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NOTE

Saturated-liquid heat capacity: new polynomial models and review of the literature experimental data

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Abstract: In this paper a review of selected literature experimental data for saturated-liquid heat capacities was presented. Two-, three- and four-parameter polynomial correlation models are tested on those data. Obtained results lead to the conclusion that correlation quality depends on the number of parameters, and slightly on the type of models. The best two-, three- and four-parameter models were proposed.

Keywords: heat capacity, saturated-liquid heat capacity, correlation, polynomial model.

INTRODUCTION

The calculation of heat capacities for saturated liquids is an important step in the design of many unit operations. In heating or cooling liquids, the energy requirements are proportional to the heat capacity. Values of this property are, therefore, necessary in such areas as equipment sizing, energy requirements, equilibrium yields and separation ratios. Also, heat capacity of mixtures can be determined from the heat capacity of the individual components.

EVALUATION OF THE MODELS

Experimental data for the heat capacity of pure saturated liquid are limited, and even when available cover mostly limited temperature ranges. Therefore, numerous estimating and correlating models have been developed. Most of these models are polynomial types, such as:

$$c_{ps} = A + BT + CT^2 \tag{1}$$

$$c_{ps} = A + BT + C/T^2 \tag{2}$$

TABLE I. Experimental data

Compound	n	ΔT/K	Ref.	Compound	n	ΔT/K	Ref.
Alkanes				Methylisopropyl ether	62	130.24–311.39	2c
Ethane	50	96.77–294.85	83	Methylpropyl ether	116	137.67–308.94	2c
Ethane	29	91.59–180.88	84	Ethylpropyl ether	62	151.28–316.30	2c
Propane	22	89.67–229.76	41	Methylbutyl ehter	52	160.20–315.69	2c
Propane	7	91.06–104.78	10	Methyl-tert-butyl ether	38	168.32–308.38	2c
Butane	20	142.22–268.14	3h	Diisopropyl ether	19	187.77–340.00	2a
Butane	8	139.70–261.80	34	Dipropyl ether	66	160.55–322.73	2b
Isobutane	25	116.94–257.02	3e	Methyldecyl ether	38	246.52–349.26	2c
2,2-Dimethylpropane	29	143.75–278.92	3g	Diphenyl ether	27	310.00–570.00	23
2-Methylbutane	13	120.00–290.00	74	Acetic acid	48	293.20–400.19	75c
2-Methylbutane	14	120.50–275.80	61d	Propionic acid	74	254.82–447.15	46
2-Methylbutane	83	115.67–297.81	27a	Butyric acid	32	272.75–373.06	46
Pentane	19	151.32–286.41	49a	Enanthic acid	8	275.00–305.00	73
Pentane	14	149.90–290.00	61b	Capric acid	8	310.00–345.00	73a
2,2-Dimethylbutane	15	180.00–320.00	79	Undencanoic acid	6	305.00–330.00	73
2,2-Dimethylbutane	12	178.73–279.57	43	Ethyl acetate	8	195.70–293.60	61c
2,2-Dimethylbutane	17	177.25–296.10	15	Butyl methacrylate	27	199.25–323.78	44a
2,3-Dimethylbutane	19	140.00–320.00	79	Maleic anhydride	13	327.66–357.48	13
2,3-Dimethylbutane	38	149.37–306.46	15	Halogenated compounds			
2-Methylpentane	21	120.00–320.00	79	Carbon tetrachloride	7	260.00–320.00	79
2-Methylpentane	27	121.16–303.27	15	Carbon tetrachloride	13	253.82–298.49	30
3-Methylpentane	24	119.05–327.33	18a	Trichlorofluoromethane	13	170.55–287.82	57a
3-Methylpentane	17	160.00–320.00	79	Chlorodifluoromethane	12	121.84–226.09	53

TABLE I. Continued

Compound	n	ΔT/K	Ref.	Compound	n	ΔT/K	Ref.
3-Methylpentane	16	157.04–302.14	15	Bromomethane	16	184.46–275.59	16
Hexane	33	180.60–301.43	39	Chloromethane	10	182.24– 249.67	49
Hexane	8	183.50–295.10	61d	Perfluoroethane	10	174.88–190.67	60
Hexane	15	180.00–320.00	79	Chloropentafluoroethane	16	170.00–234.04	3k
Hexane	24	180.42–300.98	15	1,1,1,2-Tetrafluoroethane	28	182.78–325.69	86
2,2,3-Trimethylbutane	6	253.20–293.90	34b	1,1,1-Trichloroethane	10	245.40–299.59	69
2,2-Dimethylpentane	13	153.20–294.10	34b	1,1,1-Trichloroethane	10	243.13–310.00	2
2,3-Dimethylpentane	8	160.30–291.30	34b	1,1,1-Trifluoroethane	11	165.41–220.74	71
2,4-Dimethylpentane	15	160.20–294.40	34b	1,1-Dichloroethane	18	177.06–294.26	45a
3,3-Dimethylpentane	14	145.70–292.90	34b	1,2-Dichloroethane	6	238.68–307.53	63
2-Methylhexane	12	160.20–292.40	61d	Chloroethane	26	139.82–284.47	25
3-Ethylpentane	11	161.40–294.80	34b	Chlorotrifluoroethene	13	115.00–244.80	55c
3-Methylhexane	10	106.30–289.20	34b	1,1-Dichloroethene	37	157.48–290.87	31a
Heptane	6	194.60–317.65	63a	Perfluoropropane	36	125.82–233.02	60b
Heptane	96	185.03–300.99	39	1-Bromobutane	35	176.93–292.31	12
Heptane	35	190.00–520.00	23	Chlorocyclopentane	36	181.77–300.78	14
Heptane	14	188.00–299.20	61d	1-Bromopentane	10	195.82–290.68	12
2,2,4-Trimethylpentane	8	171.15–317.34	63a	Chlorocyclohexane	13	235.04–304.25	14a
2,2,4-Trimethylpentane	15	169.60–295.20	61d	1-Bromohexane	12	213.97–289.80	12
2,3,4-Trimethylpentane	14	172.76–323.59	63c	1,2-Difluorobenzene	20	229.03–357.23	75t
3-Methylheptane	32	107.25–376.00	18a	Bromobenzene	8	250.00–320.00	79
Octane	18	222.61–297.58	18	Chlorobenzene	10	230.00–320.00	79
Octane	8	223.00–293.70	61d	Fluorobenzene	16	235.13–350.30	75n

TABLE I. Continued

Compound	n	ΔT/K	Ref.
Nonane	22	225.03–313.88	18
Nonane	8	224.50–299.10	61d
Nonane	8	228.30–297.90	34
Diisopentyl	8	223.20–295.00	61d
2-Methylnonane	11	200.00–298.00	61h
3-Methylnonane	12	190.00–298.00	61h
4-Methylnonane	13	180.00–298.00	61h
5-Methylnonane	12	190.00–298.00	61h
Decane	17	247.02–318.62	18
Decane	6	242.30–295.50	61d
Decane	6	251.20–297.70	34
Undecane	12	251.74–298.92	18
Dodecane	11	266.69–317.41	18
Tridecane	8	271.66–306.38	18
Tetradecane	7	282.71–302.77	61g
Pentadecane	7	285.51–312.78	18
Hexadecane	9	295.41–320.28	18
11-Decylheneikosane	35	276.16–297.76	19
Alkenes, alkines, dienes			
Ethene	12	106.69–168.71	16a
Propene	18	93.91–223.40	65
Propene	10	93.10–210.30	34
2-Methylpropene	15	139.20–253.10	81
Fluorobenzene	9	240.00–320.00	79
Iodobenzene	8	250.00–320.00	79
Perfluoroheptane	10	221.87–310.00	55a
Benzotrifluoride	13	252.52–364.73	75a
4-Fluorotoluene	19	221.45–360.50	75s
Thioles, sulfides, disulfides			
Methanethiol	16	154.16–271.06	72
Ethanethiol	27	130.05–315.26	47g
1-Propanethiol	19	167.58–314.58	62a
2-Propanethiol	22	149.26–321.63	47d
2-Methyl-1-propanethiol	24	137.42–348.80	75p
2-Methyl-2-propanethiol	9	280.91–329.09	47h
1-Butanethiol	20	160.23–314.33	75i
2-Butanethiol	28	135.50–306.87	47e
1-Pentanethiol	28	200.34–321.00	18e
Cyclopentanethiol	26	162.49–366.49	4
Benzenethiol	15	262.47–374.50	75o
Dimethyl sulfide	14	181.21–286.69	57
Methylethyl sulfide	21	147.21–297.61	75h
Diethyl sulfide	26	181.96–316.09	75e
2-Thiapentane	21	167.45–325.78	75i
3-Methyl-2-thiabutane	22	177.19–343.79	47j
Ethylpropyl sulfide	25	165.59–366.02	47c

TABLE I. Continued

Compound	*n*	Δ*T*/K	Ref.	Compound	*n*	Δ*T*/K	Ref.
1-Butene	24	81.30–253.40	81	Methylbutyl sulfide	23	186.90–358.01	47c
1-Butene	18	89.80–258.51	3a	3,3-Dimethyl-2-thiabutane	21	189.96–364.38	75k
2-Butene, *cis*	18	138.20–266.60	81	Dipropyl sulfide	19	173.74–315.02	47c
2-Butene, *trans*	6	176.00–259.60	81	Dibutyl sulfide	17	205.06–355.52	47c
2-Butene, *trans*	14	170.66–271.03	28	Dimethyl disulfide	25	191.99–352.27	75b
Trimethylethene	15	143.90–293.90	61b	Diethyl disulfide	22	168.17–299.30	75g
2-Pentene, *trans*	8	136.10–289.10	61b	Dipropyl disulfide	20	193.63–351.22	33
Tetramethylethene	12	202.40–295.50	3d	Diphenylen disulfide	12	435.71–518.41	78a
2,3-Dimethyl-2-butene	18	204.25–318.14	75f	Nitrogen compounds			
1-Heptene	21	151.10–295.10	61g	Methylamine	25	186.61–259.28	3j
2,4,4-Trimethyl-1-pentene	15	178.40–296.00	61g	Ethylenediamine	10	293.25–334.33	50a
2,4,4-Trimethyl-2-pentene	15	170.00–298.60	61g	Dimethylamine	20	184.82–280.45	3
1,4-Pentadiene	23	125.40–292.50	61g	Trimethylamine	22	160.88–275.90	3i
1-Butyne	22	149.88–275.09	3f	Cyclopropylamine	10	242.28–314.85	18c
2-Butyne	10	249.49–284.33	85	1,2-Propanediamine	17	240.03–367.64	50a
Cyclic hydrocarbons				2-Methyl-1,2-propanediamine	17	257.67–374.58	50a
Cyclopropane	14	153.65–242.83	70a	Cyclopentylamine	15	196.95–348.69	18c
Cyclobutane	19	184.79–284.57	66	N,N-Dimethyl-2-pentylnonylamine	21	323.15–423.15	51
Cyclopentane	16	185.75–300.12	15a	Aniline	17	270.22–313.06	29
Cyclopentane	19	184.08–291.40	3c	2-Methylaniline	26	235.22–441.12	78b
Cyclopentane	15	186.00–293.70	35	Dimethylmalononitrile	9	309.05–346.12	67
Methylencyclobutane	17	146.36–300.75	18c	Methyl hydrazine	9	220.79–298.16	3b
Spiropentane	18	176.44–312.11	63b	Formamide	8	276.79–293.73	13

TABLE I. Continued

Compound	*n*	Δ*T*/K	Ref.	Compound	*n*	Δ*T*/K	Ref.
Methylcyclopentane	32	126.58–307.52	15a	Nitromethane	11	249.75–297.12	38
Methylcyclopentane	8	139.00–293.70	34	Heterocycles			
Cyclohexane	12	175.20–293.20	61b	Ethylene oxide	22	165.97–283.93	21b
Cyclohexane	7	282.27–301.30	70	Propylenoxid	62	166.36–301.37	54
1,3,5-Cycloheptatriene	19	201.50–312.16	18d	Furan	23	191.00–299.09	27
1,1-Dimethylcyclopentane	14	205.90–299.81	26	Dibenzofuran	17	361.98–520.28	6a
1,2-Dimethylcyclopentane, *cis*	14	223.08–302.84	26	Pyrrole	20	256.15–359.74	75
1,3-Dimethylcyclopentane, *trans*	22	143.70–304.03	26	Pyrrolidine	22	218.35–350.59	47
4-Methylcyclohexene	22	161.15–321.38	44	Pyridine	13	239.70–346.69	47a
Methylcyclohexane	15	155.09–285.76	15a	Pyridine	8	230.00–300.00	61f
Methylcyclohexane	12	151.40–294.20	61b	Pyridine	11	360.00–560.00	7i
Ethylcyclopentane	21	140.24–301.83	26	N-methylpyrrole	18	221.18–364.65	50b
Cycloheptane	7	269.31–300.42	18d	Piperidine	12	267.31–361.94	50b
1,1-Dimethylcyclohexane	13	242.74–303.53	34c	2-Methylpyridine	19	209.90–369.01	75m
1,2-Dimethylecyclohexane, *cis*	16	228.30–298.82	34c	3-Methylpyridine	16	257.52–387.93	75j
1,2-Dimethylcyclohexane, *trans*	27	183.68–301.44	34c	4-Methylpyridine	16	283.15–394.85	50b
1,3-Dimethylcyclohexane, *cis*	18	204.19–299.48	34c	2,4-Dimethylpyrrole	26	177.72–441.03	7c
1,3-Dimethylcclohexane, *trans*	30	187.65–299.04	34c	2,5-Dimethylpyrrole	19	285.13–383.89	50b
1,4-Dimethylcyclohexane, *cis*	22	189.49–303.22	34c	2-Methylpiperidine	13	273.24–369.82	50b
1,4-Dimethylcyclohexane, *trans*	9	242.16–299.25	34c	2,3-Dimethylpyridine	10	460.00–640.00	78c
Ethylcyclohexane	21	167.35–299.19	34c	2,3-Dimethylpyridine	20	266.72–441.25	7b
Ethylcyclohexane	15	160.00–300.00	61e	2,4-Dimethylpyridine	9	460.00–620.00	78c
Cyclooctane	6	294.61–321.64	18d	2,4-Dimethylpyridine	29	207.36–440.23	7b

TABLE I. Continued

Compound	*n*	Δ*T*/K	Ref.	Compound	*n*	Δ*T*/K	Ref.
Decahydronaphthalene, *cis*	8	230.00–298.16	61	2,5-Dimethylpyridine	9	460.00–620.00	78c
Decahydronaphthalene, *trans*	7	240.00–298.16	61	2,5-Dimethylpyridine	22	253.88–441.12	7b
Cyclohexylcyclohexane	44	278.10–470.00	56	2,6-Dimethylpyridine	8	460.00–620.00	78c
Heptylcyclohexane	7	240.00–300.00	61e	2,6-Dimethylpyridine	27	272.63–435.31	7b
Aromatics				3,4-Dimethylpyridine	11	460.00–660.00	78c
Benzene	6	281.10–300.00	34a	3,4-Dimethylpyridine	24	257.14–440.04	7b
Benzene	8	286.90–336.89	55	3,5-Dimethylpyridine	10	460.00–640.00	78c
Benzene	25	281.00–353.00	6	3,5-Dimethylpyridine	19	274.03–444.56	7b
Toluene	9	184.40–298.50	76	(R,S)-Decahydroquinoline, *trans*-	13	328.92–440.30	78b
Toluene	11	183.83–284.44	40c	7,8-Benzoquinoline	17	319.06–439.57	78
Toluene	35	281.00–383.00	6	Acridine	9	391.91–445.55	78
Phenylacetylene	6	231.70–298.50	76	Phenantridine	9	377.08–439.62	78
Styrene	9	246.73–298.54	21g	N-methylcarbazole	8	366.15–388.42	50b
1,2-Dimethylbenzene	8	253.30–295.10	34a	Thiacyclobutane	16	201.98–321.29	75d
1,2-Dimethylbenzene	9	251.65–301.86	63d	Thiophene	16	240.33–336.08	82
1,3-Dimethylbenzene	6	217.00–275.30	34a	Thiophene	9	237.80–289.30	35
1,3-Dimethylbenzene	11	231.40–318.16	63d	Thiacyclopentane	24	180.17–333.40	33a
1,4-Dimethylbenzene	11	295.37–373.40	50	2-Methylthiophene	16	213.30–343.94	62
1,4-Dimethylbenzene	10	292.02–354.65	63d	3-Methylthiophene	18	207.01–337.29	47i
Ethylbenzene	16	185.00–304.90	34a	Thiacyclohexane	9	295.63–341.52	47b
Ethylbenzene	9	184.40–298.50	76	Dibenzothiophene	16	377.24–515.75	7g
Ethylbenzene	16	181.51–305.41	27b	Dibenzothiophene	29	385.00–550.00	56
Tert-butylbenzene	8	220.40–294.30	18	Thiazole	13	245.00–340.00	77
Naphthalene	13	357.90–440.30	7h	Phenoxathiin	15	313.33–439.81	78a
Acenaphthane	10	374.16–436.43	18b				

TABLE I. Continued

Compound	n	ΔT/K	Ref.
Diphenyl	11	349.06–440.24	7f
Diphenyl	24	350.00–480.00	56
1,8-Dimethylnaphthalene	7	349.65–432.35	18b
2,3-Dimethylnaphthalene	8	384.54–415.15	50
2,4-Dimethylnaphthalene	9	390.16–438.31	18b
2,7-Dimethylnaphthalene	6	372.63–390.95	18b
2,7-Dimethylnaphthalene	13	372.62–433.98	7h
Cyclohexylbenzene	37	290.00–470.00	56
Fluorene	8	392.62–426.73	18b
1,2,3,4-Tetrahydrophenantrene	19	307.69–431.25	7
1,2-Diphenylethane	15	335.33–372.33	50
4-Methylphenantrene	18	331.71–445.27	7d
4,5,9,10-Tetrahydropyrene	11	418.41–518.51	7e
1,2,3,6,7,8-Hexahydropyrene	10	412.75–441.29	7e
1,2'-Dinaphthylmethane	10	343.30–422.94	18b
Alcohols, aldehydes, ketones			
Methanol	14	181.09–292.01	40a
Ethanol	11	196.20–271.40	22
Ethanol	20	163.51–294.31	40b
1-Propanol	66	181.79–303.06	39
1-Propanol	29	165.70–274.60	22
1-Propanol	7	152.10–194.10	61a
Miscellaneous			
1,1,3,3,5,5-Hexaethylcyclotrisiloxane	12	292.51–329.70	44
2-Ethoxy ethanol	7	300.60–328.30	80a
2-Metoxi ethanol	7	300.60–328.30	80a
2-Propoxi ethanol	7	300.60–328.30	80a
Carbon disulfide	18	163.93–297.43	5
Carbonyl chloride	24	148.38–279.40	21d
Carbonyl sulfide	14	137.33–220.87	41a
Cyclooctatetraene	12	272.97–328.33	75l
Hexamethyldisiloxane	20	208.94–370.89	75r
Perdeuteriumbenzene	9	283.50–322.60	87
Perdeuteriumcyclohexane	9	285.00–320.00	52
Perdeuteriumburylmethakrylat	32	208.34–329.40	44a
Perfluoroacetone	35	151.72–244.11	64
Tetramethylsilane	22	176.85–293.53	46
Trifluoroacetonitrile	18	131.95–196.98	60a
Undecafluoropiperidine	11	279.33–318.97	24
Inorganic compounds			
Aluminium trimethyl	11	286.03–377.56	47f
Ammonia	13	197.84–238.33	59
Ammonia	9	234.20–308.87	58
Ammonium hydroxide	18	197.12–290.21	31
Ammonium oxide	14	196.82–270.16	31

TABLE I. Continued

Compound	*n*	Δ*T*/K	Ref.	Compound	*n*	Δ*T*/K	Ref.
Isopropyl alcohol	12	188.45–292.84	40	Bromine trifluoride	9	285.55–316.27	55b
Butanol	25	188.22–322.33	9	Cadmium dimethyl	6	278.87–295.22	45
2-Methyl-1-butanol	6	303.02–326.16	80	Carbon dioxide	7	168.39–240.16	48
2-Methyl-2-butanol	6	303.02–326.16	80	Carbon monoxide	9	70.02–84.66	8
3-Methyl-1-butanol	6	303.02–326.16	80	Carbon suboxide	8	167.36–243.15	48
3-Methyl-2-butanol	6	303.02–326.16	80	Chlorine	11	178.98–236.77	21e
1-Pentanol	6	204.10–298.00	61c	Fluorine	6	58.14–81.32	32
2-Pentanol	6	303.02–326.16	80	Hydrazine	9	274.69–340.00	75u
3-Pentanol	6	303.02–326.16	80	Hydrogen bromide	6	189.93–205.11	21h
1-Hexanol	7	229.64–290.01	40b	Hydrogen cyanide	12	266.57–298.34	21f
2-(1,2-Dimethylpropyl)-5,6-dimethylheptenal	22	323.15–428.15	51	Hydrogen fluoride	13	197.89–289.09	32a
2-Pentylnonenal	22	323.15–428.15	51	Hydrogen sulfide	6	189.95–210.99	21
Acetone	14	180.31–296.99	40	Lithium methanoate	6	545.00–580.00	17
Benzaldehyde	69	218.03–425.30	1	Nitric acid	10	238.57–302.89	20
Cyclododecanone	12	269.80–325.50	68	Nitric acid monohydrate	8	239.89–298.63	20
Cyclopentadecanone	14	269.90–335.40	36	Nitric acid trihydrate	8	254.85–295.58	20
Diphenyl ketone	22	323.79–346.64	11	Nitrogen	7	65.02–77.74	21a
Esters, ethers, acids, anhydrides				Nitrogen oxide	6	112.81–120.56	37
Dimethyl ether	31	137.18–245.48	42	Oxygen	23	56.95–87.32	21c
Diethyl ether	36	159.89–271.21	9a	Sulfur dioxide	12	201.74–260.86	34a
Diethyl ether	10	164.40–290.00	61a	Water	21	273.15–373.15	23

$$c_{ps} = A + BT + CT^2 + DT^3 \quad (3)$$

$$c_{ps} = A + BT + C/T^2 + D/T^3 \quad (4)$$

The aim of this article is an evaluation of the polynomial models. Two-, three- and four-parameter polynomial models are tested on 354 sets of experimental data, with 6224 experimental points for 293 organic and inorganic pure compounds. The literature references for all sets of experimental data, with number of experimental points per set and temperature ranges are given in Table I.

The results are listed as follows: for two-parameters models in Table II, for three-parameter models in Table III, and for four-parameter models in Table IV. Overall percent errors

$$P_{\mathrm{av}} = \sum_{i=1}^{N} n_i \, p_{av,\,i} / \sum_{i=1}^{N} n_i, \qquad p_{av} = 100 \sum_{i=1}^{n} \left| c_{ps,\,\mathrm{exp},\,i} - c_{ps,\,\mathrm{cal},\,i} \right| / c_{ps,\,\mathrm{exp},\,i} \quad (5)$$

are presented in Tables II–IV.

TABLE II. Two-parameter models

$c_{ps} = A + BT^n$											
No.	n	P_{av}/%	No.	n	P_{av}/%	No.	n	P_{av}/%	No.	n	P_{av}/%
1.	– 2.5	1.596	5.	– 0.5	1.160	9.	0.67	0.807	13.	2.4	0.496
2.	–1.5	1.456	6.	– 0.33	1.109	10.	1	0.714	14.	2.5	0.498
3.	–1	1.310	7.	0.33	0.906	11.	1.5	0.594	15.	3	0.531
4.	– 0.67	1.210	8.	0.5	0.855	12.	2	0.514	16.	4	0.674
$c_{ps} = A + B \ln^n T$											
No.		n		P_{av}/%		No.		n		P_{av}/%	
17.		–1		1.119		18.		1		1.008	

TABLE III. Three-parameter models

$c_{ps} = A + BT^n + CT^m$											
No.	n	m	P_{av}/%	No.	n	m	P_{av}/%	No.	n	m	P_{av}/%
1.	–1	– 0.5	0.336	10.	1	–1	0.265	19.	1	5	0.264
2.	–1	0.5	0.286	11.	1	– 0.5	0.256	20.	2	– 2	0.246
3.	–1	2	0.239	12.	1	0.5	0.242	21.	2	0.4	0.236
4.	0.5	– 2	0.315	13.	1	1.4	0.236	22.	2	3	0.242
5.	0.5	2	0.236	14	1	1.5	0.236	23.	2	4	0.246
6.	0.5	2.4	0.238	15.	1	2	0.236	24.	2	5	0.251
7.	0.5	2.5	0.238	16.	1	2.4	0.238	25.	3	–2	0.256

TABLE III. Continued

$c_{ps} = A + BT^n + CT^m$

No.	n	m	P_{av}/%	No.	n	m	P_{av}/%	No.	n	m	P_{av}/%
8.	0.5	3	0.243	17.	1	3	0.242	26.	3	– 0.5	0.247
9.	1	– 2	0.285	18.	1	4	0.252	27.	3	4	0.248

$c_{ps} = A + BT^n + C \ln^m T$

No.	n	m	P_{av}/%	No.	n	m	P_{av}/%	No.	n	m	P_{av}/%
28.	–1	1	0.310	34.	2	1	0.236	40.	2.4	1	0.238
29.	0.5	1	0.260	35.	2	1.5	0.236	41.	2.4	2.4	0.238
30.	1	–1	0.255	36.	2	2	0.236	42.	2.4	3	0.238
31.	1	1	0.248	37.	2	2.5	0.236	43.	2.5	1	0.239
32.	1.5	1.5	0.239	38.	2	3	0.236	44.	3	1	0.245
33.	1.5	2	0.238	39.	2	4	0.236				

$c_{ps} = A + B \ln^n T + C \ln^m T$

No.	n	m	P_{av}/%	No.	n	m	P_{av}/%	No.	n	m	P_{av}/%
45.	1	– 2	0.301	46.	1	– 1	0.294	47.	1	2	0.275

TABLE IV. Four-parameter models

$c_{ps} = A + BT^n + CT^m + DT^k$

No.	n	m	k	P_{av}/%	No.	n	m	k	P_{av}/%	No.	n	m	k	P_{av}/%
1.	0.5	2	3	0.166	8.	1	2	– 1	0.172	14.	1	2	5	0.163
2.	1	– 2	– 3	0.190	9.	1	2	– 0.5	0.171	15.	1	3	0.5	0.168
3.	1	1.5	0.5	0.172	10.	1	2	0.5	0.170	16.	1	3	1.5	0.167
4.	1	1.5	2	0.169	11.	1	2	2.5	0.167	17.	1	3	2.5	0.165
5.	1	1.5	2.5	0.167	12.	1	2	3	0.166	18.	1	3	5	0.162
6.	1	2	– 3	0.175	13.	1	2	4	0.164	19.	2	3	4.5	0.162
7.	1	2	– 2	0.173										

$c_{ps} = A + BT^n + CT^m + D \ln^k T$

No.	n	m	k	P_{av}/%	No.	n	m	k	P_{av}/%	No.	n	m	k	P_{av}/%
20.	– 1	2	1	0.175	24.	1	1.4	1	0.176	28.	1	2	2	0.171
21.	0.5	2	1	0.176	25.	1	1.5	1	0.174	29.	1	3	1	0.169
22.	1	– 2	1	0.179	26.	1	2	– 1	0.171	30.	2	3	1	0.167
23.	1	0.5	1	0.184	27.	1	2	1	0.171					

RESULTS

Percentage overall error for two-parameter models was between 0.5 and 1.5 %, while for three-parameter models the error was about 0.25 %, while for the four-parameter models the error was about 0.16 %. These evaluations lead to the conclusion that correlation quality depends on the number of parameters, and slightly on the type of the models. Thus, on the base of these experimental data, the following models can be recommended: two-parameter model No. 18 (P_{av} = 0.496 %), three-parameter model No. 19 (P_{av} = 0.236 %), and four-parameter model No. 30 (P_{av} = 0.162 %).

NOTATION

c_{ps} – Saturated-liquid heat capacity, J/mol K
T – Temperature, K
A, B, C, D – Adjustable parameters of the models
p_{av} – Percentage average error
P_{av} – Percentage overall error
n – Number of experimental data points
N – Number of compounds
ΔT – Temperature range, K

Subscripts
exp – Experimental value
cal – Calculated value

ИЗВОД

ТОПЛОТНИ КАПАЦИТЕТ ЗАСИЋЕНЕ ТЕЧНОСТИ: НОВИ ПОЛИНОМСКИ МОДЕЛИ И ПРЕГЛЕД ЛИТЕРАТУРНИХ ПОДАТАКА

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У овом раду дат је преглед селектованих литературних експерименталних података топлотног капацитета c_p засићене течности. На основу ових података тестирани су полиномски корелациони модели са два, три и четири параметра. Констатовано је да квалитет корелације (укупна средња процентуална грешка) пре свега зависи од броја параметара модела, а мање од облика модела. Предложени су најбољи дво-, три- и четворопараметерски модели.

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