Structural contributions for calculating velocity of sound by Rao's method—Table IV

Types of Compounds	Constant β
Basic structure:	
Methane	1,850
Benzene	4,534
Cyclohexane	5,363
Naphthalene	6,566
Substituted radicals:	
$-\overset{\vert}{\underset{\vert}{C}}-$, $-\overset{\vert}{C}H-$, $-CH_2-$, $-CH_3$	872
$-COO-$	1,220
$-\overset{O}{\overset{\Vert}{C}}-H$	449
$-\overset{O}{\overset{\Vert}{C}}-$	872
$-NH$	638
$-NH_2$	478
$-COOH$	942
$-C\equiv N$	819
$-O-$	273
$-OH$	137
$-Cl$	610
$-Br$	692
$-I$	893
$-NO_2$	893
$-S$	550
$=S$	550
Double bonds	−254
Triple bonds	−507
Position contributions:	
Ortho	0
Meta	59
Para	117

ther hand, can be used even if no data are available.*

Velocity of Sound—Of the three methods considered for the velocity of sound, Rao's is the easiest to use, requires only density data, and appears to be the most reliable. Calculations on 144 organics yielded 95% reliability limits of ±23%. ■

* In this series, reliability limits means that 95% of the time the value calculated for *j*th thermophysical property by the *k*th method, in general class ABCDE, lies between +X% and −Y% of the experimental value.

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Accuracy of methods for isothermal and adiabatic compressibilities and velocity of sound—Table V

Class Symbol[a]	Kinds of Liquids	N^b	Avg. % Error[c]
ISOTHERMAL COMPRESSIBILITY			
Rao-Li Method			
A	All organics	16	−12.4 ± 64.4
A	Organics, excluding oxygen-containing compounds	8	9.62 ± 20.7
AK	Oxygen-containing organics	8	34.5 ± 50.2
Wada Method			
A	All organics	19	−0.03 ± 20.0
ACK	Nonassociated oxygen-containing organics	15	−2.62 ± 12.5
ADIABATIC COMPRESSIBILITY			
Rao Method			
A	All organics	146	−2.24 ± 7.0
ACEK	Associated, oxygen-containing organics (acids, alcohols, aldehydes)	37	−4.8 ± 11.4
ACK	Nonassociated oxygen-containing organics (ethers, esters, ketones)	39	−2.89 ± 20.1
A	Other organics	71	−1.33 ± 4.0
Wada Method			
A	All organics	132	−17.6 ± 51.9
VELOCITY OF SOUND			
Rao Method			
A	All organics	134	0.9 ± 22.7
AC	Polar organics	120	1.4 ± 19.8
ACE	Associated organics	46	0.3 ± 14.2
ACN	Halogenated organics	22	4.2 ± 16.6
ACF	Polar hydrocarbons	14	4.3 ± 24.4
AC	Polar organics, except associated, halogen-containing compounds, and hydrocarbons	38	−2.3 ± 20.3
AD	Nonpolar organics	14	−3.7 ± 51.0
Rykov Method			
A	All organics	67	12.2 ± 35.0
AC	Polar organics	65	12.2 ± 35.0
ACE	Associated organics	17	36.8 ± 32.4
ACN	Halogenated organics	8	3.8 ± 42.7
ACF	Polar hydrocarbons	17	4.1 ± 13.1
AC	Polar organics, except associated, halogen-containing ones, and hydrocarbons	23	3.8 ± 26.0
Surface-Tension Correlation			
A	All organics	112	−8.7 ± 52.5
AC	Polar organics	98	−9.0 ± 54.7
ACE	Associated organics	30	7.4 ± 25.3
ACN	Halogenated organics	16	−28.8 ± 80.0
ACF	Polar hydrocarbons	15	4.4 ± 23.3
AC	Polar organics, except associated, halogen-containing ones, and hydrocarbons	30	−19.4 ± 89.0

[a] Symbol definition given in Table IV of Part 8, *Chem. Eng.*, May 19, 1969, p. 194.
[b] Sample population.
[c] The ± value indicates the 95% reliability limits described in the footnote in the left-hand column of this page.

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* Data source.