

95. *Dipole Moment and Molecular Structure. Part XVI.*  
*Configuration of Ethylenic Compounds.*

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THE application of dipole moments to the determination of configuration is particularly useful in the case of rigid molecules, *e.g.*, benzene and ethylene derivatives; for the latter, only scanty data are available (Errera, *Physikal. Z.*, 1926, 27, 764; 1928, 29, 689; *J. Phys. Radium*, 1925, 6, 390; Bergmann, Engel, and Meyer, *Ber.*, 1932, 65, 446).

I. Ethylene compounds in this series contain substituents with axes of symmetry in the direction of their bonding. The following table records the dipole moments (Debye units) determined in solution.



of which is indistinguishable from that of benzophenone (compare ethyl benzoate and ethyl cinnamate). Comparison of benzylidene-*p*-bromo- with *pp'*-dibromobenzylideneacetophenone (2.93 and 2.03) and of benzylidene- with *p*-bromobenzylideneacetophenone (2.92 and 2.47) shows that the latter compounds contain the polar groups in the *trans*-position. In  $\alpha\beta$ -dibromobenzylideneacetophenone the bromine moments neutralise each



other and are therefore in the *trans*-position (III). For similar reasons, in (IV) the polar groups must lie on the same side of the double bond.

Probably that form of  $\alpha$ -bromobenzylideneacetophenone investigated corresponds configuratively to the  $\alpha$ -bromocinnamic acid of m. p. 126° (moment of the ester 2.80); both have much higher moments than the non-brominated parent substances.

III. In connexion with the above investigations, the dipole moments of some related substances have been measured. The moments of ethyl *p*-nitro- and methyl *p*-bromo- $\beta$ -

Compound.	$\mu$ .	Compound.	$\mu$ .
Ethyl $\beta$ -phenylpropionate.....	1.75	Phenylchloroacetylene .....	1.21 <sup>3</sup>
Ethyl <i>p</i> -nitro- $\beta$ -phenylpropionate .....	4.58	Ethyl <i>p</i> -phenylbenzoate.....	2.01 <sup>4</sup>
Methyl <i>p</i> -bromo- $\beta$ -phenylpropionate .....	2.39	$\omega$ -Nitrostyrene.....	4.48
Tolan .....	0 <sup>1</sup>	$\omega$ -Chlorostyrene .....	1.40
Ethyl phenylpropionate.....	2.19 <sup>2</sup>	$\omega$ -Bromostyrene .....	1.51
Ethyl <i>p</i> -nitrophenylpropionate .....	3.54	$\omega$ -Ethoxystyrene.....	1.68

<sup>1</sup> Cf. Weissberger and Sängewald (*Z. physikal. Chem.*, 1933, *B*, **20**, 145) and the erroneous determination by Smyth and Dornte (*J. Amer. Chem. Soc.*, 1931, **53**, 1296). <sup>2</sup> Cf. the high value found by Otto (*ibid.*, 1934, **57**, 1263) and the data for phenylacetylene (Smyth and Dornte, *loc. cit.*; Bergmann and Tschudnovsky, *Z. physikal. Chem.*, 1932, *B*, **17**, 116). <sup>3</sup> Cf. Pflaum and Wenzke, *J. Amer. Chem. Soc.*, 1934, **56**, 1106. <sup>4</sup> Cf. Weissberger, *Z. physikal. Chem.*, 1933, *B*, **20**, 145.

phenylpropionate point definitely to a kind of *cis*-structure for these compounds, since their moments are higher than those of ethyl *p*-nitro- and ethyl  $\beta$ -bromo-cinnamate, respectively. Ramart-Lucas (Solvay lecture, 1931) assigned a "*cis*-structure" to  $\beta$ -phenylpropionic acid. The moment of ethyl *p*-nitrophenylpropionate, which is almost identical with that of ethyl *trans-p*-nitrocinnamate, shows that the acetylene compound is straight.

#### EXPERIMENTAL.

*Materials.*—*iso*Stilbene (Schlenk and Bergmann, *Annalen*, 1928, **463**, 115) had b. p. 148—149°/17 mm. *pp'*-Dinitrostilbene (Walden and Kernbaum, *Ber.*, 1890, **23**, 1959) was recrystallised from glacial acetic acid, m. p. 280—285°.  $\alpha\beta$ -Diphenylstyryl chloride (Bergmann and Bondi, *Ber.*, 1931, **64**, 1467), m. p. 117°. *o*-Phenylbenzotrile (Schlenk and Bergmann, *Annalen*, 1928, **464**, 34) had m. p. 41° (Pfeiffer *et al.*, *ibid.*, **467**, 174 describe it as an oil). Ethyl  $\beta$ -phenylcinnamate (Schlenk and Bergmann, *ibid.*, 1928, **463**, 237), b. p. 205°/16 mm. Ethyl *p*-nitrocinnamate (Drewsen, *ibid.*, 1882, **212**, 150), m. p. 141°, from alcohol. Methyl  $\alpha$ -phenylcinnamate (Bergmann and Schreiber, *Ber.*, 1933, **66**, 44), m. p. 75°. Benzylideneacetophenone (Schlenk and Bergmann, *Annalen*, 1928, **463**, 234), m. p. 55°. *p*-Bromobenzylideneacetophenone (Weygand, *ibid.*, 1927, **459**, 118), from methyl alcohol, m. p. 120°; yield 65%. Benzylidene-*p*-bromoacetophenone (Bergmann and Hampson, *J.*, 1935, 989), from light petroleum, m. p. 105°. *pp'*-Dibromobenzylideneacetophenone (Bergmann, Hoffmann, and Meyer, *J. pr. Chem.*, 1932, **135**, 252; cf. Blatt, *J. Amer. Chem. Soc.*, 1931, **53**, 1139), from toluene, m. p. 185—186°. Tolan (Schlenk and Bergmann, *Annalen*, 1928, **463**, 76), b. p. 158°/12 mm., from light petroleum, m. p. 60°. Ethyl phenylpropionate, from the acid (Schlenk and Bergmann, *ibid.*, p. 82), had b. p. 137—138°/12 mm. Ethyl *p*-nitrophenylpropionate, from the crude acid (Perkin and Bellenot, *J.*, 1886, **49**, 441), had m. p. 126°. Phenylchloroacetylene (Truchat, *Ann. Chim.*, 1931, **16**, 309), b. p. 74°/15 mm.  $\omega$ -Nitrostyrene (Thiele and Haackel, *Annalen*, 1902, **325**, 7), from methyl alcohol, m. p. 60°.  $\omega$ -Ethoxystyrene (Nef, *Annalen*, 1899, **308**, 26), b. p. 98—100°/13 mm.  $\omega$ -Chlorostyrene (Erlenmeyer, *Ber.*, 1881, **14**, 1868; see Biltz, *Annalen*, 1879, **296**, 266), b. p. 89°/17 mm. Ethyl cinnamate (b. p. 263°), methyl *p*-bromobenzoate (m. p. 81°), ethyl *p*-nitrobenzoate (m. p. 57°), ethyl  $\beta$ -phenylpropionate (b. p. 242°), and  $\omega$ -bromostyrene (b. p. 108°/20 mm.) were commercial samples.

**$\alpha\beta$ -Dichlorostilbenes.** (a) By Blank's method (*Annalen*, 1888, **248**, 21), 30 g. of tolan on chlorination by 12 g. of the gas afforded first 0.8 g. (Found: C, 67.2; H, 4.3. Calc. for  $C_{14}H_{10}Cl_2$ : C, 67.5; H, 4.0%), m. p. 143—144°; and ether extraction of the residue of the mother-liquors gave a product which, after several recrystallisations from methyl alcohol, had m. p. 67—69°, and was a *molecular compound* (see below) (Found: Cl, 20.9.  $2C_{14}H_{10}Cl_2, C_{14}H_{10}$  requires Cl, 21.0%).

(b) Tolane tetrachloride (24 g.; Redsko, *Ber.*, 1889, **22**, ref., 760) was heated with copper bronze (25 g.) (see Onufrowicz, *Ber.*, 1884, **17**, 835) under reduced pressure (20 mm.) in a Claisen flask. At 220° (bath temp.) a colourless liquid distilled over, which crystallised rapidly. The crude product was shaken for 12 hours with 100 c.c. of alcohol (which does not dissolve the higher-melting  $\alpha\beta$ -dichlorostilbene formed), the alcohol distilled off, and the residue triturated with ice-cold light petroleum. The substance, recrystallised from methyl alcohol, had m. p. 60°. When methyl-alcoholic solutions of this (2 mols.) and tolan (1 mol.) were mixed, characteristic crystals of the above double compound were obtained; m. p. and mixed m. p. 65—66°.

**$\alpha\beta$ -Dibromostilbenes.** (a) The bromination product of tolan in ether (Limpricht and Schwanert, *Ber.*, 1871, **4**, 379) was extracted with hot alcohol after evaporation of the ether. The greater part of the higher-melting isomeride remained undissolved, and was recrystallised from propyl alcohol; m. p. 206—208°; yield, 70% (Found: C, 49.8; H, 3.2. Calc. for  $C_{14}H_{10}Br_2$ : C, 49.7; H, 3.0%). The alcoholic extract gave on cooling a further crop of the higher-melting compound; its mother-liquor gave on evaporation a residue, which was recrystallised several times from methyl alcohol. The long brittle needles, m. p. 77°, were a *molecular compound* (see below) (Found: C, 59.3; H, 3.7.  $2C_{14}H_{10}Br_2, C_{14}H_{10}$  requires C, 59.0; H, 3.5%).

(b) 5 G. of the higher-melting compound were partly isomerised (see Limpricht and Schwanert, *loc. cit.*) by 18 hours' heating with 20 c.c. of water in a sealed tube at 180°. From the crystalline mass obtained, the lower-melting isomeride was extracted with cold alcohol; the solution was evaporated, and the residue triturated with ice-cold light petroleum, filtered off, and several times fractionated from the same solvent; m. p. 66—68° (yield, very small). With tolan in light petroleum (ratio 2 : 1), the substance gave the above double compound, m. p. 77°.

**$\alpha\beta$ -Di-iodostilbene.** The product from tolan and iodine (Fischer, *Annalen*, 1882, **211**, 233) was triturated with cold chloroform, and the residue several times recrystallised from the same solvent; leaflets, m. p. 204° (decomp.) (yield, 10%) (Found: I, 58.6. Calc. for  $C_{14}H_{10}I_2$ : I, 59.0%).

**$\alpha\beta$ -Dinitrostilbene.** The crystals prepared by Schmidt's method (*Ber.*, 1901, **34**, 621) were recrystallised six times from alcohol; yellowish prisms, m. p. 185—186°. The lower-melting isomeride could not be detected.

**$\alpha\beta$ -Diphenyl-*p*-chlorostyryl bromides.** Koelsch (*J. Amer. Chem. Soc.*, 1932, **54**, 2487) stated that apparently uniform preparations of certain triarylvinyl bromides gave, on treatment with magnesium and then with carbon dioxide, mixtures of stereoisomeric triarylacrylic acids. It is more likely that the ability of bromides to form mixed crystals or molecular compounds prevents final purification in these cases.  $\alpha\beta$ -Diphenyl-*p*-chlorostyrene (31 g.) in glacial acetic acid (100 c.c.) was treated with bromine (5.2 c.c.) in the same solvent (10 c.c.), and the resulting crystals were heated with benzene. Hydrogen bromide was vigorously evolved, and the clear solution obtained was evaporated, the residue washed with methyl alcohol, and recrystallised several times from propyl and amyl alcohol; yield, 14.5 g., m. p. 160°. The glacial acetic acid mother-liquor was poured into a large volume of water, extracted with ether, and the solution evaporated. Several recrystallisations of the remaining crop from alcohol and glacial acetic acid gave a substance, m. p. 112—113° (not sharp), which was proved by dipole-moment measurements to be a double compound of both the possible isomerides.

**$\alpha$ -Bromostilbenes.** (a) From stilbene dibromide (m. p. 239°), by the method of Wislicenus and Seeler (*Ber.*, 1895, **28**, 2693), an oil was finally obtained, but it could not be purified because distillation (b. p. 187—191°/17 mm.) caused partial isomerisation.

(b) The same procedure with stilbene dibromide (m. p. 110°; 7.5 g.) and potassium hydroxide (1.3 g.) gave the solid  $\alpha$ -bromostilbene, which could be separated from the crude product by means of cold benzene. The benzene solution was evaporated in a vacuum desiccator, and the remaining crystals had m. p. 31°.

**Ethyl allocinnamate.** Ethyl phenylpropionate (15 g.) in alcohol (20 c.c.) was catalytically hydrogenated in presence of a palladium-barium sulphate catalyst (1.5 g.) at room temperature. The required amount of hydrogen was absorbed in about 3 hours; b. p. 131—134°/17 mm.; yield 11 g. (Found: C, 75.0; H, 7.0. Calc. for  $C_{11}H_{12}O_2$ : C, 75.0; H, 6.8%).

**Methyl *p*-nitro- $\alpha$ -phenylcinnamate.** Prepared by recorded methods (Bakunin, *Gazzetta*, 1895,

25, I, 146, 175; 1901, 31, II, 83; see Sudborough and Lloyd, J., 1898, 73, 90), this formed prisms, m. p. 141—142°, from alcohol.

*αβ-Dibromocinnamic acids.* Phenylpropionic acid (40 g.) was treated with bromine (44 g.) in ice-cold chloroform, the solvent evaporated, and the residue triturated with benzene and light petroleum (1 : 1) and recrystallised from benzene. The large colourless leaflets of the *trans*-isomeride (20 g., m. p. 134°) crystallised first, then the yellow prisms of the *cis*-acid (1.2 g., m. p. 98°). The addition of bromine is, therefore, largely a "*trans*-reaction." The methyl ester of the *cis*-acid (1.2 g.) was prepared by use of diazomethane (0.2 g.) in ether; yield, 1 g., b. p. 171—172°/18 mm. (Found : C, 37.7; H, 2.7. Calc. for  $C_{10}H_8O_2Br_2$  : C, 37.5; H, 2.5%). In the same way the *trans*-acid (5 g.) and diazomethane (1 g.) gave the corresponding methyl ester (4.1 g.), b. p. 167°/15 mm. On esterification with 3% alcoholic hydrochloric acid (boiling for 48 hours), no stereochemical rearrangement of the *trans*-acid occurred; the ester, b. p. 174°/12 mm., contained the bromine atoms in the *trans*-position.

*β-Bromocinnamic acids.* By the method of Sudborough and Thompson (J., 1903, 83, 1156), phenylpropionic acid (22 g.) afforded ultimately 20 g. of the *trans*-acid (m. p. 132—134°) and 10.5 g. of the *cis*-acid (m. p. 159°), the preponderance of the former acid being contrary to recorded results. (Debromination of the *β*-bromocinnamic acids is accompanied by total configurational inversion, and is therefore not simply a substitution of hydrogen for the bromine atom, but more probably addition of hydrogen to the double bond, followed by elimination of hydrogen bromide; in the intermediate stage, the configurational rigidity of the molecules is lost and steric change can occur.) The higher-melting acid (5 g.) gave with diazomethane (1 g.) in ether the methyl ester (3.9 g.), m. p. 58°, from alcohol. The lower-melting acid was quantitatively esterified with 3% alcoholic hydrochloric acid; the *ester* had b. p. 171—172°/18 mm. (Found : C, 51.8; H, 4.5.  $C_{11}H_{11}O_2Br$  requires C, 51.8; H, 4.3%). In both esterification reactions, no configurational change occurs (cf. Auwers and Schmellenkamp, *Ber.*, 1921, 54, 624; James, J., 1911, 99, 1626).

*αβ-Dibromobenzylideneacetophenone.* This was prepared according to Dufraisse (*Compt. rend.*, 1920, 171, 1062) from benzoylphenylacetylene (Nef, *Annalen*, 1899, 308, 267), and recrystallised from alcohol, and then from light petroleum; m. p. 113—114°. *β*-Bromobenzylideneacetophenone (Dufraisse, *loc. cit.*) was a yellow, thick oil, b. p. 219—220°/14 mm.; and the *α*-isomeride (Abell, J., 1912, 101, 1002) had b. p. 218—219°/14 mm., but could not be induced to crystallise.

*α-Bromocinnamic acids.* (a) Higher-melting acid. Phenylpropionic acid was treated with a stream of gaseous hydrogen bromide (see J., 1903, 83, 1156), and the product purified through the barium salt; m. p. 130—131°. Esterification with 3% alcoholic hydrogen chloride (4 hours' boiling) afforded the ester, b. p. 169°/15 mm., in 75% yield.

(b) Lower-melting acid. *αβ*-Dibromo-*β*-phenylpropionic acid was treated with alcoholic potash solution (Sudborough and Thompson, *loc. cit.*); purification through the barium salt, and recrystallisation from benzene-light petroleum afforded the acid; m. p. 120°. The silver salt (10 g.) was heated with iodine-free ethyl iodide (9.3 g.) and a few c.c. of absolute ether in a sealed tube for 1 hour at 100°; the mass was extracted with ether, and the residue distilled in a vacuum; b. p. 156—157°/15 mm. (yield, 2 g.).

*Methyl p-bromo-β-phenylpropionate.* The acid (8 g.) (Glaser, *Annalen*, 1867, 143, 341; from methyl alcohol, m. p. 136°) was esterified with diazomethane (2 g.) in ether, affording the *ester* in quantitative yield; b. p. 154—155°/16 mm. (Found : C, 49.6; H, 4.8.  $C_{10}H_{11}O_2Br$  requires C, 49.4; H, 4.5%).

*Ethyl p-phenylbenzoate.* 4-Acetyldiphenyl (J. Amer. Chem. Soc., 1930, 52, 3718) (30 g.), potassium hydroxide (18 g.), potassium permanganate (96 g.), and water (1 l.) were boiled for 3 hours; the colourless liquid was immediately filtered and acidified, affording 17 g. of *p*-phenylbenzoic acid, m. p. 210°. The acid (30 g.) was boiled with thionyl chloride (120 g.) for 5 hours, the excess chloride distilled off, and the *acid chloride* recrystallised from light petroleum, forming clusters of needles, m. p. 112° (24 g.) [Found (method of Baubigny) : Cl, 16.6.  $C_{13}H_9OCl$  requires Cl, 16.2%]. It (7.5 g.) was treated with alcohol (40 c.c.) at room temperature (24 hours), and the solution boiled, filtered, and cooled, the resulting leaflets being recrystallised from light petroleum; m. p. 45°.

*Measurements.*—In the following tables,  $c$  = molar fraction,  $\bar{M}$  = average molecular weight of the solution,  $\zeta$  = density,  $\epsilon$  = dielectric constant,  $n$  = refractive index,  $P_{\frac{1}{2}}(P_{E_1})$  = total (electronic) polarisation of the solution,  $P(P_E)$  = the same for the solute,  $P_{A+O}$  = (atomic and) orientation polarisation, which is extrapolated graphically for infinite dilution. Most of the experiments were carried out in benzene as solvent. The dipole moment of *pp'*-dibromo-

benzylideneacetophenone was determined in dioxan, that of *pp'*-dinitrostilbene, m. p. 285°, in  $\alpha$ -methyl-naphthalene. The physical constants of dioxan were taken from the data of Williams (*J. Amer. Chem. Soc.*, 1930, 52, 1831, 1838; see Bergmann and Schuetz, *Z. physikal. Chem.*, 1932, B, 19, 395) and from unpublished work done in our laboratory. The data for  $\alpha$ -methyl-naphthalene are due to Bergmann and Schuetz (*loc. cit.*). The experiments were made partly in collaboration with Dr. W. Schuetz.

*iso*Stilbene;  $t = 17.6^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$n^2$ .	$P_{\downarrow}$ .	$P_{E\downarrow}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8815	2.2888	2.2888	26.590	26.590	—	—	—
0.02039	80.080	0.8875	—	2.3081	—	27.397	—	66.16	—
0.03542	81.613	0.8919	2.3133	2.3223	27.860	27.993	62.44	66.20	—
0.05480	83.590	0.8977	2.3262	2.3400	28.546	28.751	62.27	66.02	—
0.06664	84.797	0.9011	2.3351	2.3504	28.980	29.209	62.46	65.90	—

$$\mu = 0.$$

*pp'*-Dinitrostilbene (m. p. 285°) in  $\alpha$ -methyl-naphthalene;  $t = 16.4^\circ$ .

0	142	1.0240	2.7336	2.7336	50.787	50.787	—	—	—
0.00047	142.06	1.0241	2.7347	2.7345	50.824	50.820	131.05	121.68	—

$$\mu \sim 0.$$

 $\alpha\beta$ -Dichlorostilbene (m. p. 143—144°);  $t = 15.25^\circ$ .

0	78	0.8843	2.2935	2.2935	26.575	26.575	—	—	—
0.00475	78.812	0.8880	2.2989	2.2983	26.816	26.807	77.28	75.36	—
0.01240	80.121	0.8941	2.3074	2.3066	27.199	27.188	76.93	75.97	—

$$\mu = 0.$$

 $\alpha\beta$ -Dichlorostilbene (m. p. 60°);  $t = 19.9^\circ$ .

0	78	0.8788	2.2842	2.2842	26.606	26.606	—	—	→
0.00599	79.024	0.8829	2.3506	2.2898	27.786	26.911	223.74	77.55	146.19
0.00707	79.210	0.8836	2.306	2.2909	27.966	26.969	218.82	77.85	140.97
0.01423	80.434	0.8886	2.4422	2.2083	29.470	27.341	227.81	78.25	149.56
0.01634	80.794	0.8900	2.4669	2.3007	29.811	27.456	222.74	78.58	144.16

$$P_{A+0}^x = 152.5. \quad \mu = 2.69.$$

 $\alpha\beta$ -Dibromostilbene (m. p. 68°);  $t = 19.9^\circ$ .

0	78	0.8788	2.2842	2.2842	26.606	26.606	—	—	→
0.00548	79.425	0.8860	2.3415	2.2913	27.699	26.974	225.88	93.75	132.13

$$P_{A+0}^x \sim 435. \quad \mu = 2.53.$$

 $\alpha\beta$ -Dinitrostilbene (m. p. 185—186°);  $t = 16.4^\circ$ .

0	78	0.8829	2.2012	2.2912	26.583	26.583	—	—	—
0.00519	78.996	0.8873	2.2964	2.2068	26.863	26.869	80.57	81.65	—
0.00657	79.261	0.8884	2.2982	2.2983	26.948	26.949	82.08	82.27	—

$$\mu = 0.$$

 $\alpha\beta$ -Diphenyl-*p*-chlorostyryl bromide (m. p. 160°);  $t = 17.1^\circ$ .

0	78	0.8821	2.2898	2.2898	26.587	26.587	—	—	→
0.00706	80.058	0.8919	2.3716	2.3025	28.163	27.173	249.73	109.59	140.14
0.00828	80.413	0.8936	2.3872	2.3046	28.454	27.273	252.10	109.45	142.65
0.00958	80.792	0.8954	2.4069	2.3073	28.805	27.385	258.09	109.88	148.28
0.01054	81.072	0.8968	2.4175	2.3089	29.009	27.461	256.39	109.54	146.85

$$P_{A+0}^x \text{ (average)} = 144.48. \quad \mu = 2.61.$$

 $\alpha\beta$ -Diphenyl-*p*-chlorostyryl bromide (m. p. 113°);  $t = 16.2^\circ$ .

0	78	0.8831	2.2916	2.2916	26.581	26.581	—	—	→
0.00967	80.818	0.8963	2.3366	2.3102	27.791	27.409	151.69	112.19	39.50
0.01414	82.123	0.9024	2.3684	2.3188	28.506	27.789	162.67	111.96	50.71
0.01935	83.642	0.9095	2.3973	2.3287	29.221	28.227	162.99	111.60	51.39

$$P_{A+0}^x = 52.3. \quad \mu = 1.57.$$

 $\alpha\beta$ -Diphenylstyryl chloride;  $t = 17.5^\circ$ .

0	78	0.8816	2.2890	2.2890	26.589	26.589	—	—	→
0.01025	80.153	0.8879	2.3395	2.3059	27.864	27.378	151.07	103.62	47.45
0.02160	82.590	0.8949	2.3907	2.3235	29.291	28.251	151.73	103.56	48.17
0.02710	83.758	0.8983	2.4240	2.3324	30.011	28.675	152.91	103.57	49.34
0.02970	84.311	0.8999	2.4389	2.3385	30.370	28.905	153.91	104.57	49.34

$$P_{A+0}^x = 49.5. \quad \mu = 1.53.$$

$\alpha$ -Bromostilbene (m. p. 31°);  $t = 20.85^\circ$ .

$c.$	$\overline{M.}$	$\zeta.$	$\epsilon.$	$n^2.$	$P_i.$	$P_{Ei.}$	$P.$	$P_E.$	$P_{A+o.}$
0	78	0.8777	2.2823	2.2823	26.612	26.612	—	—	→
0.01676	81.033	0.8947	2.3512	2.3069	28.125	27.484	116.95	78.67	38.28
0.02433	82.403	0.9024	2.3813	2.3170	28.791	27.859	116.18	77.89	38.29
0.03352	84.067	0.9117	2.4173	2.3300	29.584	28.322	115.29	77.63	37.66
0.04392	85.949	0.9223	2.4594	2.3391	30.498	28.759	115.09	75.51	39.58

$$P_{A+o}^x = 40.05. \quad \mu = 1.38.$$

 $\alpha$ -Bromostilbene, liquid;  $t = 23.05^\circ$ .

0	78	0.8751	2.2778	2.2778	26.625	26.625	—	—	→
0.00796	79.441	0.8841	2.3039	2.2891	27.224	27.008	101.92	74.67	27.25
0.01033	79.870	0.8867	2.3142	2.2928	27.438	27.125	105.32	75.03	30.29
0.01895	81.429	0.8965	2.3458	2.3049	28.128	27.533	105.96	74.54	31.42

$$P_{A+o}^x = 35.4. \quad \mu = 1.30.$$

Ethyl cinnamate;  $t = 20.2^\circ$ .

0	78	0.8784	2.2836	2.2836	26.608	26.608	—	—	→
0.01747	79.712	0.8836	2.3656	2.2921	28.218	27.156	(118.76)	57.99	(60.77)
0.02745	80.690	0.8866	2.4324	2.2972	29.411	27.473	128.73	58.13	70.60
0.03615	81.542	0.8892	2.4798	2.3015	30.292	27.747	128.53	58.13	70.40
0.04083	82.001	0.8906	2.5095	2.3045	30.822	27.905	129.83	58.38	71.45

$$P_{A+o}^x = 71.3. \quad \mu = 1.84.$$

Ethyl *allocinnamate*;  $t = 15.4^\circ$ .

0	78	0.8841	2.2932	2.2932	26.576	26.576	—	—	→
0.01694	79.660	0.8899	2.3678	2.2958	28.032	27.004	112.55	51.86	60.69
0.02472	80.422	0.8925	2.3084	2.2974	28.648	27.203	110.42	51.97	58.45
0.03246	81.181	0.8951	2.4401	2.2981	29.415	27.390	114.06	51.67	62.39
0.03969	81.889	0.8976	2.4704	2.3000	30.002	27.582	112.92	51.94	60.98

$$P_{A+o}^x = 67.2. \quad \mu = 1.77.$$

Ethyl  $\beta$ -phenylcinnamate;  $t = 18.7^\circ$ .

0	78	0.8802	2.2866	2.2866	26.599	26.599	—	—	→
0.01678	80.920	0.8887	2.3937	2.2967	28.882	27.478	162.65	79.00	79.67
0.02138	81.721	0.8911	2.4226	2.3060	29.500	27.816	162.27	83.50	79.29
0.02567	82.466	0.8933	2.4458	2.3100	30.023	28.135	159.99	86.44	77.01

$$P_{A+o}^x = 83.0. \quad \mu = 1.98.$$

*o*-Phenylbenzotrile;  $t = 17.7^\circ$ .

0	78	0.8814	2.2886	2.2886	26.592	26.592	—	—	→
0.00324	78.327	0.8825	2.3567	2.2919	27.639	26.704	350.39	61.48	288.91
0.00490	78.495	0.8831	2.3952	2.2924	28.216	26.763	357.81	61.59	296.22
0.00656	78.663	0.8837	2.4344	2.2936	28.795	26.821	362.43	61.50	300.93
0.00994	79.004	0.8848	2.5095	2.2963	29.880	26.941	358.32	61.72	296.60

$$P_{A+o}^x = 308.0. \quad \mu = 3.81.$$

Ethyl *p*-nitrocinnamate;  $t = 21.3^\circ$ .

0	78	0.8771	2.2814	2.2814	26.615	26.615	—	—	→
0.00475	78.678	0.8787	2.3779	2.2855	28.149	26.828	323.01	71.32	251.69
0.01176	79.682	0.8836	2.5209	2.2920	30.337	27.146	316.44	71.71	244.73
0.01486	80.125	0.8853	2.5841	2.2950	31.276	27.289	313.65	71.95	241.70

$$P_{A+o}^x = 256.4. \quad \mu = 3.50.$$

Methyl  $\alpha$ -phenylcinnamate;  $t = 18.4^\circ$ .

0	78	0.8806	2.2872	2.2872	26.596	26.596	—	—	→
0.00723	79.157	0.8839	2.3308	2.2950	27.519	27.003	154.37	82.96	71.41
0.01622	80.597	0.8880	2.3903	2.3046	28.743	27.508	158.84	82.87	76.06
0.02038	81.261	0.8899	2.4120	2.3093	29.223	27.743	155.48	82.91	72.57
0.02224	81.558	0.8908	2.4240	2.3108	29.477	27.840	156.19	82.56	73.63

$$P_{A+o}^x = 78.4. \quad \mu = 1.92.$$

Methyl *p*-nitro- $\alpha$ -phenylcinnamate;  $t = 16.8^\circ$ .

0	78	0.8824	2.2904	2.2904	26.585	26.585	—	—	→
0.00315	78.646	0.8853	2.3569	2.2968	27.670	28.811	369.68	98.24	271.44
0.00397	78.814	0.8861	2.3779	2.2999	27.996	26.878	381.43	100.25	271.18
0.00466	78.955	0.8867	2.3938	2.3008	28.247	26.932	383.38	101.03	282.35
0.00620	79.272	0.8881	2.4025	2.3039	28.573	27.043	350.18	100.26	249.92

$$P_{A+o}^x = 305.0. \quad \mu = 3.78.$$

Methyl  $\alpha\beta$ -dibromocinnamate (m. p. 134°);  $t = 21.4^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.08771	2.2814	2.2814	26.615	26.615	—	—	→
0.01452	81.718	0.9023	2.3713	2.2905	28.413	27.242	150.39	69.77	80.62
0.01682	82.305	0.9062	2.3844	2.2921	28.677	27.340	149.21	69.72	79.49
0.02050	82.248	0.9126	2.4066	2.2942	29.117	27.492	148.66	69.38	79.28

$$P_{A+0}^x = 82.1. \quad \mu = 1.98.$$

Methyl  $\alpha\beta$ -dibromocinnamate (m. p. 100°);  $t = 21.4^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8770	2.2812	2.2812	26.616	26.616	—	—	→
0.00378	78.914	0.8847	2.3181	2.2836	27.227	26.728	(188.48)	56.18	(132.30)
0.00594	79.438	0.8891	2.3453	2.2851	27.674	26.793	204.82	56.45	148.37
0.00728	79.763	0.8919	2.3613	2.2859	27.914	26.833	204.88	56.36	148.52

$$P_{A+0}^x = 150.6. \quad \mu = 2.68.$$

Methyl  $\beta$ -bromocinnamate (m. p. 159°);  $t = 21.6^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8768	2.2807	2.2807	26.616	26.616	—	—	→
0.00903	79.599	0.8865	2.3726	2.2856	28.185	26.934	200.33	61.88	138.45
0.01371	80.426	0.8915	2.4163	2.2885	28.930	27.105	195.45	62.30	133.15
0.02016	81.569	0.8985	2.4874	2.2927	30.091	27.338	198.96	62.44	136.52
0.02649	82.689	0.9053	2.5482	2.2971	31.091	27.569	195.52	62.61	132.91

$$P_{A+0}^x = 144.7. \quad \mu = 2.63.$$

Ethyl  $\beta$ -bromocinnamate (m. p. 134°);  $t = 19.2^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8796	2.2856	2.2856	26.601	26.601	—	—	→
0.01247	80.032	0.8938	2.3455	2.2914	27.725	26.945	116.78	54.22	62.56
0.01460	80.380	0.8962	2.3591	2.2929	27.963	27.012	119.94	54.81	65.13
0.01972	81.214	0.9020	2.3849	2.2955	28.435	27.154	119.65	54.66	64.99
0.02660	82.336	0.9099	2.4162	2.2990	29.019	27.343	117.51	54.51	63.00

$$P_{A+0}^x = 69.2. \quad \mu = 1.81.$$

Methyl *p*-bromobenzoate;  $t = 14.0^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8857	2.2962	2.2962	26.569	26.569	—	—	→
0.01614	80.211	0.9036	2.3798	2.3015	27.965	26.858	113.08	44.47	68.61
0.02057	80.818	0.9085	2.4006	2.3029	28.313	26.963	111.34	44.37	66.97
0.02676	81.666	0.9154	2.4320	2.3048	28.827	27.042	110.94	44.23	66.71
0.03446	82.721	0.9239	2.4714	2.3074	29.464	27.177	110.57	44.20	66.37

$$P_{A+0}^x = 70.9. \quad \mu = 1.82.$$

Benzylideneacetophenone;  $t = 19.8^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8789	2.2844	2.2844	26.606	26.606	—	—	→
0.00710	78.924	0.8823	2.3813	2.2952	28.202	26.976	251.31	78.69	172.62
0.01176	79.528	0.8845	2.4492	2.3033	29.285	27.229	254.56	79.67	174.89
0.01614	80.099	0.8867	2.5155	2.3114	30.319	27.477	256.62	80.59	176.03

$$P_{A+0}^x = 179.4. \quad \mu = 2.92.$$

*pp'*-Dibromobenzylideneacetophenone, in dioxan;  $t = 17.1^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	88	1.0343	2.4187	2.4187	27.318	27.318	—	—	→
0.00493	89.372	1.0425	2.4582	2.4370	28.040	27.764	173.60	90.43	83.17
0.00683	89.800	1.0457	2.4715	2.4460	28.293	27.961	169.92	90.13	79.79

$$P_{A+0}^x = 88.0. \quad \mu = 2.03.$$

*p*-Bromobenzylideneacetophenone;  $t = 22.15^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8761	2.2796	2.2796	26.619	26.619	—	—	→
0.00932	79.949	0.8882	2.3715	2.2993	28.239	27.201	200.36	89.03	111.33
0.01238	80.587	0.8922	2.4104	2.3044	28.885	27.373	209.65	87.47	122.18
0.01513	81.162	0.8958	2.4334	2.3111	29.294	27.554	203.43	88.43	115.00
0.01838	81.841	0.9000	2.4715	2.3189	29.926	27.770	206.54	89.23	117.31

$$P_{A+0}^x = 127.7. \quad \mu = 2.47.$$

Benzylidene-*p*-bromoacetophenone;  $t = 18.2^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$\eta^2$ .	$P_i$ .	$P_{Ei}$ .	$P$ .	$P_E$ .	$P_{A+0}$ .
0	78	0.8808	2.2876	2.2876	26.594	26.594	—	—	→
0.00998	80.085	0.8927	2.4319	2.3079	28.984	27.236	266.14	90.94	175.20
0.01189	80.485	0.8950	2.4603	2.3118	29.442	27.358	266.13	90.83	175.30
0.01525	81.187	0.8990	2.5082	2.3182	30.212	27.568	265.88	90.42	173.46
0.01926	82.025	0.9038	2.5648	2.3259	31.110	27.816	261.09	90.01	171.08

$$P_{A+0}^x = 182.0. \quad \mu = 2.93.$$



$\alpha\beta$ -Dibromobenzylideneacetophenone (m. p. 113—114°);  $t = 21.6^\circ$ .

<i>c.</i>	$\bar{M}$ .	$\zeta$ .	$\epsilon$ .	$n_D^{20}$ .	$P_A^*$ .	$P_{E1}$ .	<i>P.</i>	$P_E$ .	$P_{A+0}$ .
0	78	0.8768	2.2807	2.2807	26.616	26.616	—	—	→
0.00586	79.678	0.8885	2.3704	2.2886	28.122	26.948	283.83	83.25	200.58
0.00884	80.547	0.8945	2.4264	2.2993	28.878	27.125	282.40	84.19	198.21
0.01201	81.458	0.9009	2.4701	2.2980	29.373	27.306	286.50	84.11	202.39
0.01524	82.388	0.9074	2.5204	2.3032	30.539	27.498	284.10	84.52	199.58

$$P_{A+0}^{\infty} = 210.0. \quad \mu = 3.17.$$

 $\beta$ -Bromobenzylideneacetophenone;  $t = 20.9^\circ$ .

0	78	0.8776	2.2822	2.2822	26.612	26.612	—	—	→
0.00511	79.068	0.8842	2.3849	2.2900	28.244	26.891	346.10	81.07	265.03
0.00869	79.816	0.8888	2.4556	2.2957	29.339	27.089	240.42	81.45	258.97
0.01222	80.553	0.8933	2.5223	2.3014	30.356	27.284	333.00	81.56	251.44
0.01629	81.404	0.8985	2.6058	2.3074	31.588	27.499	332.12	81.07	251.05

$$P_{A+0}^{\infty} = 271.2. \quad \mu = 3.59.$$

 $\alpha$ -Bromobenzylideneacetophenone;  $t = 20.05^\circ$ .

0	78	0.8786	2.2839	2.2839	26.608	26.608	—	—	→
0.00497	79.040	0.8851	2.3989	2.2913	28.399	26.871	386.74	79.65	307.09
0.00855	79.788	0.8898	2.4799	2.2970	29.621	27.065	378.85	80.09	298.76
0.01153	80.409	0.8937	2.5498	2.3020	30.647	27.230	377.11	80.62	296.49
0.01514	81.164	0.8985	2.6303	2.3082	31.807	27.431	370.01	80.98	289.03

$$P_{A+0}^{\infty} = 316.1. \quad \mu = 3.87.$$

Ethyl  $\alpha$ -bromocinnamate (m. p. 131°);  $t = 21.6^\circ$ .

0	78	0.8768	2.2807	2.2807	26.616	26.616	—	—	→
0.01371	80.427	0.8907	2.3905	2.2907	28.598	29.163	171.13	66.48	104.65
0.02161	81.826	0.8987	2.4522	2.2970	29.697	27.481	169.16	66.63	102.53
0.03022	83.349	0.9075	2.5228	2.3042	30.924	27.831	169.18	66.82	102.36
0.03574	84.326	0.9131	2.5700	—	31.727	—	169.63	(66.65)	102.98

$$P_{A+0}^{\infty} = 105.6. \quad \mu = 2.25.$$

Ethyl  $\alpha$ -bromocinnamate (m. p. 126°);  $t = 19.4^\circ$ .

0	78	0.8794	2.2852	2.2852	26.603	26.603	—	—	→
0.00418	78.741	0.8836	2.3331	2.2874	27.416	26.759	220.92	63.95	156.97
0.00466	78.825	0.8841	2.3400	2.2877	27.528	26.778	225.22	64.15	161.07
0.00710	79.257	0.8866	2.3592	2.2889	27.874	26.866	205.58	63.63	141.95
0.01090	79.940	0.8905	2.4010	2.2912	28.579	27.013	206.92	64.05	142.87

$$P_{A+0}^{\infty} = 165.6. \quad \mu = 2.80.$$

Ethyl *p*-nitrobenzoate;  $t = 13.1^\circ$ .

0	78	0.8868	2.2980	2.2980	26.562	26.562	—	—	→
0.00424	78.497	0.8899	2.3930	2.2988	27.971	25.650	358.46	47.32	311.14
0.00769	78.899	0.8924	2.4695	2.2998	29.068	26.726	352.56	47.86	304.70
0.01271	79.487	0.8961	2.5782	2.3011	30.577	26.833	342.60	47.91	294.69
0.01770	80.071	0.8997	2.6863	2.3021	32.023	26.934	335.15	47.61	287.54

$$P_{A+0}^{\infty} = 318.0. \quad \mu = 3.84.$$

Ethyl  $\beta$ -phenylpropionate;  $t = 21.15^\circ$ .

0	78	0.8773	2.2817	2.2817	26.614	26.614	—	—	→
0.02437	80.437	0.8837	2.3796	2.2787	28.673	27.203	111.08	50.75	60.33
0.03042	81.042	0.8853	2.4082	2.2782	29.243	27.350	113.02	50.80	62.22
0.03684	81.684	0.8870	2.4339	2.2777	29.782	27.507	112.59	50.84	61.75
0.04891	82.891	0.8902	2.4893	2.2767	30.891	27.799	114.05	50.83	63.22

$$P_{A+0}^{\infty} = 64.57. \quad \mu = 1.75.$$

Ethyl *p*-nitro- $\beta$ -phenylpropionate;  $t = 20.0^\circ$ .

0	78	0.8787	2.2840	2.2840	26.607	26.607	—	—	→
0.00672	78.974	0.8827	2.4912	2.2851	29.704	26.829	487.69	59.65	428.04
0.00873	79.265	0.8840	2.5509	2.2856	30.556	26.898	479.19	59.91	419.28
0.01055	79.330	0.8851	2.6141	2.2859	31.431	26.958	483.91	59.90	424.01
0.01367	79.983	0.8871	2.7075	2.2867	32.705	27.064	472.57	60.07	412.50

$$P_{A+0}^{\infty} = 442.8. \quad \mu = 4.58.$$

Methyl *p*-bromo- $\beta$ -phenylpropionate;  $t = 19.8^\circ$ .

0	78	0.8789	2.2844	2.2844	26.605	26.605	—	—	→
0.01147	79.893	0.8890	2.3585	2.2895	28.011	26.964	177.45	57.89	119.56
0.01470	80.425	0.8918	2.4100	2.2870	28.833	27.073	176.16	58.42	117.74
0.01994	81.290	0.8965	2.4303	2.2874	20.276	27.229	(160.55)	57.92	(102.63)
0.02521	82.160	0.9011	2.4974	2.2890	30.358	27.402	175.47	58.22	117.25

$$P_{A+0}^{\infty} = 120.25. \quad \mu = 2.39.$$

Tolan; $t = 18.4^\circ$ .									
$c.$	$\bar{M}.$	$\zeta.$	$\epsilon.$	$n^2.$	$P_1.$	$P_{E1}.$	$P.$	$P_E.$	$P_{A+O}.$
0	78	0.8865	2.2872	2.2872	26.596	26.596	—	—	—
0.00249	78.249	0.8812	—	2.2901	—	26.703	—	69.46	—
0.00497	78.497	0.8819	—	2.2932	—	26.813	—	70.09	—
0.00744	78.744	0.8825	—	2.2963	—	26.923	—	70.46	—
0.02621	80.621	0.8875	2.3139	—	27.667	—	67.45	—	—
0.3831	81.831	0.8907	2.3248	—	28.142	—	66.94	(70.00)	—
0.04728	82.728	0.8931	2.3344	—	28.517	—	67.21	—	—
$\mu = 0.$									
Ethyl <i>p</i> -nitrophenylpropionate; $t = 21.8^\circ$ .									
0	78	0.8765	2.2803	2.2803	26.618	26.618	—	—	→
0.00634	78.894	0.8809	2.3993	2.2853	28.485	26.860	321.03	64.82	256.21
0.00847	79.194	0.8821	2.4397	2.2869	29.113	26.951	321.29	66.01	255.28
0.01194	79.684	0.8848	2.5058	2.2895	30.096	27.073	317.89	64.70	253.19
0.01628	80.296	0.8878	2.5865	2.2921	31.284	27.226	313.21	64.00	249.21
$P_{A+O}^\infty = 262.0. \mu = 3.54.$									
Ethyl phenylpropionate; $t = 20.5^\circ$ .									
0	78	0.8781	2.2830	2.2830	26.611	26.611	—	—	→
0.01118	79.073	0.8817	2.3416	2.2868	27.714	26.922	125.31	54.46	70.85
0.01915	79.839	0.8842	2.4083	2.2900	28.844	27.150	143.23	54.78	88.45
0.02701	80.593	0.8868	2.4694	2.2933	29.879	27.378	147.64	55.01	92.63
0.03586	81.442	0.8896	2.5361	2.2971	31.002	27.634	149.08	55.14	93.94
$P_{A+O}^\infty = 100.8. \mu = 2.19.$									
Phenylchloroacetylene; $t = 18.8^\circ$ .									
0	78	0.8800	2.2864	2.2864	26.600	26.600	—	—	→
0.02600	79.521	0.8890	2.3462	2.2954	27.706	26.976	69.12	41.07	28.05
0.02800	79.638	0.8897	2.3554	2.2963	27.854	27.008	71.41	41.16	30.25
0.04544	80.658	0.8958	2.3887	2.3026	28.492	27.260	68.23	41.12	27.11
$P_{A+O}^\infty = 31.0. \mu = 1.21.$									
Ethyl <i>p</i> -phenylbenzoate; $t = 14.6^\circ$ .									
0	78	0.8850	2.2949	2.2949	26.573	26.573	—	—	→
0.00915	79.354	0.8906	2.3569	2.3032	27.750	26.984	155.32	71.61	83.71
0.01411	80.088	0.8936	2.3904	2.3075	28.383	27.204	154.91	71.36	83.55
0.01719	80.544	0.8955	2.4110	2.3104	28.771	27.343	154.48	71.37	83.11
0.01904	80.817	0.8966	2.4219	2.3120	28.984	27.425	153.26	71.36	81.90
$P_{A+O}^\infty = 86.8. \mu = 2.01.$									
$\omega$ -Nitrostyrene; $t = 17.2^\circ$ .									
0	78	0.8819	2.2896	2.2896	26.588	26.588	—	—	—
0.00528	81.748	0.8837	2.4439	2.2940	30.057	27.877	683.93	270.79	413.14
0.00750	83.327	0.8845	2.5105	2.2995	31.548	28.414	687.76	275.70	412.06
0.00890	84.317	0.8849	2.5542	2.2962	32.517	28.752	692.96	269.83	423.13
0.01191	86.460	0.8860	2.6461	2.2991	34.555	29.489	695.30	270.13	425.17
$P_{A+O}^\infty = 427.0. \mu = 4.48.$									
$\omega$ -Chlorostyrene; $t = 18.8^\circ$ .									
0	78	0.8800	2.2864	2.2864	26.600	26.600	—	—	—
0.02641	79.598	0.8883	2.3683	2.2962	28.069	27.037	82.23	43.14	39.09
0.03133	79.895	0.8897	2.3841	2.2982	28.351	27.123	82.50	43.28	29.22
0.03842	80.324	0.8918	2.4042	2.3007	28.717	27.242	82.71	43.32	39.39
0.04393	80.658	0.8929	2.4210	2.3030	29.036	27.355	82.06	43.79	38.27
$P_{A+O}^\infty = 41.1. \mu = 1.40.$									
$\omega$ -Bromostyrene; $t = 18.0^\circ$ .									
0	78	0.8810	2.2880	2.2880	26.594	26.594	—	—	—
0.02114	80.169	0.8961	2.3673	2.2993	28.009	27.036	93.58	47.55	46.03
0.02673	80.807	0.9001	2.3911	2.3024	28.440	27.175	95.68	48.35	47.33
0.03970	82.169	0.9094	2.4377	2.3010	29.273	27.464	94.09	48.52	45.57
0.05267	83.530	0.9187	2.4877	2.3171	30.142	27.740	93.97	48.37	45.60
$P_{A+O}^\infty = 48.0. \mu = 1.51.$									
$\omega$ -Ethoxystyrene; $t = 18.3^\circ$ .									
0	78	0.8807	2.2874	2.2874	26.596	26.596	—	—	—
0.02497	79.748	0.8896	2.3984	2.2965	27.501	27.051	102.91	44.83	58.08
0.03191	80.234	0.8921	2.9284	2.2986	29.110	27.170	102.27	44.60	57.67
0.03810	80.667	0.8943	2.4565	2.3007	29.479	27.281	102.30	44.59	57.71
0.04329	81.031	0.8962	2.4785	2.3028	29.851	27.378	101.81	44.66	57.15
$P_{A+O}^\infty = 59.7. \mu = 1.68.$									