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Synthesis of New Poly(amide-imide)s Derivatives Based on Amino Acid Compounds

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ABSTRACT

With condensation polymerization method in solution phase 31 new compound with polymerization property have been synthesized. These compounds derivate from amide-imides groups and obtained results indicate that they have high heat resistance (above 300 °C). Obtained results show that also they have mechanisms with high yield in suitable speed. However, obtained poly(amide-imide)s derivatives have active light reactions and polarized light optical active. For identifying obtained structures have used of some methods like: ^{1}H-NMR, FT-IR, mass spectroscopy and thermal gravimetric analysis (TGA) and elemental analysis. Some advantages of synthetic method is low synthetic levels and economically costs.

Key words: FT-IR, NMR, Poly (amide-imide)s, TGA, New Syntheses.

INTRODUCTION

Polymers consist of monomeric units that process has done in different compounds and with different methods. Chemical and physical parameters can lead to production of a polymer with unexpected molecular weight (less than normal range). Some physical parameters are as follows. Stirring quality, di amines sediments and polymer sediments [1].Some chemical factors include: range of material reactions with impurities and related acid receivers, other parameters like: impurities [2] and solvent activity [3] and side reactions [4-6]. The most rapid reactions have a speed about 102-106 mol^{-1} sec^{-1} [7-8]. Solvent efficiency has significant influence on polymerization process. Most important parameters involve on the effects of solvents on polymerization process. These are including: solving primary materials for more mixing and contact, swelling agent of growing polymer, salvation of acid acceptor and its effecting formation of side salt products, polarized interactions with using solvent efficiency and absorbing heat of reactions by solvents polymerization mechanisms are done with swelling reagents for activating di carboxylic acids immediately and then condensation under the soft conditions. This method has done with three ways: a) Separable active intermediate is formed in a separation process and is purified before aminolysis. b) Intermediate acylation agent is formed through reaction of carboxylic acid and swelling reagent and then at the same time reacts with amine. c) Activeacylation agent in presence of an amine with augmentation of condensation reagent to amine and carboxylic acid [9-12]. Today modified method (Yamazaki method) [10]is used through condensation polymerization by phosphorylation. In this method, amino acids or aromatic di amines and aromatic di carboxylic acids in presence of an aryl phosphate (diphenyl and tri aryl phosphites) and an organic base like pyridine (C_5H_5N) as swelling reagents in N-methyl pyrrolidine (NMP) solvent including inorganic salts like LiCl and $CaCl_2$. This lead to synthesis of polymers with high molecular weight. Effective parameters on polymers molecular weight are as follow: temperature, intrinsic solvent, monomer nature, monomer concentration effect and reagents and applied base, other condensation reagent, inorganic salts, solvent nature, stirring and homogeneous solution [13]. Usually condensation polymerization reactions in solution are quick and irreversible [14]. Effective variables on condensation polymerization of solution are divided into two groups: a) Properties and intrinsic specialties of pure materials. b) Selected physical conditions by operation in all of systems optimizing of all of these parameters are not necessary and presence of other parameter can compensate lack of another parameter [15]. But poly(amide-imides)s as a subgroup of co poly imides have intermediate properties of these two polymers and maybe have the most similarity with the same poly-imides from heat properties view. They have high yield and are known for following reasons: thermal, chemical and mechanical stability an as processed polymers have high melting point and salvation. They derivate of Tumoplastic poly imides groups. They are widely used in various industrials like: covered electronic wires, glues, selectivity membranes and etc. in comparison with poly imides, poly amides and their homologues have better properties [16].One of the most important of commercial poly amide- poly imides is Turlon that is made from reaction of (tri mellitic anhydride chloride) with (4,4-diamino di phenyl methane). Turlon has good thermal stability, low dielectric constant, very low friction coefficient and high tensile strength. It has very low thermal expansion coefficient (260 °C) and high creeping resistance in which lead to unique dimensional stability and high mechanical stiffness and other functions of Turlon lead to using in hardwares and electronic consumption. This polymer is amorphous and its TG is (280 °C). The most important application of this polymer is in electronic micro chips and other device of computers. Today, poly (imide-amide)s are substituted in auto mobile, shuttles and electric industrial and microelectronic tools instead of metals or ceramic coating because of these polymers have good resistance in high temperatures and are known as new generation of plastics [17-20]. There are various ways for synthesis of these compounds including: synthetic methods based on poly-amice-acid intermediates [21-23], swelling polymerization in low temperatures with other di amines [24], direct-condensation polymerization [25,26]. But in this research for polymerization process in amides and imides direct-polymerization is used some new kinds of poly amide-poly imides derivatives obtained that the effects and application of these compounds will examined in the future.

EXPERIMENTAL

General method

All of necessary materials are purchased from Merck company (Germany) and are purified before application. Domestic-microwave system (Sumsung-2450 MHZ, 900W) is used for polymerization reactions. Magnetic resonance spectrum of hydrogen nucleus (^{1}H-NMR) with 90 MHz was recorded by varian EM-390 and with 500 MHz was recorded by Brukeravance 500. Peak variation in magnetic resonance spectrum are shown with (s), (d), (dd) and (m). (TMS) IS used standard sample in NMR measurements. Infrared (IR) spectrum are recorded by (Shimadzo 435 IR spectrometer). IR are taken after preparation of (KBr) discs as sample and after preparing of thin film of sample on polished NaCl crystal. Vibrational transition frequencies are in wave number (cm^{-1}). Absorbing bands are shown with: (w), (m), (sh), (s) and (br). Thermal gravimetric analysis (TGA) polymers was done by Mettler TGA-50 and with speeds: 10 °C/min, 30 °C/min, 40 °C/min. elementary analysis of sample have done by CHN-RAPID (Heraeus).

Synthesis

Synthesis 2-(1-carboxy-2-methylpropyl)-1,3-dioxoisoindoline-5-carboxylic acidstructure

In a flask (25 mL) with refrigerant, magnetic stirring, 2.00 g (10.40^{3-} 10×mol) of trimellitic anhydride, 1,3-dioxo-1,3-dihydroisobenzofuran-5-carboxylic acid 1.39 g^{3-} 10×10.4)mol) 2,3 –amino methylbutanoic acid and 24.00 mL acetic acid are mixed. This mixture were refluxed for 4 hours and then obtained mixture added to 20.00 mL of HCl (solution). After stirring for 2 hours, 20.00 mL of distilled water added and white 2-(1-carboxy-2-methylpropyl)-1,3-dioxoisoindoline-5-carboxylic acid was dried and purified. 2.54 g of 2-(1-carboxy-2-methylpropyl)-1,3-dioxoisoindoline-5-carboxylic acid with yield of 84% obtained. It recrystallized in methanol and water. Obtained crystals were white with melting point (193-194 °C).to give (2.54 g, 84%);

A white dark compound; Mp 193-194 °C;IR (KBr): 2500-3580 (s, br), 2648 (m, sh),1700 (m), 1714 (s, br), 1605 (m), 1495 (m), 1405 (s), 1385 (s), 1293 (s), 1268 (s), 1207 (m), 1170 (m), 1150 (m), 1101 (m), 1070 (m), 1025 (w), 936 (w), 882 (m), 850(w), 805 (w), 774 (m), 733 (s), 710 (m), 658 (m), 610 (w), 574 (w), 535 (w) cm^{-1}.^{1}H-NMR (DMSO-*d6*, TMS, 90 MHz): ä 1.05-1.30 (dd,3H, J=7.50Hz), 1.70-1.05 (d, 3H, J=7.50Hz), 2.45-2.90 (m, 1H), 4.50-4.70 (d, 1H, J=7.5Hz), 6.20-7.80 (m, 2H), 8.50 (s, 1H, J=6.0Hz), 8.55-8.75 (d, 1H, J=6.0Hz) ppm; MS *m/z* 291, 249(85.69), 205 (14.80); Anal .Calcd for $C_{14}H_{13}NO_6$: C, 57.73; H, 4.50; N, 4.81; O, 32.96. Found: C, 57.95; H, 4.23; N, 4.52; O, 34.96.

Synthesis 5a structure

New poly (amide-imide)s optical activity 1a to 7a were done from polymerization of diacid 2-(1-carboxy-2-methylpropyl)-1,3-dioxoisoindoline-5-carboxylic acid with aromatic diamines according to (table1). For instance: for pre paring of polymer 5a, 0.10 g (3.43×10^{-4}mol) 2-(1-carboxy-2-methylpropyl)-1,3-dioxoisoindoline-5-carboxylic, 0.08 g (3.43×10^{-4}mol) diamine according to (table 1), 0.10 g $CaCl_2$, 0.33 mL (1.27×10^{-4}mol) TPP, 0.29 mL pyridine and 0.60 mL (NMP) were added into a flask (10 mL) with refrigerant drying tube, magnetic stirring. This mixture was heated for 30 minutes in 60 °C for 2 hours in 90 °C and for 8 hours in 130 °C. Then resulted viscous solution was cooled and ten diluted with some (DMF) solvent and by dropper was added to 50.00 mL of hot methanol. Obtained sediment was purified and was dried in vacuum condition for 15 hours in 100 °C. 0.174 g polymer 5a obtained with yield of 92%.to give **5a** (0.174 g, 92%);

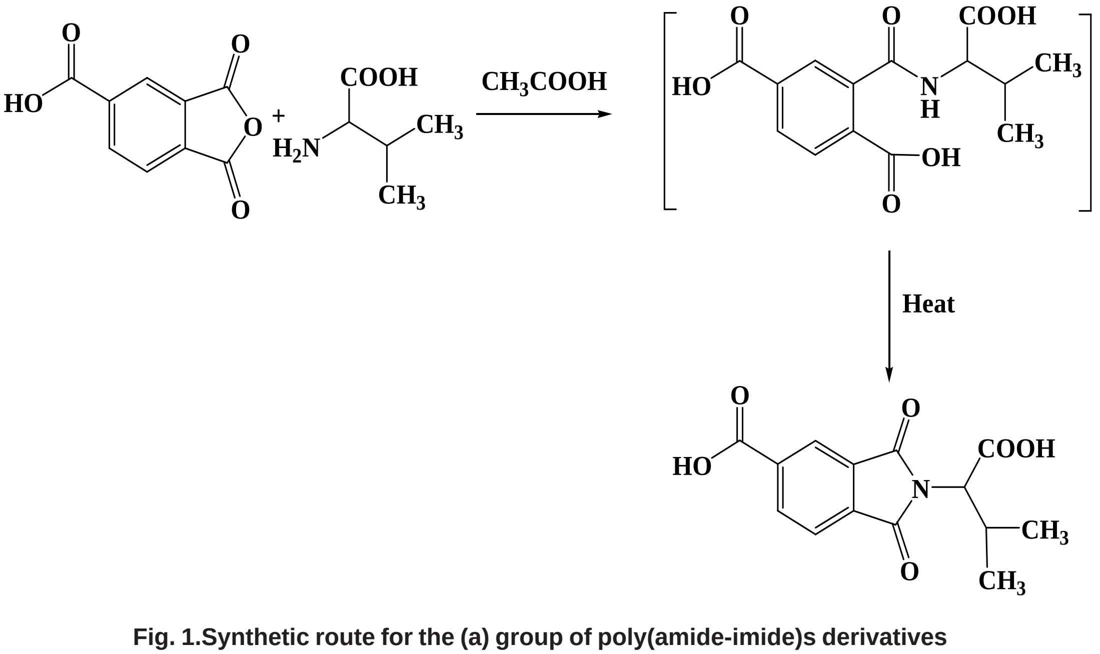


Fig. 1.Synthetic route for the (a) group of poly(amide-imide)s derivatives

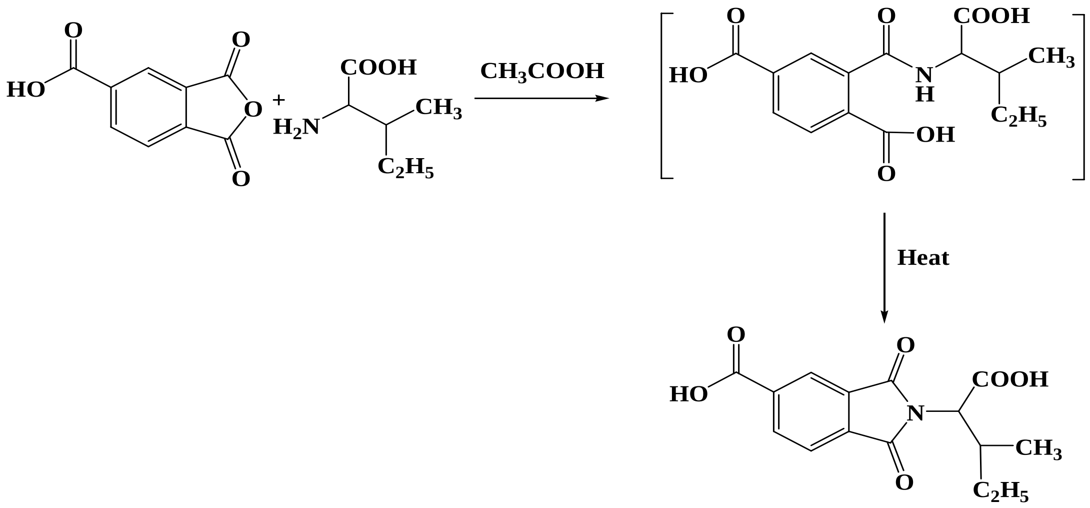


Fig. 2.Synthetic route for the (b) group of poly(amide-imide)s derivatives.

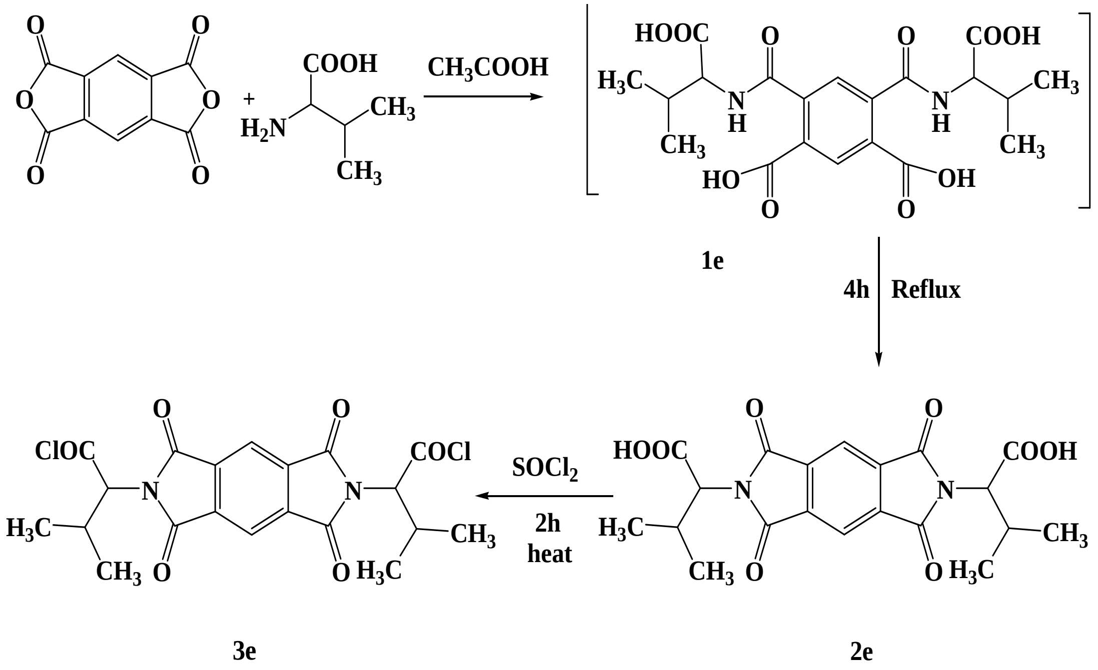


Fig. 3. Synthetic route for the (c) group of poly(amide-imide)s derivatives.

A white compound; thermistor property 300 °C; IR (KBr): 3550 (m), 3300 (m, br), 3110 (m, sh), 2955 (m), 2811 (m, sh), 1775 (m), 1712 (s), 1680 (s, sh), 1590 (s), 1520 (s), 1490 (s, sh), 1429(w, sh), 1400 (m), 1388 (s), 1318 (s), 1250 (s), 1180 (m, sh), 1155 (s), 1102 (s), 1075 (m), 1011 (w), 942 (w), 888(w), 830 (m), 722 (s), 693 (m), 626 (w, sh), 555 (m, br) cm^{-1}; MS *m/z* 521, 506(21.69), 462 (69.60), 386 (35.58); Anal. Calcd for $C_{26}H_{23}N_3O_7S$: C, 62.02; H, 4.45; N, 8.34; O, 21.47; S, 6.15.Found: C, 59.88; H, 4.29; N, 8.06; O, 20.57; S, 6.35.

Synthesis 1a structure

to give **1a** (1.42 g, 85%); A yellow compound; IR (KBr): 3305 (m, br), 3095 (m, sh), 2955

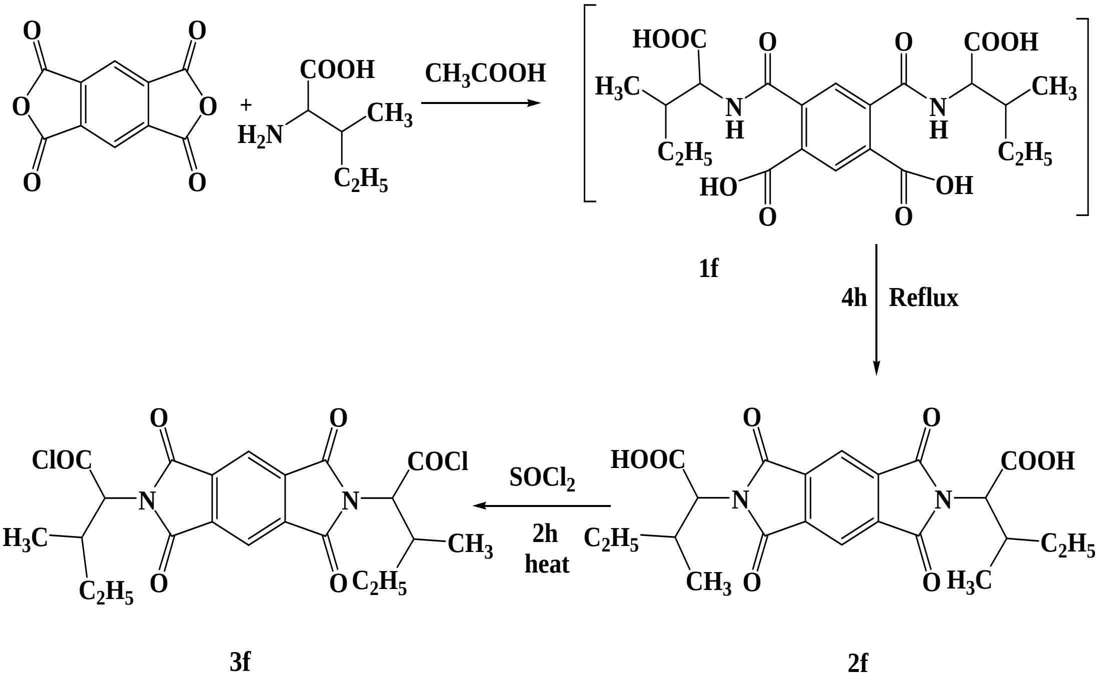


Fig. 4. Synthetic route for the (d) group of poly(amide-imide)s derivatives.

(m), 1776 (m), 1728 (s), 1670 (s), 1614 (m), 1548 (m, sh), 1510 (s), 1479 (m, sh), 1433 (m, sh), 1408 (m), 1375 (s), 1317 (s), 1255 (m), 1181 (m, sh), 1082 (m), 1001 (w), 949 (s), 835 (m), 724 (s), 522 (w) cm^{-}1; MS *m/z* 381, 351(45.23), 336(12.85), 260(76.58); Anal. Calcd for: $C_{20}H_{19}N_3O_5$:C, 66.11; H, 4.88; N, 11.56; O, 20.98. Found: C, 65.41; H, 5.01; N, 10.85; O, 21.88.

Synthesis 2a structure

to give **2a** (1.54 g, 89%); A white dark compound; IR (KBr): 3300 (m, br), 3080 (m, sh), 2970 (m), 1775 (m), 1715 (s), 1670 (s), 1590 (s), 1530 (s), 1490 (s), 1470 (m, sh), 1375 (s), 1280 (m), 1250 (m), 1190 (m), 1160 (m), 1070 (m), 1020 (m), 1000 (w), 950 (s), 910 (m), 820 (w), 760 (m), 720 (s), 680 (m), 580 (w) cm^{-1}; MS *m/z* 395, 381(46.19), 351(24.64), 336(16.68); Anal. Calcd for: $C_{21}H_{21}N_3O_5$:C, 65.83; H, 5.07; N, 11.13; O, 20.23. Found: C, 64.96; H, 5.35; N, 10.67; O, 21.13.

Synthesis 3a structure

to give **3a** (1.98 g, 90%); A green dark complexes; IR (KBr): 3306 (m, br), 3085 (m, sh), 2965 (m), 17775 (m), 1725 (s), 1675 (s), 1605 (m), 1535 (s), 1496 (s), 1418 (m), 1385 (s), 1334 (m), 1266 (m), 1255 (m), 1195 (m), 1076 (m), 944 (w), 906 (w, sh), 865 (w), 784 (m), 729 (s), 688 (w), 580 (w) cm^{-1}; MS *m/z* 431, 416(39.19), 386(15.70), 372(87.38); Anal. Calcd for: $C_{24}H_{21}N_3O_5$; C, 69.72; H, 4.93; N, 10.16; O, 18.57.Found: C, 68.37; H, 4.59; N, 9.74; O, 17.57.

Synthesis 4a structure

To give **4a** (2.12 g, 97%); A white compound; IR (KBr): 3303 (m, br), 3082 (m, sh), 2994 (m), 1776 (m), 1715 (s), 1666 (s, sh), 1609 (s), 1535 (s), 1482 (s), 1477 (s), 1370 (s), 1305 (m, sh), 1256 (m), 1079 (m), 1021 (w), 933 (w), 872 (w), 785 (m), 723 (s), 684 (m), 581 (w), cm^{-1}; MS *m/z* 381, 366(54.19), 336(57.24), 322(27.58); Anal. Calcd for: $C_{20}H_{19}N_3O_5$:C, 66.20; H, 4.71; N, 11,56; O, 20.98. Found: C, 64.80; H, 5.03; N, 11.04; O, 22.13.

Synthesis 6a structure

To give **6a** (2.14 g, 97%); A yellow dark compound; IR (KBr): 3300 (m, br), 3048 (m, sh), 2951 (m), 1775 (m), 1716 (s), 1677 (s), 1606 (s), 1532 (s, sh), 1518 (s), 1437 (m, sh), 1404 (s), 1388 (s), 1314 (s), 1248 (s), 1180 (m), 1100 (m, sh), 1074

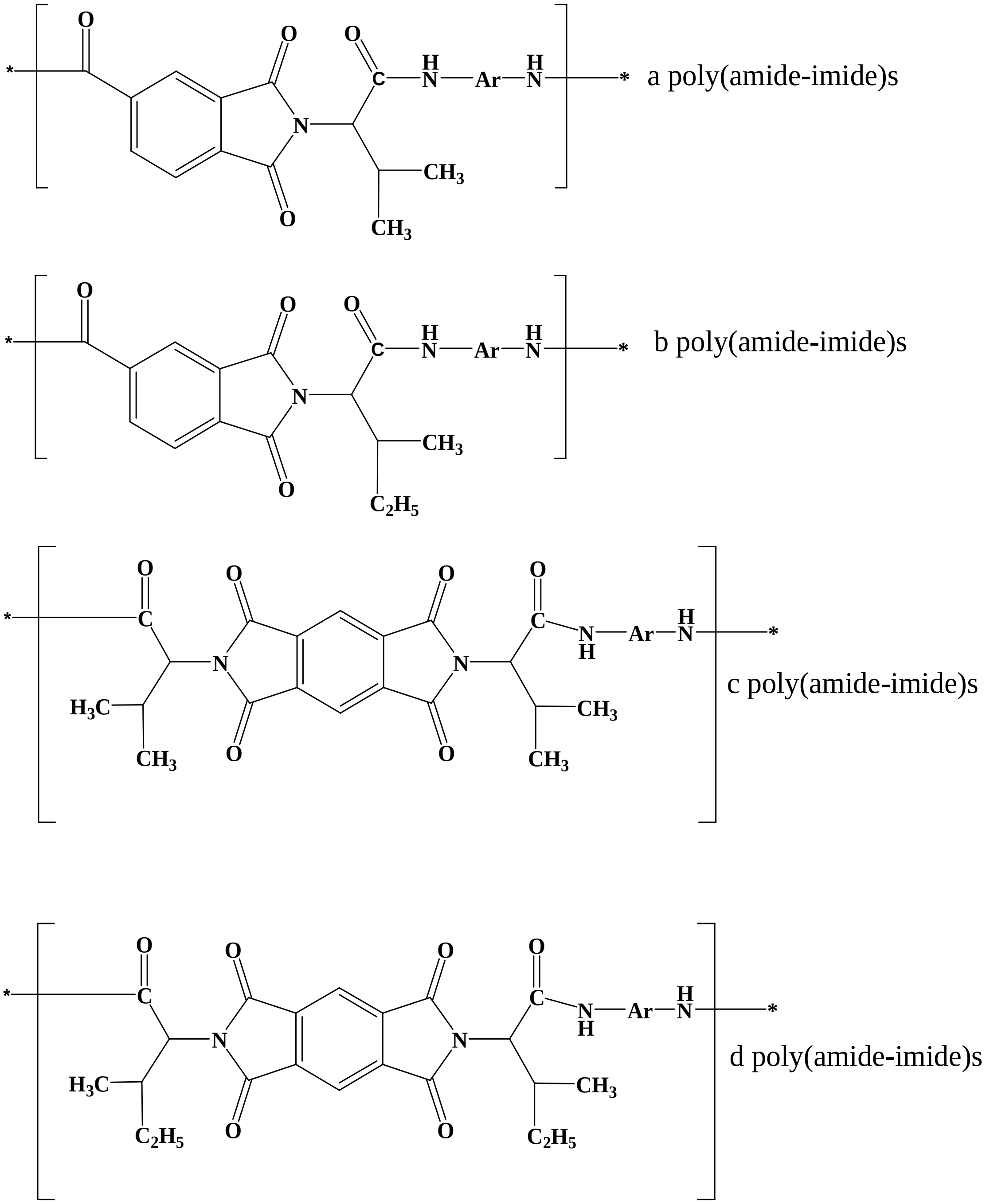


Fig. 5. Show obtained poly(amide-imide)s derivatives structures.

(m), 1016 (w), 943 (w), 912 (w), 858 (w), 811 (m), 765 (m), 723 (s), 602 (w), 505 (w) cm^{-1}; MS *m/z* 471, 456(54.16), 426(87.12), 412(45.28); Anal. Calcd for: $C_{27}H_{25}N_3O_5$; C, 71.51; H, 5.11; N, 9.26; O, 16.97.Found: C, 68.94; H, 5.34; N, 8.91; O, 15.87.

Synthesis 7a structure

To give **7a** (2.10 g, 96%); A yellow dark compound; IR (KBr): 3300 (m, br), 3105 (m, sh), 2959 (m), 1775 (m), 1715 (s), 1666 (s, sh), 1604 (m), 1533 (m, sh), 1504 (s), 1468 (m, sh), 1415 (m), 1355 (m, sh), 1226 (s), 1165 (m), 1101 (m, sh), 1072 (m), 1011 (w), 934 (m), 855 (w, sh), 825 (m), 760 (m), 726 (s), 685 (w), 504 (w, br) cm^{-1}; MS *m/z* 473, 458(18.19), 428(32.20), 414(30.58); Anal. Calcd for: $C_{26}H_{23}N_3O_6$; C, 68.56; H, 4.90; N, 9.22; O, 20.27. Found: C, 67.94; H, 4.55; N, 8.97; O, 21.37.

Synthesis of 2-(1-carboxy-2-methylbutyl)-1,3-dioxoisoindoline-5-carboxylic acidstructure

In a flask (25 mL) equipped with magnetic stirring 0.15 g (7.806×10^{-4}mol) (tri mellitic anhydride)-1,3-dioxo-1,3-dihyroisobenzofuran-5-carboxylic acid, 0.10 g (7.806×10^{-4}mol) Isoleucine 2-amino-3-methylpentanoic acid was added to 2.00 mL (DMF) and were refluxed for 4 hours. Then obtained solution was added to 20.00 mL dilute HCl (10%) and obtain white sediment of 2-(1-carboxy-2-methylbutyl)-1,3-dioxoisoindoline-5-carboxylic aid. This sediment dried in vacuum condition and purified. Compound of 2-(1-carboxy-2-methylbutyl)-1,3-dioxoisoindoline-5-carboxylic acid resulted with yield of 76% and weight (0.18 g). It was easily recrystallized in methanol and water and formed white crystals. Melting point of this compound is (195-197 °C).

To give (0.18 g, 76%); A white dark compound; Mp 195-197°C; IR (KBr): 2700-3700 (s, sh), 2809 (s, br), 1788 (s, sh), 1704 (s, br), 1609 (m, sh), 1488 (m), 1466 (m),1425 (m), 1387 (s), 1344 (s, sh), 1285 (s), 1263 (m, sh), 1203 (m), 1171 (m), 1151 (m, sh), 1092 (m), 1022 (w), 962 (w, sh), 933 (m), 888 (m), 800 (w), 768 (m), 735 (s), 704 (m), 651 (m), 574 (w), 533 (w), cm^{-1}. ^{1}H-NMR (DMSO-*d6,* TMS, 90MHz): d 0.70-1.09 (t, 3H, *J* = 6.0 Hz), 1.10-1.30 (d, 3H, *J* = 6.0 Hz), 1.37-2.70 (m, 3H), 4.55-4.80 (d, 1H, *J* = 6.9 Hz), 8.50-8.75 (m, 2H, *J* = 6.30 Hz), 8.00-9.80 (s, 2H) ppm; MS *m/z* 305, 263(85.69), 249(58.80), 205(16.13); Anal. Calcd for $C_{15}H_{15}ON_6$: C, 59.01; H, 4.95; N, 4.59; O, 31.45. Found: C, 59.28; H, 4.55; N, 5.04; O, 32.48.

Synthesis of 1b structure

Optical activity of poly (amide-imides) 1b to 7b are prepared with direct condensation polymerization of monomer 2-(1-carboxy-2-methylbutyl)-1,3-dioxoisoindoline-5-caboxylic acid and aromatic di amines according to (table 2) in long time and with graduate temperature. For instance, for preparation of 1b polymer, 0.10 g (3.27×10^{-4}mol) di acid 2-(1-carboxy-2-methylbutyl)-1,3-dioxoisoindoline-5-caboxylic acid, 0.03 g of diamine (1e) (3.27×10^{-4}mol), 0.100 g of calcium chloride ($CaCl_2$), 0.33 mL of TPP (1.27×10^{-3}mol), 0.29 mL of pyridine, 0.50 mL of N-methyl pyrrolidine (NMP) in a flask (10 mL) equipped with claisen adapter, refrigerant, drying tube, magnetic stirring. This mixture reacted under the nitrogen atmosphere for 30 minutes in 60 °C, for 2 hours in 90 °C and for 8 hours in 130 °C. resulting viscous solution was diluted with 2.00 mL of (DMF) and then cooled and by dropper added to 50.00 mL of methanol. 1b polymer produced yellow wish sediment in methanol. The sediment was purified and for 15 hours was dried under the vacuum condition in 100 °C. 0.114 g polymer 1b obtained with yield of 92%.

To give **1b** (0.114 g, 92%); A yellow dark compound; IR (KBr): 3300 (m, br), 3100 (m, sh), 2950 (m), 1770 (m), 1710 (s), 1650 (s), 1600 (m), 1540 (m, sh), 1505 (s), 1460 (m, sh), 1430 (w), 1400 (m), 1370 (s), 1330 (s), 1250 (m), 1170 (m), 1070 (m), 1020 (w), 940 (m), 900 (w), 830 (m), 760 (w), 720 (s) cm^{-1}; MS *m/z* 395, 380(97.00), 350(45.15), 336(78.58); Anal. Calcd for $C_{21}H_{21}N_3O_5$: C, 66.73; H, 5.07; N, 11.13; O, 20.23. Found: C, 66.04; H, 5.35; N, 10.63; O, 21.45.

Synthesis of 2b structure

To give **2b** (1.54 g, 98%); A white dark compound; IR (KBr): 3300 (m, br), 2935 (m), 1775 (m), 1714 (m), 1650 (s), 1595 (s), 1521 (s), 1505 (s),1366 (s), 1250 (m), 1199 (m, sh), 1180 (m), 1086 (m), 1025 (m), 1000 (w), 945 (m), 904 (m), 860 (w, sh), 825 (w), 760 (m), 728 (s), 680 (m) cm^{-1}; MS *m/z* 409, 379(48.19), 365(87.80), 336(56.19); Anal. Calcd for $C_{22}H_{23}N_3O_5$: C, 67.41; H, 5.41; N, 10.73;O, 19.45. Found: C, 67.56; H, 5.66; N, 10.26; O, 18.54.

Synthesis of 3b structure

To give **3b** (0.2 g, 93%); A green compound; IR (KBr): 3308 (m, br), 3070 (m), 2955 (m), 1770 (m), 1719 (s), 1679 (s), 1628 (m,sh), 1600 (m), 1529 (s), 1498 (s), 1485 (s, sh), 1416 (m), 1375 (s), 1336 (s), 1268 (m), 1255 (m), 1196 (m), 1075 (m), 940 (w), 905 (w), 865 (w), 790 (m), 722 (s), 683 (w) cm^{-1}; MS *m/z* 445, 415(58.19), 401(75.98), 386(98.00); Anal. Calcd for $C_{25}H_{23}N_3O_5$: C, 70.25; H, 4.95; N, 9.83; O, 17.95. Found: C, 68.61; H, 4.90; N, 9.46; O, 17.45.

Synthesis of 4b structure

To give **4b** (1.22 g, 97%); A white dark compound; IR (KBr): 3302 (m, br), 3051 (m, sh), 2952 (m), 1775 (m), 1710 (s), 1665 (s, sh), 1604 (s), 1522 (s), 1508 (s), 1425 (s), 1375 (s), 1304 (s, sh), 1256 (m), 1165 (m), 1075 (m), 940 (w), 850 (w), 778 (m), 725 (s), 686 (m) cm^{-1}; MS *m/z* 395, 365(38.97), 351 (45.70), 336(54.58); Anal. Calcd for $C_{21}H_{21}N_3O_5$: C, 66.93; H, 5.17; N, 11.13; O, 20.23. Found: C, 66.74; H, 5.23; N, 10.68; O, 19.95.

Synthesis of 5b structure

To give **5b** (0.4 g, 93%); A white compound; IR (KBr): 3300 (m, br), 2908 (m), 1789 (m), 1711 (s), 1654 (s), 1580 (s), 1515 (s), 1496 (s), 1383 (s), 1302 (s), 1250 (s), 1176 (m, sh), 1145 (s), 1095 (s), 1074 (s, sh), 1026 (m, sh), 930 (m, sh), 839 (m), 724 (s), 680 (m), 551 (m) cm^{-1}; MS *m/z* 535, 505(28.69), 491(14.80), 476(26.58); Anal. Calcd for $C_{27}H_{25}N_3O_7S$: C, 62.76; H, 4.78; N, 8.12; O, 20.91; S, 5.99. Found: C, 62.64; H, 4.41; N, 7.81; O, 21.51; S, 5.78.

Synthesis of 6b structure

To give **6b** (0.10 g, 83%); A yellow dark compound; IR (KBr): 3300 (m, br), 3059 (m, sh), 2957 (m), 1785 (m), 1714 (s), 1652 (s), 1603 (s), 1521 (s, br), 1514 (s), 1496 (m, sh), 1465 (m, sh), 1405 (m), 1375 (s), 1310 (s), 1250 (m), 1180 (m), 1072 (m), 1025 (w), 944 (m), 910 (w), 856 (w), 819 (m), 767 (m), 720 (s), 688 (w) cm^{-1}; MS *m/z* 485, 455(35.54), 441(87.58), 426(91.18); Anal. Calcd for $C_{28}H_{27}N_3O_5$: C, 71.78; H, 5.39; N, 8.88;O, 16.48. Found: C, 72.27; H, 5.64; N, 8.53; O, 17.91.

Synthesis of 7b structure

To give **7b** (1.24 g, 97%); A yellow compound; IR (KBr): 3300 (m, br), 3050 (m, sh), 2950 (m), 1770 (m), 1710 (s), 1670 (s, sh), 1600 (m), 1520 (m, sh), 1490 (s), 1400 (m, sh), 1360 (m), 1310 (m), 1210 (s), 1090 (m, sh), 1065 (m), 1005 (w), 940 (m), 870 (w, sh), 820 (m), 750 (m), 720 (s), 680 (w) cm^{-1}; MS *m/z* 487, 457(98.69), 443(18.80), 428(36.18); Anal. Calcd for $C_{27}H_{25}N_3O_6$: C, 69.47; H, 4.94; N, 8.95; O, 19.68. Found: C, 68.50; H, 4.83; N, 8.62; O, 20.48.

Synthesis 2e reactant

In a round-bottomed flask (25 mL) equipped with refrigerant and drying tube, 1.00 g of pyro mellitic di anhydride (4.58×10^{-3}mol), 1.07 g (9.16×10^{-4}mol) 2-amino-3-methylbutanoic acid and 15.00 mL of acetic acid pot on a magnetic stirring. This mixture was stirring at room temperature for 5 hours and then was refluxed in boiling temperature of solvent for 6 hours. Then 25.00 mL of diluted HCl (10%) cooled and obtained mixture was stirring at room temperature for 1 hours. White sediment was purified and dried for 10 hours in 80 °C under the vacuum condition. Finally, have (2e) with yield of 92% and weight of 1.75 g. This compound easily recrystallized in methanol and water. At the end, white crystal formed. Melting point of di acid optical active was (265-267 °C).

To give **2e** (1.75 g, 92%); A white dark compound; Mp 265-267°C;IR (KBr): 2450-3500 (s, br), 1766 (s, sh), 1728 (s, br), 1468 (m), 1447 (m), 1389 (s), 1366 (s), 1263 (s), 1152 (m), 1085 (s), 1024 (m), 896 (s), 826 (m), 786 (m), 725 (s), 624 (m) cm^{-1}.^{1}H-NMR (DMSO-*d6*, TMS, 90 MHz)ä: 0.8-1.3 (d,12H), 2.5-2.9 (m, 2H), 4.5(d, 2H, *J* = 9 Hz), 11.3 (s, 2H) ppm; MS *m/z* 416, 388 (87.19), 330 (54.10), 316 (78.48); Anal. Calcd for $C_{20}H_{20}N_2O_8$: C, 57.58; H, 5.99; N, 6.85; O, 30.68. Found: C, 57.69; H, 5.84; N, 6.73; O, 30.4.

Synthesis 3e reactant

In a round-bottomed flask (25 mL) equipped with refrigerant and drying tube, 0.50 g (1.20×10^{-3}mol) di acid 2e and 4.00 mL of thionyl chloride put on a magnetic stirring. This mixture were reacted in room temperature for 2 hours and then refluxed for 1 hours. Then excess thionyl chloride omitted with vacuum distillation and rest of this reaction rinsed with (n-Hexane). 0.53 gr of production with yield of 0.98%.melting point of this product was (134-140 °C).

To give **3e** (0.53 g, 0.98%); A white dark compound; Mp134-140°C; IR (KBr): 3110 (w), 2953 (s), 2905 (m), 1823 (s, sh), 1790 (s), 1728 (s, br), 1469 (s), 1388 (s), 1369 (s), 1346 (s), 1276 (m), 1254 (w), 1152 (s), 1120 (m), 1084 (s), 1050 (s), 1024 (m), 995 (m), 911 (s), 863 (m), 842 (m), 814 (m), 777 (s), 730 (s), 620 (s), 580 (w) cm^{-1}; MS *m/z* 452, 424(78.19), 348(36.87), 334(16.18); Anal. Calcd for $C_{20}H_{18}Cl_2N_2O_6$: C, 53.08; H, 4.89; N, 6.18;O, 21.18; Cl, 15.64. Found: C, 52.69; H, 5.24; N, 6.73;O, 21.08; Cl, 14.89.

Synthesis of 1c structure

Polymerization of di acid chloride (3e) with aromatic amines in above condition have done (Table 3). For instance, for preparation of polymer (1c) in a crucible, 0.10 g (2.20×10^{-4}mol) (3e) and 0.02 g (2.20×10^{-4}mol) di amine (1c) put in and after complete abrade for 5 minutes, when mixture of reactants became powder, 0.10 mL of *ortho*corsol as solvent added to reaction system. After complete erosion of reactants for 3 minutes 0.04 mL of (TMSCl) added and this reaction was abraded for 3 minutes. Then reactant mixtures influenced with radiation of microwave with potentials by of 100% for 6 minutes. Forming film polymer with increasing of 20 mL methanol and erosion, was separated and after purification, under the vacuum condition dried at 80 °C for 10 hours. Obtained polymer was with yield of 61% and weight of 0.07 g.

To give **1c** (0.07 g, 61%); A yellow dark compound; IR (KBr): 3305 (m, br), 2952 (m), 1770 (s), 1724 (s, br), 1612 (m), 1513 (s), 1462 (m), 1380 (s), 1351 (s), 1304 (s), 1249 (m), 1157 (m), 1084 (s), 1006 (w), 925 (m), 832 (m), 723 (s), 622 (w) cm^{-1}.^{1}H NMR (DMSO-*d6*, TMS, 500 MHz): d 0.86-0.87 (d, 3H, *J* = 5.86 Hz), 1.04-1.05 (d, 3H, *J* = 5.82 Hz), 2.83 (m, 1H), 3.98-4.10 (m, 1H, *J* = 7.56 Hz), 4.58-4.60 (d, 1H, *J* = 7.98 Hz), 7.46 (s, 1H), 8.31 (s, 1H), 9.99 (s, NH), 10.21-10.68 (s, 1H) ppm; MS *m/z* 506, 491(88.20), 463(20.87), 449(11.18); Anal. Calcd for $C_{26}H_{26}N_4O_7$: C, 63.93; H, 4.95; N, 11.47;O, 19.98. Found: C, 64.42; H, 5.46; N, 12.34;O, 16.68.

Synthesis of 2c structure

To give **2c** (0.11g, 85%); A yellow compound; IR (KBr): 3300 (m, br), 2935 (s), 1777 (s), 1728 (s), 1604 (s), 1520 (s), 1450 (m), 1389 (s), 1356 (s), 1215 (m), 1144 (m), 1080 (s), 1005 (w), 916 (w), 861 (m), 810 (m), 725 (s), 654 (w), 624 (w) cm^{-1}; MS *m/z* 520, 505(78.19), 491(36.87), 463(16.18); Anal. Calcd for $C_{27}H_{28}N_4O_7$: C, 64.53; H, 5.21; N, 12.15; O, 15.38. Found: C, 64.46; H, 5.88; N, 13.45; O, 16.68.

Synthesis of 3c structure

To give **3c** (0.09 g, 70%); A white dark compound; IR (KBr): 3303 (m, br), 2938 (m), 1777 (s), 1729 (s), 1601 (s), 1535 (s), 1481 (s), 1422 (s), 1385 (s), 1346 (s), 1307 (m, sh), 1204 (m), 1155 (m), 1076 (m), 1004 (w), 911 (w), 862 (w), 780 (m), 725 (s), 680 (m), 624 (w), 566 (w) cm^{-1}; MS *m/z* 506, 491(89.32), 463(46.17), 449(78.20); Anal. Calcd for $C_{26}H_{26}N_4O_7$: C, 63.93; H, 4.85; N, 11.57; O, 16.08. Found: C, 64.41; H, 5.08; N, 11.14; O, 16.58.

Synthesis of 4c structure

For instance have is presented preparing method of poly (amide-imide 4c). In a round-bottomed flask (5 mL) equipped with drying tube, 0.10 g of di acid chloride (2.21×10^{-4}mol) according to table 3, 0.05 g (2.21×10^{-4}mol) di amine, 0.04 mL tri methyl silyl chloride (TMSCl) and 0.02 mL N,N-di methyl acetamide (DMAC) added (Table 3). This mixture was refluxed for 8 minute. After reaching reaction temperature to room temperature, obtained viscous solution added to 30.00 mL (methanol) and then system temperature reached to room temperature and was stirring for 5 hours. Resulting viscous solution added to 30.00 mL of methanol and polymer sedimentation was dried in 80 °C for hours. Yield of reaction was 94.00%and polymer weight was (5c) 0.13 g.

To give **4c** (0.13 g, 94%); A yellow compound; IR (KBr): 3308 (m, br), 2951 (s), 1773 (s), 1724 (s, br), 1594 (s), 1525 (s), 1461 (m), 1380 (s), 1345 (s), 1317 (m, sh), 1244 (m), 1153 (s), 1102 (s), 1075 (m), 910 (w), 835 (m), 724 (s), 625 (m), 560 (w), cm^{-1}; MS *m/z* 646, 631(85.11), 603(36.87), 589(24.25); Anal. Calcd for $C_{32}H_{30}N_4O_9S$: C, 61.24; H, 4.89; N, 8.91; O, 16.58. Found: C, 61.45; H, 5.78; N, 9.45;O, 16.08.

Synthesis of 5c structure

To give **5c** (0.098 g, 77%); A yellow dark compound; IR (KBr): 3305 (m, br), 2954 (m), 1775 (s), 1726 (s), 1604 (s), 1510 (s), 1467 (m), 1416 (m), 1381 (s), 1344 (s), 1240 (m), 1150 (m), 1074 (s), 1013 (w), 912 (m), 810 (m), 724 (s), 622 (w) cm^{-1}; MS *m/z* 596, 581(56.20), 553(21.41), 539(45.99);

Anal. Calcd for $C_{33}H_{32}N_4O_7$: C, 68.50; H, 5.23; N, 9.68; O, 12.36.Found: C, 68.38; H, 5.76; N, 10.82; O, 11.28.

Synthesis of 6c structure

For instance here present preparing method of 7c poly (amide-imide). In a round-bottomed flask equipped with drying tube, 0.04 g (2.21×10^{-4}mol) of di amine added to 0.50 of NMP (Table 5). After complete salvation of di amine, reaction temperature reduced to (-5 °C). through stirring 0.10 g (2.21×10^{-4}mol) (3e) added. After reactant salvation, 0.04 mol of (TMSCl) added and at the -5 °C reaction under the nitrogen atmosphere was stirring for 4 hours. Then system temperature reached to room temperature and was stirring for 5 hours. Resulting viscous solution added to 25.00 mL of methanol and obtained polymer was purified and under the vacuum condition was dried at 80 °C for 10 hours. Yield of reaction was 89% and polymer amount was 0.11 g.

To give **6c** (0.11 g, 89%); A yellow compound; IR (KBr): 3604 (s), 3306 (m), 2990 (m), 2988 (m, sh), 1775 (s), 1720 (s), 1600 (s), 1532 (s, sh), 1501 (s), 1463 (m), 1404 (m, sh), 1389 (s), 1344 (s), 1305 (m, sh), 1227 (s), 1155 (m), 1064 (s), 1004 (w), 913 (w), 824 (s), 727 (s), 627 (m) cm^{-1}.^{1}H NMR (DMSO-*d6*, TMS, 500 MHz) d: 0.86-0.87 (d, 3H, *J* = 5.45 Hz), 1.04-1.05 (d, 3H, *J* = 5.41 Hz), 2.84 (m, 1H), 3.68-4.02 (m, 1H, *J* = 7.56 Hz), 4.59-4.61 (d, 1H, *J* = 8.00 Hz), 6.90-6.92 (d, 1H, *J* = 8.25 Hz), 7.49-7.5 (d, 1H, *J* = 8.35 Hz), 8.33 (s, 1H), 10.04 (s, NH), 10.45-11.02 (s, 1H) ppm ; MS *m/z* 598, 583 (77.11), 555 (12.98), 541 (45.56); Anal. Calcd for $C_{32}H_{30}N_4O_8$: C, 66.20; H, 4.86; N, 9.65; O, 16.39. Found: C, 67.70; H, 4.94; N, 10.76;O, 16.36.

Synthesis 3f reactant

In a round-bottomed flask (25 mL) equipped with refrigerant and drying tube, 0.10 g (2.25×10^{-4}mol) (2f) and 2.50 mL excessive thionyl chloride put on a magnetic stirring. This mixture reacted and refluxed for 2 hours. Then excessive thionyl chloride with vacuum distillation omitted and rest of reaction rinsed with (n-Hexane) 3 times. Yield of reaction was 97% and resulted production was 0.105 g.

To give **3f** (0.105 g, 97%); A white dark compound; Mp 143-144°C; IR (KBr): 2955 (m), 2904 (m), 1811 (s), 1799 (s), 1778 (s), 1457 (m), 1384 (s), 1363 (s), 1150 (m), 1122 (m), 1080 (s), 1012 (m), 895 (m), 804 (w), 760 (w), 739 (s), 635 (w), 604 (m) cm^{-1}; MS *m/z* 480, 438(58.20), 362(12.98), 348(89.16); Anal. Calcd for $C_{22}H_{22}Cl_2N_2O_6$: C, 54.89; H, 4.61; N, 5.82; O, 19.94; Cl, 14.73. Found: C, 54.94; H, 4.87; N, 5.65; O, 18.74; Cl, 15.83.

Synthesis of 1d structure

3f polymerization (di acid chloride) were done with aromatic di amines in above conditions. For example, for preparation of 1d polymer, in a crucible, 0.10 g (2.07×10^{-4}mol) 3f and 0.02 g (2.07×10^{-4}mol) various di amine added and after complete erosion for 5 minutes, when all of reactants became powder, 0.10 mL (NMP) was added as solvent to reaction system. After complete erosion of reactants for 5 minute this mixture was reacted under the radiation with microwave by potentiality of 50% obtained film polymer with increasing of 20.00 mL methanol and erosion, it was separated and under the vacuum conditions dried at 80 ºC for 10 hours. Yield of this reaction was 80% and resulting polymer is 0.20 g.

To give **1d** (0.20 g, 80%); A yellow dark compound; IR (KBr): 3300 (m, br), 2958 (s), 1779 (s), 1722 (s, br), 1601 (m), 1523 (m, sh), 1501 (s), 1465 (m), 1419 (m), 1380 (s), 1343 (s), 1220 (s), 1154 (m), 1105 (m), 1070 (m), 1011 (w), 914 (w), 852 (m), 830 (s), 720 (s), 620 (w), 560 (w) cm^{-1}. ^{1}H-NMR (DMSO-*d6*, TMS, 500 MHz) d: 0.82 (s, br, 3H), 0.99 (m, 3H), 1.50 (s, br, 2H), 2.63 (s, br, 1H),3.54-4.12 (m,1H,*J* = 7.56 Hz), 4.71-4.73 (d, 1H, *J* = 7.60 Hz), 7.74-7.76 (d, 1H, *J* = 7.75 Hz), 7.82-7.84 (d, 1H, *J* = 7.85 Hz), 8.29-8.31 (s, 1H), 10.45-10.50 (s, NH), 10.69-11.00 (s, 1H) ppm; MS *m/z* 534, 519(89.31), 477(54.55), 463(35.16); Anal. Calcd for $C_{28}H_{30}N_4O_7$: C, 65.11; H, 5.46; N, 10.85; O, 15.37. Found: C, 65.33; H, 5.81; N, 11.45; O, 14.17.

Synthesis of 2d structure

To give **2d** (0.045 g, 52%); A yellow compound; IR (KBr): 3303 (m, br), 2920 (s), 1774 (s), 1725 (s, br), 1668 (s), 1600 (m), 1525 (m), 1494 (m), 1453 (m), 1386 (s), 1340 (s), 1317 (m), 1148 (m), 1107 (m, sh), 1079 (s), 1000 (w), 911 (w), 867 (m), 821 (m), 722 (s), 650 (w), 626 (w), 564 (w) cm^{-1}; MS *m/z* 548, 533(69.10), 477(78.52), 463(33.56); Anal. Calcd for $C_{29}H_{32}N_4O_7$: C, 65.65; H, 5.69; N, 10.56; O, 14.77. Found: C, 64.81; H, 6.11; N, 11.19; O, 13.87.

Synthesis of 3d structure

To give **3d** (0.079 g, 61%); A white dark compound; IR (KBr): 3307 (m, br), 2954 (s), 1770 (s), 1721 (s, br), 1605 (s), 1534 (s), 1489 (s), 1428 (s), 1380 (s), 1346 (s), 1213 (m), 1150 (m), 1105 (m, sh), 1081 (s), 1000 (w), 910 (w), 865 (m), 764 (m), 723 (s), 687 (m), 624 (w), 561 (w) cm^{-1}; MS *m/z* 534, 519(32.89), 443(45.98), 429(76.12); Anal. Calcd for $C_{28}H_{30}N_4O_7$: C, 65.41; H, 5.36; N, 10.85;O, 15.77. Found: C, 64.38; H, 5.82; N, 11.58; O, 15.37.

Table 1.Yields and reaction conditions of the synthesized (a) group of poly(amide-imide)s derivatives

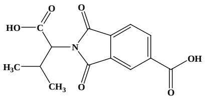
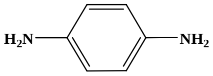
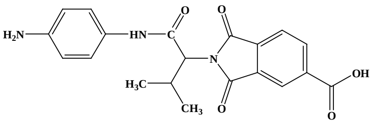
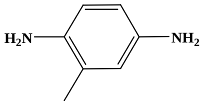
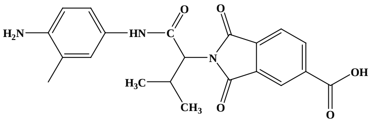
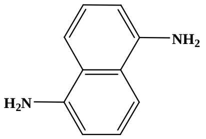
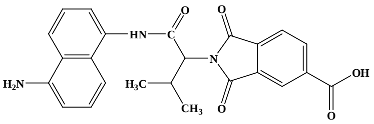
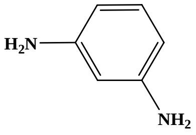
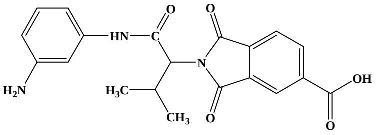
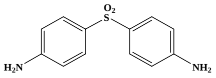
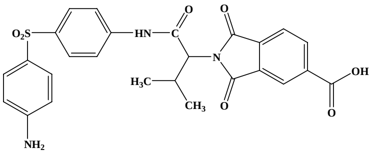
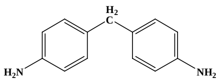
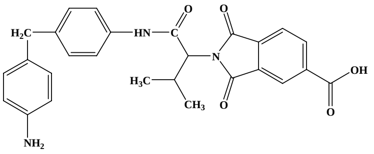
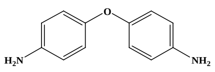
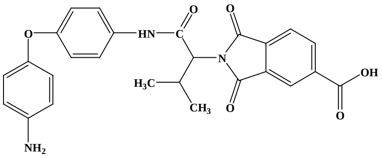
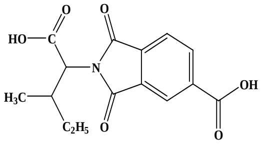
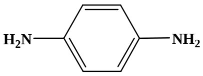
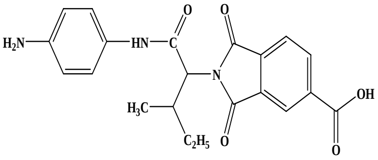
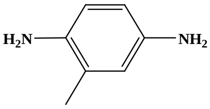
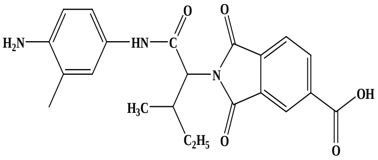
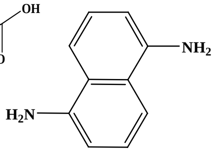
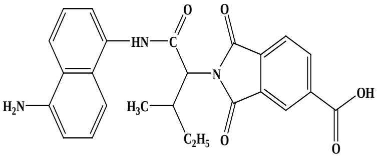
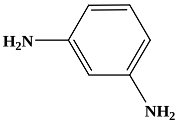
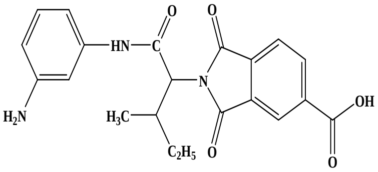
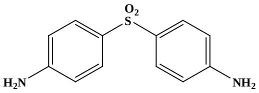
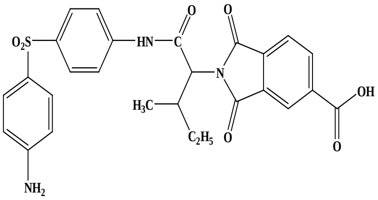
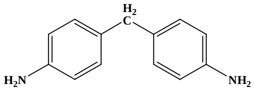
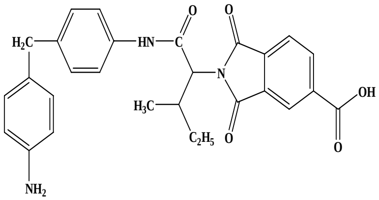
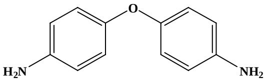
Entry	Reactant	Product	Yield (%)	Color
1a	 		85	Yellow
2a			89	White
3a			90	Green
4a			97	White
5a			92	White
6a			97	Yellow
7a			96	Yellow

Table 2.Yields and reaction conditions of the synthesized (c) group of poly(amide-imide)s derivatives.

Entry	Reactant	Product	Yield (%)	Color
1b	 		92	Yellow
2b			98	White
3b			93	Green
4b			97	White
5b			93	White
6b			83	Yellow
7b			97	Yellow

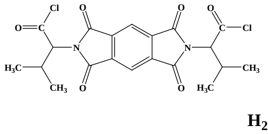
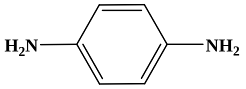
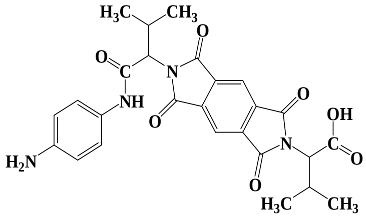
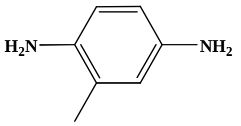
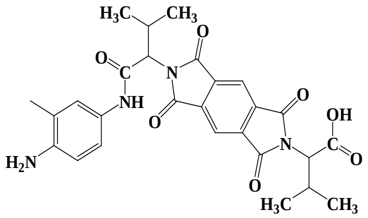
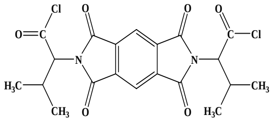
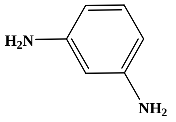
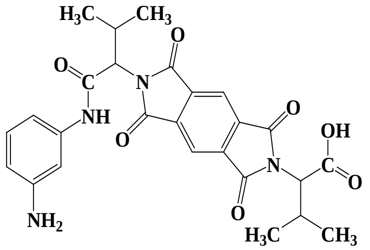
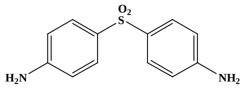
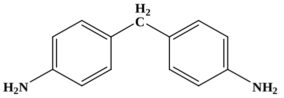
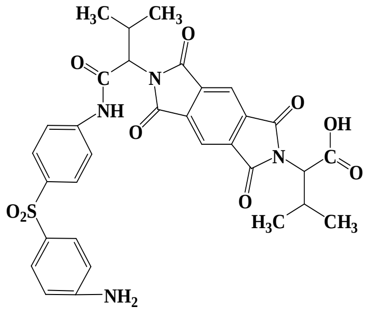
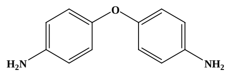
Synthesis of 4d structure

To give **4d** (0.10 g, 91%); A white dark compound; IR (KBr): 3308 (m, br), 2954 (s), 1771 (s), 1720 (s, br), 1593 (s), 1525 (s), 1464 (m), 1407 (s, sh), 1389 (s), 1347 (s), 1318 (s, sh), 1247 (m), 1185 (m), 1152 (s), 1075 (s), 1104 (s), 1075 (s), 1010 (w), 900 (w), 830 (m), 720 (s), 680 (m), 621 (m), 555 (m) cm^{-1}; MS *m/z* 674, 659(77.11), 597(12.98), 583(45.56); Anal. Calcd for $C_{34}H_{34}N_4O_9S$: C, 62.28; H, 4.91; N, 8.63; O, 17.67; S, 7.09. Found: C, 61.03; H, 5.24; N, 9.55; O, 16.77; S, 8.19.

Synthesis of 5d structure

To give **5d** (0.119 g, 96%); A yellow compound; IR (KBr): 3308 (m, br), 2950 (s, br), 1725

Table 3.Yields and reaction conditions of the synthesized (c) group of poly(amide-imide)s derivatives.

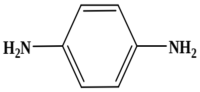
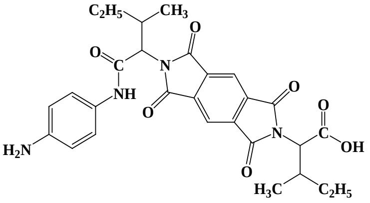
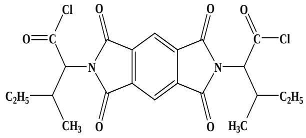
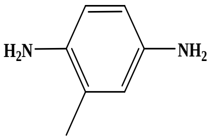
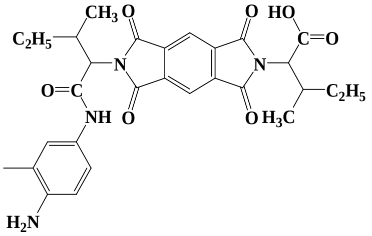
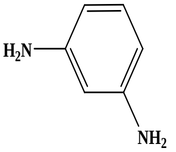
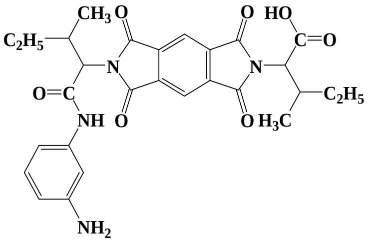
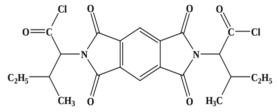
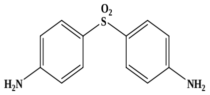
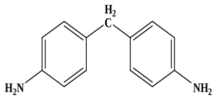
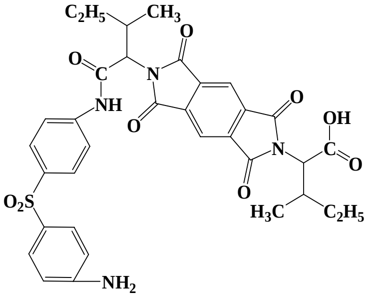
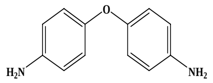
Entry	Reactant		Product	Yield (%)	Color
1c				61	Yellow
2c				85	Yellow
3c				70	White
4c				94	Yellow
5c				77	Yellow
6c				89	Yellow

(s, br), 1673 (s, sh), 1606 (m), 1513 (s), 1468 (m), 1417 (m), 1384 (s), 1346 (s), 1250 (m), 1182 (m), 1154 (m), 1100 (m), 1070 (s), 1018 (w), 919 (w), 817 (m), 728 (s), 627 (w), 564 (w) cm^{-1}; MS *m/z* 624, 609(65.18), 533(92.56), 519(28.45); Anal. Calcd for $C_{35}H_{36}N_4O_7$: C, 69.39; H, 5.70; N, 9.23; O, 11.93. Found: C, 67.93; H, 5.79; N, 9.95; O, 10.87.

Synthesis of 6d structure

For instance here is presented the method of preparing (6d) poly (amide-imides). In a round-bottomed flask (25 mL) equipped with drying tube, 0.04 g (2.07×10^{-4}mol) diamine added to 0.50 mL of NMP. After complete salvation of diamine, this solution cooled until (-5 °C) and through stirring

Table 4.Yields and reaction conditions of the synthesized (d) group of poly(amide-imide)s derivatives.

Entry	Reactant		Product	Yield (%)	Color
1d				80	Yellow
2d				52	Yellow
3d				61	White
4d				91	Yellow
5d				96	Yellow
6d				90	Yellow

0.10 g of 3f was added (2.07×10^{-4}mol). After reactants solvation, 0.03 mL of (TMSCl) added and this reaction for 4 hours was stirring at the nitrogen atmosphere. System temperature reduced to room temperature an was stirring for 5 hours. Obtained viscous solution added to 40.00 mL of methanol and polymer sediment after purification was dried under the vacuum condition at 80 °C for (1e) hours. Yield of reaction was 90% and resulting polymer was 0.114 g.

To give **6d** (0.114 g, 90%); A yellow dark compound; IR (KBr): 3300 (m, br), 2954 (s), 1772 (s), 1723 (s, br), 1595 (s), 1525 (s), 1464 (m), 1406 (s, sh), 1381 (s), 1344 (s), 1316 (s, sh), 1247 (m), 1186 (m), 1154 (s), 1075 (s), 1106 (s), 1079 (s), 1010 (w), 907 (w), 838 (m), 720 (s), 680 (m), 628 (m), 559 (m) cm^{-1}.^{1}H-NMR (DMSO-d_6, TMS, 500 MHz)d: 0.83 (s, br, 3H), 1.02 (s, br, 3H), 1.50 (m, 2H), 2.69 (m, 1H), 3.85-4.08 (m, 1H, *J* = 7.56 Hz), 4.66-4.68 (d, 1H, *J* = 7.90 Hz), 6.90-6.92 (d, 1H, *J* = 7.60 Hz), 7.51-7.54 (d, 1H, *J* = 7.85 Hz), 8.29 (s, 1H), 10.12 (s, NH), 10.82-11.05 (s, 1H) ppm; MS *m/z* 626, 611(99.12), 535(49.35), 521(74.36); Anal. Calcd for $C_{34}H_{34}N_4O_8$: C, 67.09; H, 5.30; N, 9.20; O, 15.87.Found: C, 67.14; H, 5.66; N, 9.97; O, 14.77.

RESULTS AND DISCUSSION

26 new poly (amide-imides) which have optical active were synthesized in solution phase with direct condensation polymerization. For more information refer to primary materials, product and yield with speed of mechanism (Table 1 to 4). For synthesizing of related diacids of di methyl formamide solvent acetic acid and acetic acid pyridine mixture that acetic acid was selected because of high yield and increasing of reaction speed. New monomers with aromatic di amines with direct condensation polymerization in solution phase were reacted with two kinds of different conditions: graduated heat processing and quick heat processing and at the end, new optical active poly (amide-imides) obtained with high yield. Through one minute with quick heat processing, in the reflux state, two monomers and active reagent were reacted and in comparison with graduated heat processing, under the same conditions, are obtained polymers with higher viscosity. NMP/ $CaCl_2$was used in this method because of high polarization and it reduces hydrogen bond between polymeric chains and causing high molecular weight for polymerization. One of the advantages of direct method is that the reaction needs to lower levels and monomers have stability. But disadvantage of that it is very expensive for reagents and in the industrial measurement is not economically. Necessary conditions for synthesis of these polymers are as follow: presence of TMSCl low temperature and high temperature in DMAC and NMP solvents. Using of TMSCl lead to formation of polymers with higher yield. Another advantage of this mechanism is that reducing time for synthesis of compounds. Reaction of amine with diacyl chloride is a famous method for synthesis of poly amides in the industrial measurement.

CONCLUSION

Analysis of mentioned reactions lead us to following out comes:

1. From salvation view, synthetic polymers, as are show in tables related to polymers, all of polymers in polarized aprotic solvents are solvated.
2. Poly(amide-imides)s in comparison with other polymers have higher heat stability about (300 °C) and this parameter can introduce these compounds as an important material in heat- insulations.
3. Direct condensation polymerization was used and lead to produce of polymers with higher molecular weight in optimized conditions and consequently at the least time mentioned compounds with highest output have synthesized.
4. All of the synthetic compounds have polymerization potentiality and have active optical active and they are derivations of active poly(imide-amide)s.
5. Obtained results showed that in condensation polymerization, reactants can react in neutral environments and produce polymer and side products. For deleting of acid side products must use of acid acceptors.

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