A REVISED PARACHOR-MOLECULAR REFRACTION CONSTANT

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Samygin (1938) has shown the relationship between surface tension, index of refraction and density by the following equation:[1]

$$\gamma = \frac{(KU + CD)^4}{M} \qquad (1)$$

The following revision shows it to be a combination of the Parachor and Molecular Refraction formulae:

$$C = \frac{M\gamma^{1/4}}{D} - \frac{KM(n^2 - 1)}{D(n^2 + 2)} \qquad (2)$$

γ is surface tension, D is density, n is the index of refraction, and M is the molecular weight of the compound. K and C are constants having different values for saturated hydrocarbons, alcohols, acids, aldehydes and ketones. Samygin's equation is limited to the calculation of physical values and has little use for the interpretation of molecular structure.

The following revised Parachor-Molecular Refraction equation is more useful:

$$PR = \frac{M\gamma^{1/4}(n_D^{\,2} - 1)}{D(n_D^{\,2} + 2)} \qquad (3)$$

in which the refractive index using the D line of sodium was used as indicated by the subscript.

First approximations as obtained from calculations at 20° C. on thirty-one saturated aliphatic compounds give the following structural constants: OH in alcohols, 7.5; CH_2, 10.3; H, 0.3; C, 9.7; C = O in esters, aldehydes, ketones and anhydrides, 14.2; O in ethers, 3.9; and COOH, 19.1.

PR values obtained by using equation (3) agree well with calculated values using the structural constants. The first members of the series do not give as good agreement as the higher members.

[1]Samygin. 1938. *C. A.*, 32: 1155.

The Parachor and Molecular Refraction constants increase with temperature in many liquids. This has been interpreted in most of the cases examined as being due to association. It is probable that the PR constant will not have this temperature effect due to the factor

$$\frac{n^2 - 1}{n^2 + 2}$$

, which decreases with increase of temperature. Thus the PR constant is the Parachor corrected by the above compensating factor so as to obtain a physical constant that does not depend upon temperature. At temperatures at which the vapor pressure of the liquid reaches an appreciable value the density of the liquid may be corrected by substituting (D — d) for D, in which d is the density of the vapor.

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FEMALE WASP FIXES SEX OF HATCH FROM HER EGGS

Female insects of at least one group can regulate the sex of their offspring. Entomologists of the United States Department of Agriculture find that a parasitic wasp brought here from the Orient 15 years ago to help control the Japanese beetle varies the treatment of her eggs according to the size of the host on which she lays them. She withholds the sperms that insure a female hatch from eggs deposited on the relatively small worms—beetle larvae—that have moulted only once to enter the stage known as the second instar. Nearly all the young wasps from these eggs are males. The hatch from eggs laid on the larger, third-instar larvae, however, is preponderantly female.

To prove that the female wasp (*Tiphia popilliavora*) fixes the sex of her progeny when she deposits her eggs, the entomologists transferred eggs laid on second-instar larvae to third-instar larvae and those laid on third-instar larvae to second-instar larvae. Mostly males hatched out on the third-instar hosts and mostly females on the second-instar hosts.

These imported wasps will not deposit eggs on first-instar hosts—the small worms that have not yet moulted. They will lay them on second-instar larvae, but prefer third-instar larvae. Variations in numbers of second or third-instar larvae available to the wasp during its brief adult life cause it to fluctuate in numbers from year to year. This, the entomologists say, may be partly responsible for the failure of the wasp to become consistently numerous enough to fight the Japanese beetle as successfully in the United States as in the Far East, the native home of both.

VALUE OF BEES TO OTHERS GREATER THAN TO OWNERS

The beekeeper is not able to collect the cash value of the work his bees do—outside of the honey they produce—Dr. C. A. Browne of the United States Department of Agriculture said recently at a meeting of beekeepers. This byproduct labor of the bees, 3 to 10 times the value of the honey and beeswax, is the pollination of growing crops—particularly fruits.