMILES:	O=CN1CCOCC1
Mol. weight [g/mol]:	115.13
CAS:	4394-85-8

Physical Properties

Property code	Value	Unit	Source
log10ws	0.76		Crippen Method
logp	-0.525		Crippen Method
mcvol	87.870	ml/mol	McGowan Method
pc	5080.00	kPa	Critical Point and Vapor Pressure Measurements for 17 Compounds by a Low Residence Time Flow Method
tb	513.10	K	Isobaric (vapour + liquid) equilibria for N-formylmorpholine with ethylbenzene, n-butylbenzene, iso-propylbenzene and 1,2,4-trimethylbenzene at 101.33 kPa
tb	509.95	K	Cosolvent Selection for Benzene-Cyclohexane Separation in Extractive Distillation

Temperature Dependent Properties

Property code	Value	Unit	Temperature [K]	Source
cpl	188.00	J/mol×K	313.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	202.00	J/mol×K	353.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	201.00	J/mol×K	348.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	200.00	J/mol×K	343.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	197.00	J/mol×K	338.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K

cpl	186.00	J/mol×K	308.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	195.00	J/mol×K	333.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	193.00	J/mol×K	328.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	191.00	J/mol×K	323.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
cpl	185.00	J/mol×K	303.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K

cpl	189.00	J/mol×K	318.15	Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K
dvisc	0.0027070	Pa×s	343.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
dvisc	0.0022740	Pa×s	353.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
dvisc	0.0076556	Pa×s	298.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0065981	Pa×s	303.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0050678	Pa×s	313.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure

dvisc	0.0040357	Pa×s	323.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0033035	Pa×s	333.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0027822	Pa×s	343.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0023680	Pa×s	353.15	Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure
dvisc	0.0078700	Pa×s	298.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C
dvisc	0.0067500	Pa×s	303.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C

dvisc	0.0051300	Pa×s	313.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C
dvisc	0.0040300	Pa×s	323.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C
dvisc	0.0032500	Pa×s	333.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C
dvisc	0.0026800	Pa×s	343.15	Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C
dvisc	0.0079550	Pa×s	298.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
dvisc	0.0068770	Pa×s	303.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
dvisc	0.0052140	Pa×s	313.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures

dvisc	0.0040800	Pa×s	323.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
dvisc	0.0032840	Pa×s	333.15	Densities and Viscosities of N-Formylmorpholine + Benzene, + Toluene at Different Temperatures and Atmospheric Pressures
pvap	101.32	kPa	509.95	Cosolvent Selection for Benzene-Cyclohexane Separation in Extractive Distillation
rfi	1.48400		293.10	Liquid liquid equilibria of methylcyclohexane benzene N-formylmorpholine at several temperatures
rfi	1.48400		293.10	Measurement and Correlation of Liquid-Liquid Equilibria of Methylcyclohexane + Toluene + N-Formylmorpholine at (293, 303, 313, and 323) K
rfi	1.48440		293.15	Vapor Liquid Equilibrium Data for the Morpholine-4-carbaldehyde + n-Hexane or n-Heptane Binary Systems Using a Static-Synthetic Apparatus
rfi	1.48490		293.15	Experimental solubility for betulin and estrone in various solvents within the temperature range T = (293.2 to 328.2) K

rfi	1.48400	293.10	(Liquid + liquid) equilibria of three ternary systems: (heptane + benzene + N-formylmorpholine), (heptane + toluene + N-formylmorpholine), (heptane + xylene + N-formylmorpholine) from T = (298.15 to 353.15) K
rfi	1.47990	313.15	Refractive properties, speed of sound and FT-IR study of binary mixtures of N-formylmorpholine with some halobenzenes at 303.15, 308.15 and 313.15 K
rfi	1.48190	308.15	Refractive properties, speed of sound and FT-IR study of binary mixtures of N-formylmorpholine with some halobenzenes at 303.15, 308.15 and 313.15 K
rfi	1.48330	303.15	Refractive properties, speed of sound and FT-IR study of binary mixtures of N-formylmorpholine with some halobenzenes at 303.15, 308.15 and 313.15 K
rfi	1.48400	293.10	(Liquid + liquid) equilibria of {heptane + xylene + N-formylmorpholine} ternary system

Sources

McGowan Method:	http://link.springer.com/article/10.1007/BF02311772
Volumetric Properties and Viscosities for Aqueous NFM Solutions from 25 deg C to 70 deg C:	https://www.doi.org/10.1021/je0498208

(Liquid + liquid) equilibria for the ternary system of (N-formylmorpholine + ethylbenzene + 2,2,4-trimethylpentane) at temperatures (303.15, 313.15, and 323.15) K:	https://www.doi.org/10.1016/j.fluid.2012.05.010
Measurement of (liquid + liquid) equilibria for ternary systems of (N-formylmorpholine + benzene + cyclohexane) at temperatures (303.15, 308.15, and 313.15) K:	https://www.doi.org/10.1016/j.jct.2011.01.011
Activity coefficients at infinite dilution of organic solutes in N-formylmorpholine and N-methylpyrrolidone from gas-liquid chromatography:	https://www.doi.org/10.1016/j.jct.2013.02.006
Solubility Study of Methane and Ethane in Promising Physical Solvents for Natural Gas Sweetening Operations:	https://www.doi.org/10.1021/je050172h
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Liquid liquid equilibria of methylcyclohexane benzene N-formylmorpholine at several temperatures:	https://www.doi.org/10.1016/j.fluid.2007.03.013
Liquid-Liquid Equilibria for the Binary Systems of N-Formylmorpholine with Cycloalkanes:	https://www.doi.org/10.1021/je020089j
(Liquid + liquid) equilibria of three ternary systems: (heptane + benzene + N-formylmorpholine), (heptane + toluene + N-formylmorpholine), (heptane + xylene + N-formylmorpholine) from T = (298.15 to 353.15) K:	https://www.doi.org/10.1016/j.jct.2006.12.004
(Liquid + liquid) equilibria of {heptane + xylene + N-formylmorpholine} ternary system:	https://www.doi.org/10.1016/j.jct.2007.05.001
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NIST Webbook:	http://webbook.nist.gov/cgi/cbook.cgi?ID=C4394858&Units=SI
Measurement and Correlation of Liquid-Liquid Equilibria of Methylcyclohexane + Toluene + N-Formylmorpholine at (293, 303, 313, and 323) K:	https://www.doi.org/10.1021/je700036v
Densities and Viscosities of N-Formylmorpholine + Benzene + Toluene at Different Temperatures and Atmospheric Pressures:	https://www.doi.org/10.1021/je060475r
(Liquid + liquid) equilibria of (sulfolane + benzene + n-hexane), (N-formylmorpholine + benzene + n-hexane), and (sulfolane + N-formylmorpholine + benzene + n-hexane) at temperatures ranging from (298.15 to 318.15) K: Experimental results and correlation:	https://www.doi.org/10.1016/j.jct.2009.10.010
Isobaric (vapour + liquid) equilibria for N-formylmorpholine with ethylbenzene, o-xylene, m-xylene and p-xylene at 101.33 kPa:	https://www.doi.org/10.1016/j.jct.2012.04.016
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Densities and Viscosities of N-Formylmorpholine (NFM) + p-Xylene, + o-Xylene, + m-Xylene at Different Temperatures and Atmospheric Pressure:	https://www.doi.org/10.1021/je7002513
Vapor-Liquid Equilibrium of N-Formylmorpholine with Toluene and Xylene at 101.33 kPa:	https://www.doi.org/10.1021/je7005665
Cosolvent Selection for Benzene-Cyclohexane Separation in Extractive Distillation:	https://www.doi.org/10.1021/je100081v
Liquid-Liquid Equilibria for the Binary Systems of N-Formylmorpholine with Branched Cycloalkanes:	https://www.doi.org/10.1021/je020208v
Molar Heat Capacity of Aqueous Sulfolane, 4-Formylmorpholine, 1-Methyl-2-pyrrolidinone, and Triethylene Glycol Dimethyl Ether Solutions from (303.15 to 353.15) K:	https://www.doi.org/10.1021/je800999s
Crippen Method:	https://www.chemeo.com/doc/models/crippen_log10ws
Critical Point and Vapor Pressure Measurements for 17 Compounds by a Low Residence Time Flow Method:	https://www.doi.org/10.1021/je060269j
Vapor Liquid Equilibrium Data for the Morpholine-4-carbaldehyde + n-Hexane or n-Heptane Binary Systems Using a Static-Synthetic Apparatus:	https://www.doi.org/10.1021/je4004417

Legend

cpl:	Liquid phase heat capacity
dvisc:	Dynamic viscosity
log10ws:	Log10 of Water solubility in mol/l
logp:	Octanol/Water partition coefficient
mcvol:	McGowan's characteristic volume
pc:	Critical Pressure
pvap:	Vapor pressure
rfi:	Refractive Index
tb:	Normal Boiling Point Temperature