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FLUORINE MODIFIED ALIPHATIC DICARBOXYLIC ESTERS AS SEMI-PRODUCTS OF FLUORINE MAT PRODUCTION

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Here we have considered the opportunity of obtaining the fluorine containing esters of aliph using commercially available partly fluorinated alcohols for the purpose to create producti containing materials. We have discussed Here as well the perspectives of their application as oils, liquid heat-transfers, bases for hydrosystems and lubricating oils.

The rushing development of fluoroorganic compounds chemistry is tightly bonded with the materials. The production of such perfluorinated organic compounds, which meet the modern physic and dielectric characteristics, work in a wide temperature range and thermal loads an practical application has been developed [1,2].

The total replacement of hydrogen atoms for fluorine atoms in an organic molecule results number of characteristics, what is used for creating a new generation of materials with splen The availability of a stable production base is an important point for wide use of new fluorir produced perfluorolefines had been the main raw materials' base till recent time. In this regard obtained commercially by aliphatic alcohols influencing tetrafluoroethylene and hexafluoroprop of radical initiators' presence attract our attention [3-5].

They became one of the initial ones to obtain different compounds during fluororganic synthe existing polymer materials by polyfluorinated telomeric alcohols allows changing to a great ex physical and chemical properties expanding by that the application opportunities of such co directions [6]. It is enough to mention the opportunities of polyacrylates and methacrylates mo ester part for creation of the shielding coats on textile materials [7]. Such fluorine alcohols nucleophiles and based on that a number of fluorine materials had been created. For exam fluorine in ester part of such unsaturated acids as acrylic [8], maleinic [9, 10], and fumaric [11

Modified by their ester fragment mono- and di-carboxylic acids form the base for producti structural materials, liquid heat-transfers, hydrosystems and lubricating oils for high-speed a steel, copper and other metals corrosion [12-14]. High thermal endurance and oxidizat properties for a wide range of temperatures, high self-ignition temperature (reaching over 40(and pyrolysis are just some of their advantages compare to the hydrocarbon analogues. that 's

for that class of the organic substances is not surprising. A special attention was paid to the m monomers when obtaining elastomers [15], as hydraulic liquid and additives for lubricating oils

Sodium and potassium salts of perfluoroalkylmaleates of $H(CF_2)_nCH_2OC(O)CH=CHCOOH$ (n as surfactants [10, 17], wetting agents [10], hydraulic liquids [18] and antisoiling agents [19].

To improve the lubricating properties of oils based on fluorosiliconorganic liquid a 0,5-1% of acid ester of formula $R(CF_2)_nCH_2OC(O)CH=CHC(O)OCH_2(CF_2)_nR$, where R = H, F; n = 2-6 mN/m of such esters is equal: at n = 2 - 31.21; n = 4 - 27.57; n = 6 - 25 [15]) is introduced a of 1-octen with modified alcohols of $F(CF_2CF_2)_nCH_2CH_2OH$ (n = 3,4,5) type and maleinic acid carpet coloring agents [21]. alcohols of RCH_2OH (R = C_7F_{15}, perfluorocyclohexyl) type were itaconic and fumaric acids applied for fabrics impregnation to make them water-, soil-, and fat-r

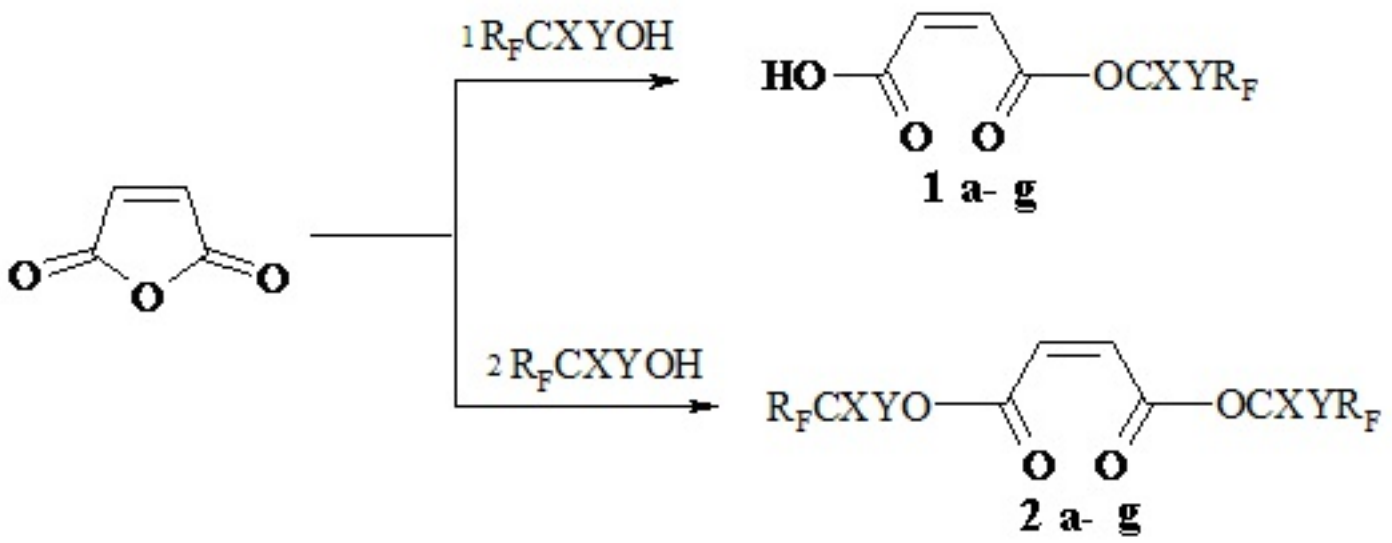
Here for this work we Have determined our goal as obtaining the maleinic acid ethers (look and esters of dicaboxylic acids (adipinic, succinic and malonic) with the use of new partly fluorin

It is known, that interaction of fluorine containing alcohols and maleinic acid anhydr fluoroalkoxymaleinates [14, 17] or in esters of maleinic acids [8-10,24]. Thus, at equimola alcohols $R(CF_2CF_2)_nCH_2OH$ (R = H, F; n = 1-3) at 90-120 ^oC and period of 10-20 h in the pres of sulphuric acid with the yield of 36-45 % [9], and at 50-75 ^oC (10-40 h) without catalyst wi acid esters of fluoroalkoxymaleinates are formed. $RFCH_2CH_2OH$ fluorocontaining alcohols react acid in the same way that is at 50-55 ^oC and period of 6 H in the presence of Et_3N in toluene a (in the form of *cis*-isomers) are formed with the yield of 97.3 %. At the same time regardless alcohol at the reagents' ratio of 1:2 the esterification of maleinic acid using fluorine alcohols sulphide or catalytic quantities of sulphuric acid at 110 ^oC (7 h) in toluene [9,12,16,22,24] o ^oC (24 H) in the presence of triethylamine results in bis(fluoroalkoxy)-maleinates. The esterif acid maleinate by 1,3-bis(-hydroxypropyl)-1,1,3,3-siliconorganic maleinates produces corresp acid [8].

Here we have drawn the optimization of the modes of carrying out the interaction process and maleinic acid anhydride. It has been determined, that when using the equimolar quanti presence of catalytic quantities of triethylamine regardless of the used fluorine alcohol struct acid **Ia-g** in the form of *cis*-isomers are obtained with the high yields, while at the ratio of r ethers of maleinic acid **IIa-g** in the form of *cis*-isomers as well (scheme 1, table 1). Their com confirmed by the data of the elemental analysis, molecular weight and NMR ^1H and ^{19}F spec and **IIe** compounds are obtained in the form of the diastereoisomer mixture.

In the IR spectra you can find the presence of the intensive absorption fields, caused by groups: C=C (1750 cm^{-1}), CF_2 (1250-1050 cm^{-1}) and double bond C=C (1640 cm^{-1}).

Scheme1



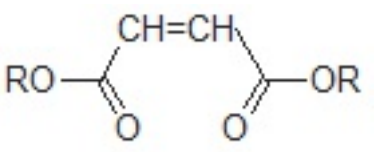
Compound	**a**	**b**	**c**	**d**	**e**	
R_F	CF_3CHFCF_2	$HCF_2(CF_2)_5$	$CF_3(CF_2)_5$	$HCF_2(CF_2)_7$	CF_3CHFCF_2	
X	H	H	H	H	H	
Y	H	H	H	H	Me	

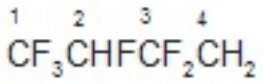
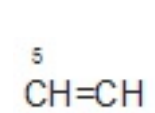
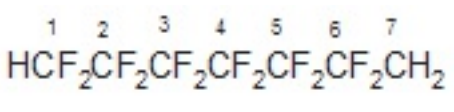
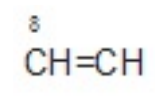
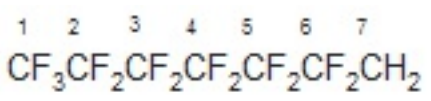
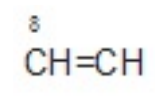
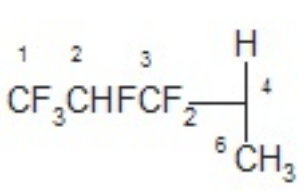
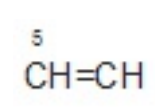
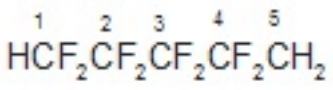
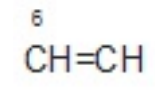
Table 1. *Analytical Data of Polyfluoroalkoxymaleinates*

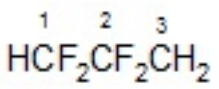
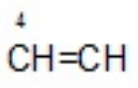
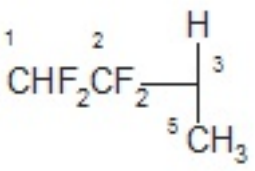
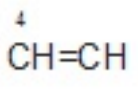
Compound	***Yield, %***	***Boiling Point/ mm Hg (Melting Point)***	***Found , %***			***Formula***	***C***
			C	***H***	***F***		***C***
Ia	76	90-91 / 6	34.15 34.24	2.01 2.17	40.54 40.68	$C_8H_6F_6O_4$	3
Ib	40	(72-73)	32.45 32.46	1.62 1.35	45.92 45.79	$C_9H_6F_8O_4$	3
Ic	73.5	146-147 / 6 (93-95)	29.26 29.56	1.02 1.09	55.84 55.96	$C_{11}H_5F_{13}O_4$	2

Id	79	178-179	29.54 29.63	1.08 1.14	57.46 57.56	$C_{13}H_6F_{16}O_4$	29
Ie	92	91-92 / 6	36.44 36.57	2.54 2.70	38.54 38.85	$C_9H_8F_6O_4$	30
If	84	70-75 / 6	38.24 38.38	3.15 3.32	37.5 37.6	$C_{10}H_{10}F_6O_4$	38
Ig	81	75-76	35.71 35.99	2.07 2.33	33.37 33.42	$C_7H_6F_4O_4$	30
IIa	67	105-106 / 6	32.49 32.65	1.99 1.95	50.41 50.47	$C_{12}H_8F_{12}O_4$	32
IIc	46	148-150 / 3	27.94 27.82	1.34 1.19	63.51 63.32	$C_{18}H_6F_{26}O_4$	27
IId	55	162-163 / 3	28.01 27.84	0.95 0.82	64.56 64.37	$C_{22}H_8F_{32}O_4$	27
IIe	58	120-122 / 8	35.67 35.89	2.58 2.36	48.44 48.56	$C_{14}H_{12}F_{12}O_4$	35
IIf	84	105-106 / 6	32.49 32.65	1.61 1.87	51.54 51.47	$C_{12}H_8F_{12}O_4$	32
IIg	85	133-134/18	35.42 35.52	2.22 2.28	43.77 43.79	$C_{10}H_8F_8O_4$	34
IIh	88	113-114/6	38.68 38.98	3.78 3.89	40.10 40.56	$C_{12}H_{12}F_8O_4$	38

Table 2. *NMR ^{1}H and ^{19}F spectra of maleinic acid esters*



Compound	***R***	***CH=CH***	***□, ppm (structure, J H***	
			1 H	***19***
(**IIa**)			4.28 (H^4,m); 4.74 (H^2, dm 47.4; 5.4)	86.2 (40.3 (F J_{FF} 44.9 dd 17.7;
(**IIb**)			4.07 (H^7 t 13.4); 5.45 (H^1 tt 52.0; 4.8); 5.71 (H^8 s)	25.6 33.6 (F^2 s); 41.4 (F^7 t 11
(**IIc**)			4.73 (H^7 t 14.0); 6.48 (H^8, s)	82.8 (F^6 m); 41.0 (F^4 m); 37.7
(**IIe**)			6.31 (H^5 s); 5.38 (H^4 m); 5.15 (H^2 dm 37.2; 0.8); 1.42 (H^6 s)	89.5 (40.5 (F J_{FF} 276) 41.6)
(**IIf**)			6.53 (H^6 s); 6.48 (H^1 tt 46.0; 2.6); 4.85 (H^5 t 13.8);	25.7 2.6); 33 (F^3 s); 4
(**IIg**)				

			6.27 (H^4 s); 5.57 (H^1 tt 52.6; 4.0); 4.30 (H^3 t 18.0)	39.3 (F^1 m)
(**IIH**)			6.95 (H^4 s); 6.00 (H^1 tt 52.6; 4.8); 5.42 (H^2 m); 1.47 (H^5 d 6.2)	37.0 AB-syste 27.6 an system 51.8)

The yield of ethers of maleinic acid depends on the structure of the used alcohol or catal polyfluorinated alcohols the yield as a rule, depends on the length of carbon chain, while for th alcohols a special demands play an important role and while they grow the yield of target pro the forming of mixtures of the corresponding ethers of maleinic acid and their potassium salt structure of alcohol used.

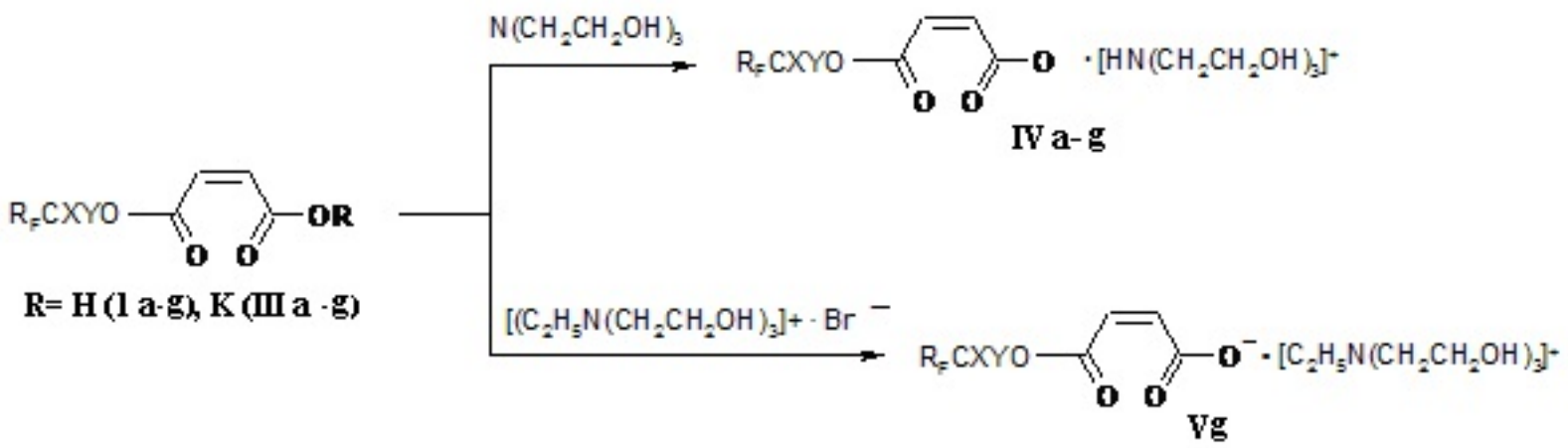
Thus, the interaction of maleinic acid anhydride and 2,2,3,4,4,4-Hexafluorobutanol-1 dimetHyl-propanol-1 over KOH results in formation of mixture of potassium salt (Z)-4(2,2,3, oxo-but-2-enic acid **IIIa** and its ester **IIa** and potassium salt (Z)-6,6,7,7-tetrafluoro-5-metHyl its ester **II j** respectively.

The synthesis of the **IIa-g** esters can be carried out in a most convenient manner if we maleinic acid of corresponding fluoroalcohol in the medium of boiling toluene over the small qua concentrated sulphuric acid with azeotropic distillation of water (reaction period no longer thar is required. In some cases we can observe the formation of two maleate isomers. Thus, whe trihydrooctafluoropentoxy)maleate we can get the mixture of two isomers with the ratio abou caused by maleinic acid isomerization into fumaric acid. At the same time, the tertiary alcol and $HCF_2CF_2C(CH_3)_2OH$ couldn't have been introduced into the reaction with maleinic a conditions. We should note, that the excess of the fluoroalcohol used after the distillation do purification and can be used again.

Before [17] it was proved, that at interaction of acid ester of maleinic acid, for example formamide with glycidyltrimethylammonium chloride the salts were obtained.

At 54 ^oC the salt $[C_6F_{13}CH_2CH_2OC(O)CH=CHCH(OH)CH_2NMe_3]^+{}_*Cl^-$ (yield 59.8 %) was isol the forming of salts by carboxylic group by the influence of either trialkylamines or of quatern proved indeed, that at triethanolamine influence on **I a-g** acid esters of maleinic acid the corr formed (scheme 2). Influencing of some quaternary ammonium salts on **IIIa**, **IIIg** potassium s salts respectively. Such salts are foaming and surface active (according to our information th salts was about 27.59 mN/m and 24.55 mN/m). that data points out the higher foaming compare to potassium salts of **IIIa**,**IIIg**.

Scheme 2



In the work [25] we have shown the opportunity of esterification of a number of aliphati influence of partly polyfluorinated alcohols over concentrated sulphuric acid. Thus, the esterifica methyl derivatives [26,27] is carried out by the partly fluorinated alcohols influence over the toluenesulpho acid [13] (1 % of the alcohol mass) both in the toluene [14], and in polychloro obtained compounds found their application as effective lubricants and hydraulic liquids [29].

α-n-Dodecylsiccinic anhydride is esterified by $F(CF_2)_6CH_2OH$ fluorocontaining alcohol under We've also got indications that esterification can be done by the mixture of telomeric alcohols 6) of adipinic acid [31], and esterification of malonic acid with the $CF_3(CF_2)_6CH_2OH$ alcohol [reaction of esterification of linear aliphatic dicarboxylic acids (**VI - VIII**) by fluorine containing a the catalytic quantities of concentrated sulphuric acid in toluene forming ethers (**IX b-d**), (**X c-** case of esterification by secondary alcohols we have obtained the ethers (**XIIe**), (**XIIIb,** compounds are listed in table 3.

Scheme 3

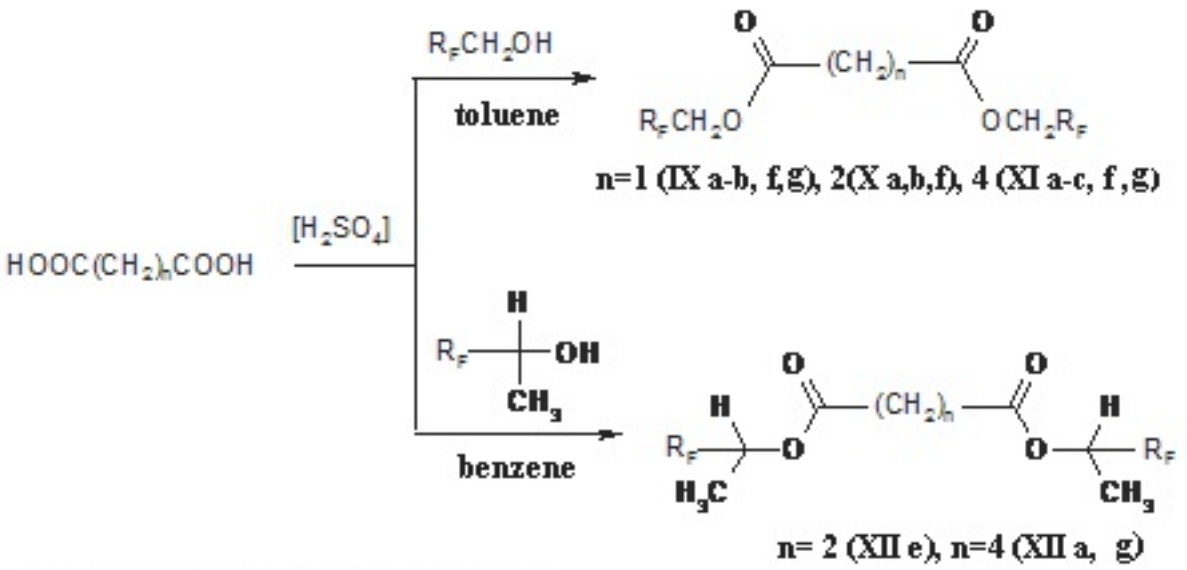


Table 3. *Analytical Data of Fluorocontaining Esters of Dicarboxylic Acids*

Compound	***Yield, %***	***Boiling Point, °C/ mm Hg***	***Found, %***			***Formula***	***C***
			C	***H***	***F***		***C***

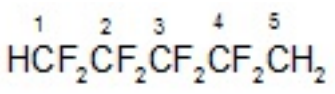
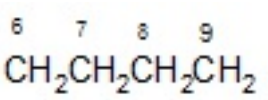
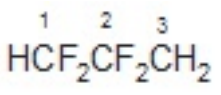
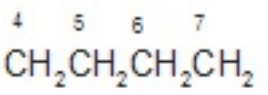
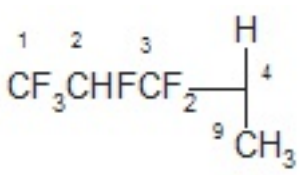
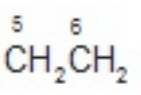
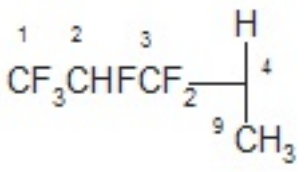
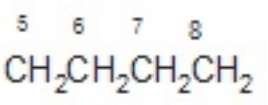
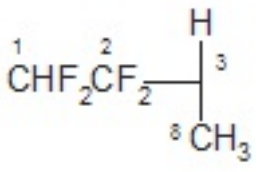
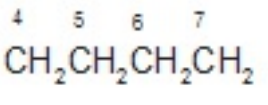
(**IXa**)	55.5	91-92/2-3	31.32 31.06	2.29 2.26	52.76 52.67	$C_{11}H_8F_{12}O_4$	3(
(**IXb**)	76.7	150-151/2-3	27.22 28.07	1.45 1.89	62.60 62.51	$C_{17}H_8F_{24}O_4$	2
(**IXf**)	47.5	133-135 / 2-3	29.48 29.10	1.51 1.13	57.22 57.38	$C_{13}H_8F_{16}O_4$	2
(**IXg**)	66.3	88-89 /2-3	33.07 33.33	2.74 2.56	46.10 45.85	$C_9H_8F_8O_4$	3
(**Xa**)	59	152-154 / 2-3	32.56 32.78	2.56 2.78	50.94 51.14	$C_{12}H_{10}F_{12}O_4$	3
(**Xb**)	65.4	160-162 / 3-4	28.81 28.90	1.49 1.57	61.22 61.33	$C_{18}H_{10}F_{24}O_4$	2
(**Xf**)	48.6	120-121 / 2-3	30.98 31.01	2.02 1.75	55.95 55.97	$C_{14}H_{10}F_{16}O_4$	3(
(**XIa**)	46.4	131-132 / 2-3	35.15 35.44	3.12 2.90	48.29 48.11	$C_{14}H_{14}F_{12}O_4$	3
(**XIb**)	94.3	168-170/3	31.37 31.57	2.08 2.32	58.46 58.50	$C_{20}H_{14}F_{24}O_4$	3
(**XIc**)	72.7	142-143 / 3	30.19 30.09	1.33 1.62	60.44 60.59	$C_{20}H_{12}F_{26}O_4$	2
(**XIf**)	58.5	168-170 / 3	33.99 33.71	2.30 2.67	52.92 52.63	$C_{16}H_{14}F_{16}0_4$	3

(**XIg**)	69.5	153-154 / 2-3	38.75 38.54	3.56 3.60	40.91 41.16	$C_{12}H_{14}F_8O_4$	3
(**XIIa**)	95	145-146 / 2-3	35.26 35.43	3.09 3.03	48.21 48.08	$C_{14}H_{14}F_{12}O_4$	3
(**XIIIa**)	63.8	148-150 /3	38.13 38.32	3.72 3.84	45.04 45.19	$C_{16}H_{18}F_{12}O_4$	3
(**XIIIg**)	58.4	132-133 / 2-3	41.26 41.04	4.52 4.43	37.86 38.11	$C_{14}H_{18}F_8O_4$	4

Table 4. *NMR ^{1}H and ^{19}F spectra of Dicarboxylic Acids Esters*

Compound	***R***	***$(CH_2)n$***	***□, ppm (structure, J***	
			1 H	***19 F***
(**IXa**)	$^{1}CF_3{}^{2}CHF{}^{3}CF_2{}^{4}CH_2$	$^{5}CH_2$	5.07 (H^2 dm 42.2), 4.57 (H^4 t 9.6), 3.56 (H^5 s)	85.8 and 4 system -52.9 43.3;3
(**IXb**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CF_2{}^{6}CF_2{}^{7}CH_2$	$^{8}CH_2$	6.10 (H^1 tt 51.8; 4.8), 4.68 (H^7 t 17.6), 3.56 (H^8 s)	26.4 34.2 (($F^{4,5}$), 13)
(**IXf**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CH_2$	$^{6}CH_2$	6.10 (H^1,tt 51.6; 5.2),	26.3 2.4), 3

			4.67 (H^5 t 13.6), 3.57 (H^6 s)	(F^3), 11.9)
(**IXj**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CH_2$	$^{4}CH_2$	5.55 (H^1 tt 52.6; 3.8), 4.15 (H^3 t 13.0), 3.16 (H^4 s)	22.1 35.9 (F
(**Xb**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CF_2{}^{6}CF_2{}^{7}CH_2$	$^{8}CH_2{}^{9}CH_2$	6.09 (H^1 tt 52.0; 5.1), 4.62 (H^7 t 14), 2.74 ($H^{8,9}$ s)	26.5 34.3 ($F^{3,4}$), 44.3 (F
(**Xf**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CH_2$	$^{6}CH_2{}^{7}CH_2$	6.11 (H^{12} tt 51.6; 4.8), 4.62 (H^5 t 14), 2.74 ($H^{6,7}$ s)	26.6 34.1 (F 44.4 (F
(**XIa**)	$^{1}CF_3{}^{2}CHF{}^{3}CF_2{}^{4}CH_2$	$^{5}CH_2{}^{6}CH_2{}^{7}CH_2{}^{8}CH_2$	5.15 (H^2 t), 4.47 (H^4 t 48), 2.42 ($H^{5,8}$ s), 1.68 ($H^{6,7}$ s)	89.3 and 4 system -49.8 42.9;7.
(**XIb**)	$^{1}HCF_2{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CF_2{}^{6}CF_2{}^{7}CH_2$	$^{8}CH_2{}^{9}CH_2{}^{11}CH_2CH_2$	6.00 (H^1 tt 54.0; 3.2), 4.48 (H^7 t 13.4), 2.29 ($H^{8,11}$ s), 1.56 ($H^{9,10}$ s)	26.5 34.4 ($F^{3,4}$), 44.4 (F
(**XIc**)	$^{1}CF_3{}^{2}CF_2{}^{3}CF_2{}^{4}CF_2{}^{5}CF_2{}^{6}CF_2{}^{7}CH_2$	$^{8}CH_2{}^{9}CH_2{}^{10}CH_2{}^{11}CH_2$	3.71 (H^7 t 13.6), 1.51 ($H^{8,11}$ s), 0.79 ($H^{9,10}$ s)	78.4 40.1 (F 37.2 (F 33.6 (F
(**XIf**)			6.20 (H^1 tt 51.8; 5.4),	26.2

			4.67 (H^5 t 13.8), 2.48 ($H^{6,9}$ s), 1.75 ($H^{7,8}$ s)	33.5 (F 44.1 (F
(**XIg**)			5.98 (H^1 tt 51.8; 5.4), 4.67 (H^5 t 13.8), 2.48 ($H^{6,9}$ s), 1.75 ($H^{7,8}$ s)	25.3 13.0),
(**XIIa**)			5.29 (H^4 m), 5.19 (H^2 d.m), 2.65 ($H^{5,6}$ s), 1.38 (H^9 s)	89.5 and 4 system -50.8 (10/1)
(**XIIIa**)			5.31 (H^2 2.38 ($H^{5,8}$ s), 1.66 ($H^{6,7}$ s), 1.36 (H^9 d 6.4)	89.3 and 4 system -50.7 218; J_{F-}
(**XIIIg**)			5.96 (H^1 tt 52.4; 3.6), 5.31 (H^3), 2.37 ($H^{4,7}$ s), 1.65 ($H^{5,6}$ s), 1.34 (H^8 d 6.4)	26.5 AB-syst 303.9; 36.5 a AB-syst 276.0)

The distillation of water is carried out by separation of azeotrope with toluene or benzene. Th to the structure of aliphatic dicarboxylic acid. Thus, by decreasing of the length of hydro corresponding ester drops, while at transfer from malonic acid to adipinic acid we can obse product (Table 3).

The reaction should be carried out at mixing the reaction mixture due to the low solubility toluene.

The structure of ethers is confirmed by the data of NMR ^{1}H and ^{19}F (Table 4), IR spectra that , the position of signals in NMR spectra are typical for initial fluorine alcohols and they s spectra the oscillations of OH group are not presented and intensive oscillations are appearing C-F bonds (1308-1124 cm^{-1}). As for the oscillations of C-H bonds well they are in the are depending on the used acid are of complicated structure.

Experimental Part

NMR ^{1}H and ^{19}F spectra were obtained at Bruker WP 400 SY spectrometer (400, 188 M inner standards hexamethyldisiloxane (HMDS), C6F6. IR-spectra were recorded Specord M chromato-mass-spectra (energy of ionizing electrons is 70 eV) were registered using chromato detector (Hewlett Packard G 1800 A GCD) (we used the column of 30 m length, 0.25mm dia side with the 0.25 μm layer of copolymer 5% diphenyl -95% dimethylsiloxane (HP-5), ga evaporator temperature equals 280 ^{o}C. The temperature of column was increasing starting fr at a rate of 10 degree per min reaching 280 ^{o}C (it was held at that point for 5 min). All reac NMR ^{19}F method.

The analysis of reaction mixtures was carried out at chromatograph LHM 72 (15 % Chromosorb W, colum 4000 mm, diameter 4 mm). Characteristics of new compounds an them are listed in Tables 1 and 3.

Common Synthesis Methods for Polyfluoroalkoxymaleates

The mixture of 49 g (0.5 mole) of maleinic anhydride and 58 g (0.5 mole) of 1,1,3-trihydr heated while being mixed at the T of 85 ^{o}C during 40 h, the reaction mixture was cooled, the separated and re-crystalized out of toluene. We obtained 83 g (74 %) of tetrafluoropropylmale ^{o}C. Other polyfluoroalkoximaleates were obtained the same way (Table 1).

Common Synthesis Methods for Dicarboxylic Acid Esters

The mixture of 24.5 g of maleinic acid (or dicarboxylic acid), 249 g of 1,1,7-trihydrodec concentrated sulphuric acid and 250 ml of toluene was boiled along with stirring at 110-120 with water was distilled. The reaction mixture was cooled, neutralized by 3%-solution of sodiu through with water till the neutral reaction (according to litmus), dried with $CaCl_2$. Upon the vacuum of water-jet pump, the residuum was distilled twice in vacuum. trihydrodecafluoroheptoxy)maleate (**IIb**) with the yield of 70.7 %, b. p. 152-153 ^{o}C/ 2- [according to data [24] b. p. 149-153 ^{o}C/ 5 mm Hg., n^{30}_{D} 1.3470, and according to [12] standing the compound is crystallized, melting point is 62-63 ^{o}C.

Analogously we have obtained bis(polyfluoroalkoxy) maleates: **II f** (85 %), **II g** (82 %). Their to the ones represented in [9,12], and the characteristics of **IIc** (yield 92 %) agree with data [

Synthesis Methods for Esters of Aliphatic Dicarboxylic Acids

Mixture of 0.01 g-mole of dicarboxylic acid, 0.02 g-mole of corresponding fluoocontai concentrated sulphuric acid is being boiled along with distillation of toluene azeotrope with wat benzene. After distillation of 0.02 g-mole of water, the reaction mixture is cooled and 70 vacuum of water-jet pump. Then it is washed through with 3% solution of sodium bicarbon (according to litmus), dried with $CaCl_2$. It is distilled in the vacuum, the characteristics of the pr

CONCLUSIONS

1. Polyfluoroalkoxymaleates and bis(polyfluoroalkoxy)maleates are obtained depending on

taken by the interaction of partly fluorinated alcohols and maleinic acid anhydride over sulphuric acid

2. During the laboratory checking of optimal conditions for synthesis of maleinic acid est technological scheme for commercial production has been offered

3. The esterification of malonic, siccinic and adipinic acids has been carried out using influ alcohols over the catalytic quantities of concentrated sulphuric acid.

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