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Pyromellitic diimide containing four-member heterocyclic derivatives synthesis, characterization and evaluation antimicrobial activity

Zahraa H.H. Al-Hamidawi[1*], Suaad M.H. Al-Majidi[2*]

[1]Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq,
Email: zahraa.hasan2305@sc.uobaghdad.edu.iq
[2]Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq,
Email: Suaad.hussein@sc.uobaghdad.edu.iq

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ABSTRACT
In this study, pyromellitic diimide and sodium hydroxide were reacted in dry DMF to yield a sodium salt pyromellitic diimide, which was then combined with ethylchloro acetate to generate N, N´-bis (ethyl acetate). This process was used to synthesize new four-member heterocyclic derivatives, 1,3diazetidene. By chemically mixing substance (1) with hydrazine hydrate, pyromethyl dichloride produces the corresponding hydrazine derivatives (2). Compound (2) underwent a condensation reaction with a range of para-aromatic aldehydes, yielding Schiff base derivatives (3–7). These Schiff base derivatives were then cyclized using phenyl isocyanate, P-Chloro phenylisocyante, and phenyl isothiocyanate to produce four-member heterocyclic derivatives (8–22). The produced compounds' physicochemical characteristics and melting points were identified. To identify novel compounds, spectral approaches such as 1H-NMR, 13C-NMR, and FT-IR were employed. Furthermore, tests were conducted on the biological activity components.

Keywords: Pyromellitic diimide, Schiff base ,1,3diazetidine, anti-microbial activity.

INTRODUCTION

Heterocycles with a mono nitrogen that have two carbonyl groups attached to the same nitrogen atom are called cyclic imides. Cyclic imides are an important class of chemical compounds due to their wide variety of various biological effects, such as anti-inflammatory, antifungal, antibacterial, analgesic, antioxidant, and anticancer properties [1,2].Schiff bases are condensation products of primary amines with carbonyl compounds, which were discovered in 1864 [4] by German chemists [3].Schiff bases are an important family of the most widely used organic chemicals, having applications in many fields such as biology, medicine, inorganic and analytical chemistry, and others [5-7].Schiff bases are derived from a variety of heterocyclic compounds and exhibit a wide range of biological activities, such asantibacterial[8–9],antifungal[10–11], antiviral[13],anticancer[14], antiprotozoal[15],antiparasitic[16],anticonvulsant[17],analgesic[18],antiinflammatory[19],antiplatelet[20], antioxidant[21], antihyproliferative[22],cardioprotective, antidepressant, antihypertensive, herbicidal, antiglycation, and cytotoxic activity[7].

1,3-Diazetidines are N-heterocyclic, four-membered species that have β-lactams with significant laboratory, pharmaceutical, and industrial applications. These substances have the potential to function as β-lactam antibiotic analogues, including cephalosporins, penicillins, thienamycins, and related antimicrobial agents. Their properties include antibacterial[23],anti-inflammatory[24],antitumor[25],hypoglycemic,and antihyperlipidemic effects[26]; anti-malarial, FAAH, and anti-antihypertensive[27-30]; anticancer[31]; lowering the toxicity of the raw materials made from it[32]; and producing compounds with improved pharmacokinetic properties. They are also employed in the synthesis of numerous kinds of pharmacophores[33] and alkaloids as intermediates and starting materials. It has been reported that acetidine derivatives have antitubercular, anti-HIV, analgesic, anti-inflammatory, and ulcerogenic properties.

MATERIALS AND METHODS

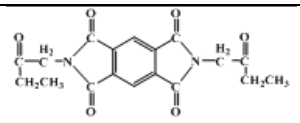
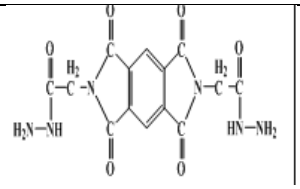
Each and every chemical used was acquired from Fluka or Aldrich Basic Chemicals. Melting points (MP) in open glass capillaries were measured using Thomas capillary melting point apparatus that was not calibrated using gallenkamp. Using a SHIMAZU FTIR 8400 Fourier transform infrared spectrophotometer, FTIR spectra were recorded on KBr disks. All of the main ingredients and the reagent were pure and easily obtained from a

store. A 300 MHz spectrometer was used to record the 1H- and 13C-NMR spectra. Using the Agilent Technologies model ultra-shield, nuclear magnetic resonance (NMR) spectra were recorded using dimethyl sulfoxide solvent (DMSO-d6). The downfield chemical changes in δ (ppm) are given with tetra methylsilane (TMS) as a point of reference.

Synthesis of N, N´-bis(ethyl acetate) Pyromelliticdiimidyl(1)[34].
Dry dimethylformamide (6 ml) was mixed with (0.5 g, 0.002mol.) of pyromellitic diimide at room temperature. Subsequently, (0.2g 0.004mole) of sodium hydrate was added, and after 15 minutes of stirring, (0.4 ml, 0.004mole) of ethyl chloroacetate was added. Stir for forty-five minutes. After that, mix reflex for six hours. The precipitate is then obtained by cooling it to room temperature, filtering it, and then pouring the filtered mixture into ice-cold water and washing it with cold distilled water. (Ethanol-Water) caused the solid white precipitate to recrystallize. Table 1 displays the physical characteristics of chemical (1) and the FT-IR spectral data.

Synthesis of N,N´-bis (aceto hydrazide) pyromelliticdiimidyl(2)[35].
Reflux for 10 hours after dissolving (0.5g, 0.002 mole) of compound (1) in absolute ethanol while stirring. Next, add (0.5 mL, 0.006 mole) of hydrazine hydrate in phases. After cooling to room temperature, the mixture was filtered through cold, washed distilled water, and the precipitate was dried. (Petroleum ether) was used to recrystallize the solid yellow precipitate. Table 1 displays the physical characteristics of chemical (2) and the FT-IR spectral data.

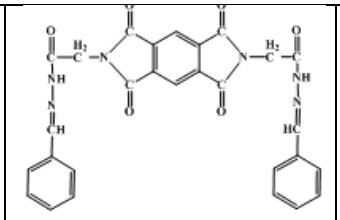
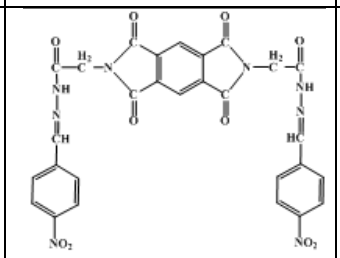
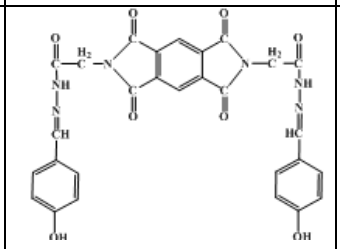
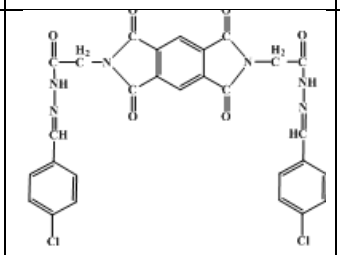
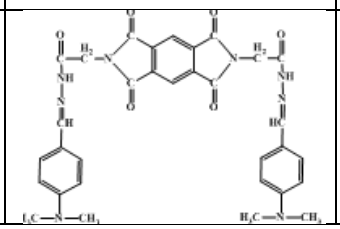
Table 1: presents the produced compounds' physical characteristics and FT-IR spectrum data (1-2).

Physical properties					**Major FTIR absorption cm^{-1}**				
No	Structure	M.p °C	Yield %	Color	υ(N-H)	υ(C-H) arom. Aliph.	υ(C=O) Imide	υ(C=C) Arom.	Other band
1		>300	90	white	___	3068 2960	1772 1735 1720este	1542	υ C-N 1033 υ O-C 1303
2		>300	90	yellow	3240	3014 2927	1722 1714 1670ami	1560	υ N-H_2 asym.3328 sym.3288

Synthesis of N, ´N(substituted benzyledine acetohydrzaide)pyromellitic diimdyl(3-7)[36].
A solution of (0.5 g,0.022 mol.) N, N´-bis (aceto hydrazide) pyromellitic diimide (0.044 mol.) Para substituted aromatic aldehydes in (10 mL) absolute ethanol solvent was mixed thoroughly with a catalytic three drops of glacial acetic acid, refluxed the mixture for (6-7) hour. It islet it reach room temperature, during which it is filtered and cleaned with cold, distilled water. The precipitate was recrystallized by the reaction of water and ethanol. The FT-IR spectral data and the physical properties of compounds (3–7) are shown in Table 2.

Table 2: presents the produced compounds' physical characteristics and FT-IR spectrum data (3-7).

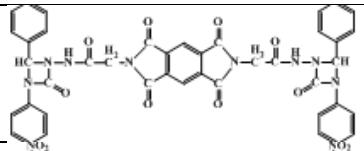
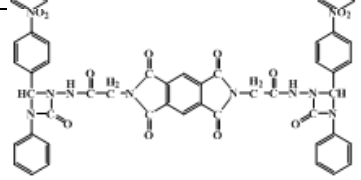
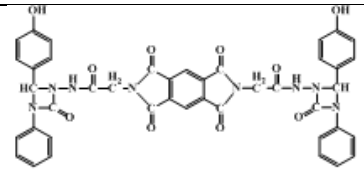
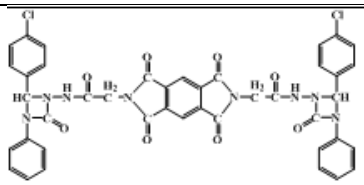
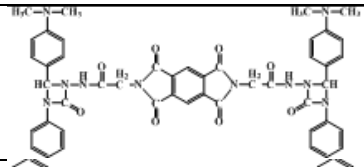
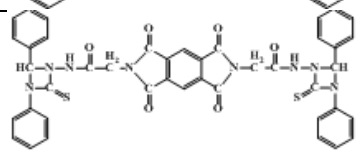
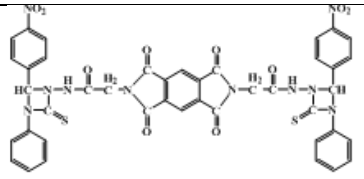
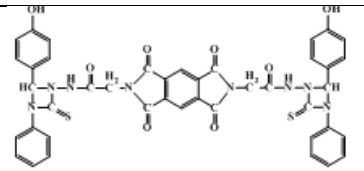
Physical characteristics					**Major FTIR absorption cm^{-1}**				
No.	Structure	M.p °C	Yield %	Color	υ(N-H)	υ(C-H) Arom. Aliph.	υ(C=O) Imide Amide	υ(C=N)	Other band

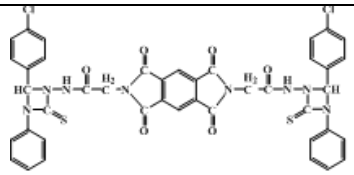
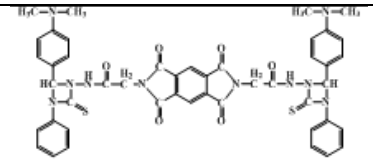
3		204 - 206	80	Gray	3247	3049 3029 2900	1774 1718 1654	1625	υC-N 1027 δ(p-sub.) 810
4		187 - 189	80	yellow	3270	3082 2975	1731 1658	1610	υ NO_2 asym15 23 sym.134 4 δ(p-sub). 810
5		207 - 208	80	Yellowisl whit	3280	3029 2891	1774 1722 1656	1627	υ O-H 3342 υ C-N 1026 δ(p-sub). 827
6		224 - 226	80	white	3230	3022 2883	1759 1714 1654	1628	υ C-Cl 1091δ(p-sub). 808
7		196 - 197	80	yellow	3272	3026 2894	1732 1654	1622	υ C-N 1066 δ(p-sub). 810

Synthesis of N, ´N-bis[(2-oxo-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl)aminoaceto] pyromelliticdiimidyl(8-12);N, ´N-bis[(2-thion-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl)aminoaceto] pyromelliticdiimidyl(13-17)[37].

A mixture of equivalent amounts of (0.00 1 mole) of Schiff base derivatives(3-7) in 10 ml of absolute ethanol as a solvent, phenyl iso cyanate (0.8 ml,0.002 mole),phenyl iso thio cyanate (0.4 ml,0.002 mole) was added. The mixture was in reflux condition for(5-6) hour. Then, it cooled at room temperature. The products (8-17) were filtered with washed cool distill water andrecrystallized with suitable solvent. Physical properties of compound (8-17)and FTIR spectral data are represented in table 3.

Table 3: physical properties and FT-IR spectral data for prepared compounds (8-17).

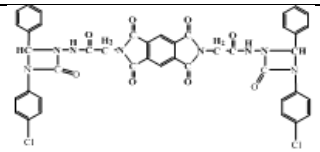
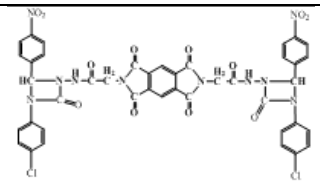
Physical properties					**Major FTIR absorption cm^{-1}**				
No.	Structure	M.p °C	Yield %	Color	υ(N-H)	υ(C-H) Arom. Aliph.	υ(C=O) Imide Amide	υ(C=C) arom.	Other band
8		220-222	85	yellow	3328	3055 2950	1772 1720 1649	1596 1554	υ C-N1024
9		183-185	80	Light yellow	3330	3085 2975	1764 1731 1649	1596 1556	υ NO_2 asym.1556 Sym.1344 υ C-N 1045 δ(P-sub) 808
10		164-165	85	Brown	3288	3062 2972	1768 1737 1650	1596 1558	υ O-H 3326 υ C-N 1050 Δ(p-sub). 838
11		154-156	85	Matt brown	3296	3072 2979	1772 1714 1656	1593 1550	δ N-H 1633 υ C-Cl 1087 δ(p-sub). 823
12		204-205	85	Yellow	3328	3051 2974	1774 1736 1649	1598 1556	υ C-N1027 δ(p-sub). 811
13		242-243	85	Light yellow	3240	3029 2883	1754 1715 1660	1598 1560	υ C=S 1359 υ C-N1027
14		82-84	85	Orang	2388	3056 2952	1768 1695 1649	1596 1542	υNO_2 Asym. 1542 Sym.1344 υ C=S 1313 δ(p-sub). 837
		95-97	80	Brown	3370	3055 2923	1774 1736 1649	1596 1554	υ O-H 3433 υ C=S 1377 υ C-N 1026

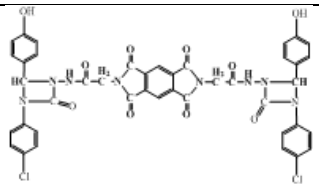
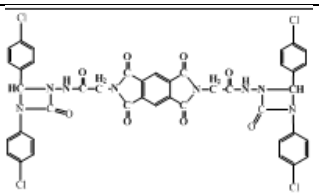
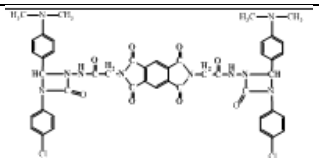
									δ(p-sub). 819
16		101-103	80	Brown	3280	3055 2881	1768 1635 1654	1596 1539	υ C=S 1359 υ C-Cl1093 δ(p-sub). 825
17		72-73	90	Reddish brown	3395	3012 2862	1770 1714	1596 1560	υ C=S 1359 δ(p-sub). 808

Synthesis of N, ´N-bis[(2-p-chloro-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl)aminoaceto] pyromelliticdiimidyl(18-22)[37].

P-chloro phenyl isocyanate was added in equivalent amounts (0.00 1 mole) of Schiff base derivatives (3-7) in 10 ml of absolute ethanol as a solvent. For (7-8) hours, the combination was in reflux condition. It cooled to room temperature after that. After being filtered through clean, cool distil water, the products (18–22) were recrystallized using an appropriate solvent. Table 4 shows the physical characteristics and FT-IR spectral data of compound (18–22).

Table 4: presents the produced compounds' physical characteristics and FT-IR spectrum data (18-22).

Physical properties					**Major FTIR absorption cm^{-1}**				
No.	Structure	M.p °C	Yield %	Color	υ(N-H)	υ(C-H) Arom. Aliph.	υ(C=O) Imide Amide	υ(C=C) arom.	Other band
18		282-283	85	Matt yellow	3296	3072 2979	1774 1714	1593 1560	δ N-H 1633 υ C-N1012 υ C-Cl1087 δ(p-sub). 823
19		92-93	80	Light orange	3365	3008 2975	1774 1763 1690	1593 1560	NO_2 Asym. 1560 Sym. 1346 υ C-N 1010 υ C-Cl1087

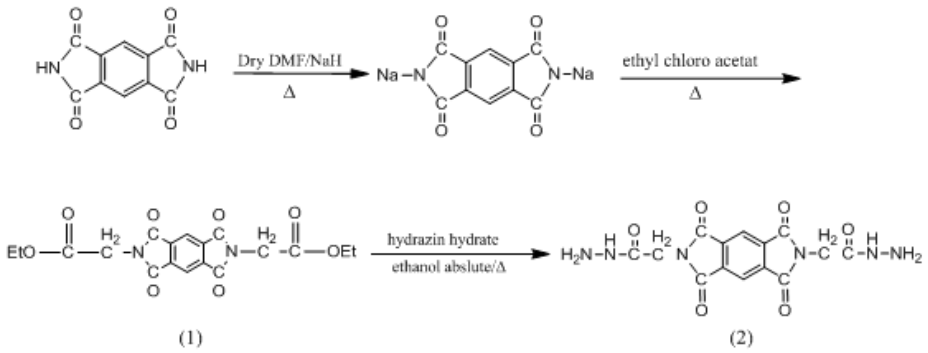
									δ(p-sub). 823
20		260-262	80	Matt brow	3385	3062 2977	1770 1665	1595 1560	υ O-H 3415 υ C-N 1012 υ C-Cl1087 δ(p-sub). 823
21		142-144	85	Gray	3348	3074 2972	1770 1714 1652	1595 1560	δ N-H 1633 υ C-Cl1091 δ(p-sub). 825
22		140-142	80	Matt yello	3296	3074 2975	1768 1735	1595 1560	υ C-N 1012 υ C-Cl1087 δ(p-sub). 823

Anti-microbial activity test[38,39].

A variety of synthetic materials' antibacterial properties was investigated using the disk diffusion method. Four strains of bacteria were used to measure the amount of compounds produced: two Gram-positive strains **(Enterococcus faecalis and Staphylococcus aureus)** and two Gram-negative strains **(Escherichia coli and pseudomonas aeruginosa).** They also looked at fungal strains, which are harmful fungi that resemble yeast **(Candida).** A 5 mm-diameter filter paper disk (Whattman no. 1) was autoclaved at 121 °C for 15 minutes to disinfect it. 800 µg of every compound under evaluation were impregnated into the sterilized disks. 800 µL of each of the two investigated microbe cultures were added to the disk surface. To allow for adequate diffusion, the impregnated disk was incubated for one hour at 5 °C and then for twenty-four hours at37 °C. The inhibitory zones on microorganisms generated by evaluated substances were measured.

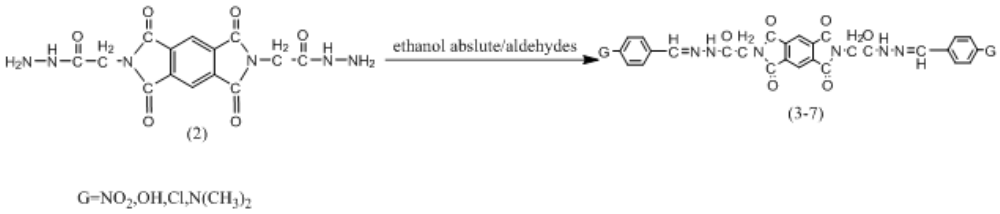
RESULTS AND DISCUSSION

The physical parameters mentioned in Table 1 confirmed the pyromellitic diimide reaction with sodium hydrate and ethyl chloro acetate to yield compound (1) in Scheme 1.Absence of infrared spectral data υ(N-H) of amide at 3448 $cm^{-1}$and showed appearanceat 3068 and 2960 cm^{-1} for(C-H aromatic and alipha.)respectively 1772,1735 and 1720 cm^{-1} for υ (C=O imide and ester).Thepresence of the ester group resulted in a positive Hydroxamic Acid test[40,41]. Combining chemical (1) with hydrate hydrazine yieldsN, N´-bis (aceto hydrazide) pyromellitic diimide (2). FTIR spectrum data showed absorption at 3328-3288 cm^{-1} for υ(NH_2)asymmetric and symmetric, (3240), (3014,2927),(1722,1714,1670),(1560,1517),(3461,3025) cm^{-1} for υ (N-H),υ(C-H aromatic and alpha),υ (C=O imide and amide), υ (C=C Aromatic). On the other hand, table 5 displays the ^{1}H-NMR spectra data of chemical (1) ppm in DMSO-d6 solvent show 1.25(t,3H, CH_3);3.42(q,2H,O-CH_2);4.20(S,2H, N-CH_2);8.07-8.37(m,2H,Ar-H).^{1}H-NMR spectrum dataof compound(2) 3.77(b,2H,CH_3);3.97(s,2H,N-CH_2);8.34-8.94(s,2H,Ar-H);10.72. Table 5 displays the 13C-NMR spectra of compounds (1) and (2).



Scheme 1 synthesis of compounds (1-2)

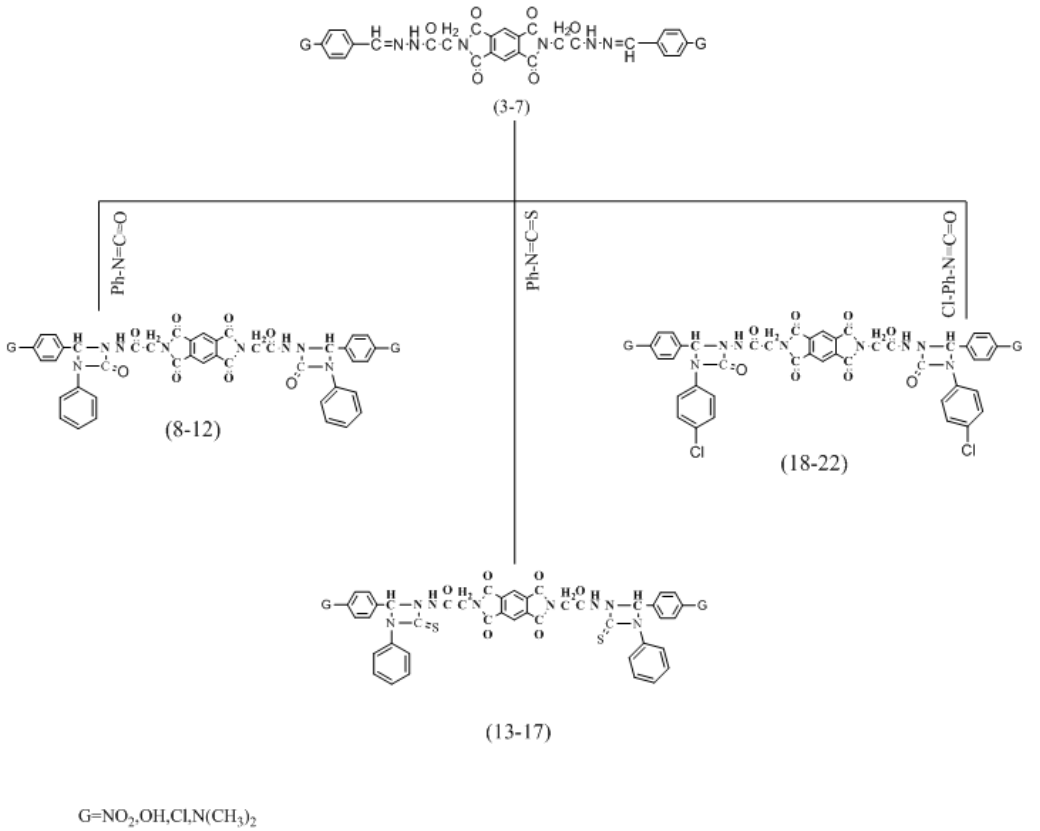
The Schiff base (3-7) was synthesized by condensation reaction of compound(2) with different p-substitutedaromaticaldehydeswith little drop of glacial acetic acid in absolute ethanol to form Schiff base(3-7) in equation 1. Absence of υ(NH_2)3328-3288 $cm^{-1}$of compound (2)FT-IR of compounds (3-7). Theabsorption bands showed at 3280-3230cm^{-1} for υ (N-H) and confirmed the formation of compound (3-7)from the appearance of the bands at (1774-1714), (1658-1654) cm^{-1} for υ (C=O) imide and amide and the absorption ofυ (C=N) 1628-1610 cm^{-1} Schiff base. All details of infrared spectral data to compounds (3-7) were table 2.^{1}H-NMR spectrum data of compound (4) 3.61(s,2H,N-CH_2);6.23(s,1H,N=CH);8.11-8.64(m,10H,Ar-H);10.72(s,1H,NH) while ^{1}HNMRspectrum data of compound (5) 3.64(s,2H,N-CH_2);6.86(s,1H,N=CH);7.69-8.57(m,10H,Ar-H);9.7(s,1H,OH);10.52(s,1H,NH)and the^{1}H-NMR spectrum data absorption of compound (7) 3.11(s,6H,N-(CH_3)$_2$);3.84(s,2H-CH_2);6.91(s,1H,N=CH);7.68-8.92(m,10H,Ar-H);11.01(s,1H,NH).Table 5 displays all of the information from the ^{1}H- and^{13}C-NMR spectra for the Schiff base compounds (3–7).



Equation (1)

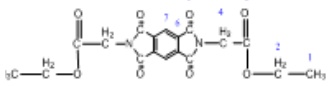
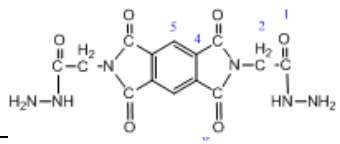
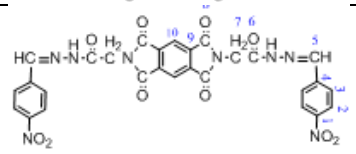
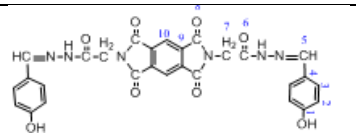
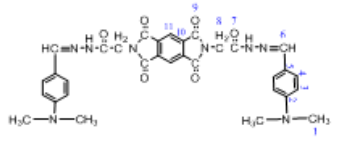
Schiff base (3-7) was reacted with (phenyl iso cyanate,phenyl iso thio cyanateand p- chloro phenyl isocyanate) in absolute ethanol as a solvent to produce the compounds(8-22) showed in scheme 2. The FT-IR spectral datashowed absence of the double bond in the cyclization reactions when Schiff base (3-7) react with phenyl iso cyanate, to give N, ´N-bis [(2-oxo-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl) aminoaceto] pyromelliticdiimidyl (8-12) showed absorption (3330-3288) cm^{-1} for υ(N-H),(1774-1714), (1650-1649) cm^{-1} for υ(C=O) imide and amide whilewhen react Schiff base compounds (3-7) with phenyl iso thio cyanate give N, ´N-bis [(2-thion-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl) aminoaceto] pyromelliticdiimidyl (13-17) showed absorption (3395-3240) for υ(N-H) cm^{-1} , (1770-1635), (1660-1649) cm^{-1} for (C=O) imide and amide and when react Schiff base compounds(3-7) with p- chloro phenyl isocyanate to give N, ´N-bis [(2-p-chloro-3-phenyl-4-(4-substituted phenyl-1,3-diazetidine-1-yl) aminoaceto] pyromellitic dimidyl (18-22) showed absorbance 3385-3296cm^{-1} for υ(N-H),(1774-1714), (1690-1652) cm^{-1} for υ (C=O) for imide and amide.Tables 3 and 4 display all of the chemical (8-22)'s FT-IR data absorption.

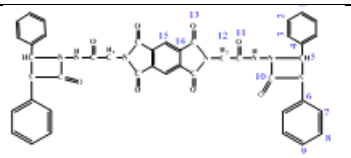
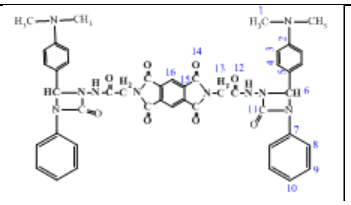
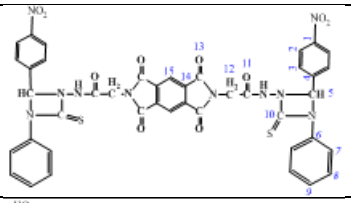
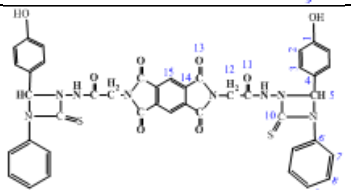
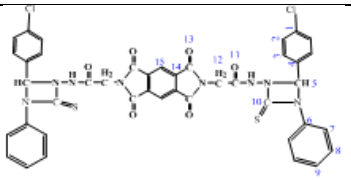
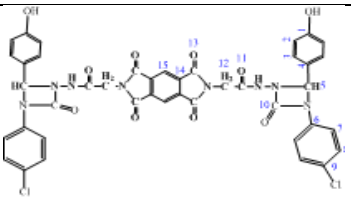
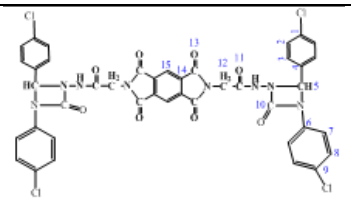
^{1}H-NMRdata spectrum of compound (8) 4.30(s,2H,N-CH_2);5.10(s,2H-H-diazetiden);6.92-7.50(m,22H,Ar-H);10.80(s,1H,NH) while ^{1}H-NMR data spectrum of compound (12) 3.05(s,6H,(CH_3)$_2$);3.83(s,2H,N-CH_2);5.96(s,1H-H-diazetiden);6.91-8.88(m,20H,Ar-H);9.60(s,1H,NH) and^{1}H-NMRdata spectrum of compound (14)3.36(s,2H,N-CH_2);5.30(s,1H,N-CH-azidring);7.01-8.39(m,20H,Ar-H);10.52(s,1H,NH).^{1}H-NMRdata spectrum of compound(15) 3.09(s,2H,N-CH2);5.61(s,1H,N-CH);6.92-7.75(m,20H,Ar-H);9.36(s,2H,OH);10.52(s,1H,NH). ^{1}H-NMRdata spectrum of compound (16) 3.29(s,2H,N-CH_2);5.22(s,2H,H-azid ring);6.95-8.84(m,18H,Ar-H);10.40(s,1H,NH).^{1}H-NMRdata spectrum of compound (20) 3.37(s,2H,N-CH2);6.79(s,1H,N-CH);6.88-8.93(m,18H,Ar-H);10.35(s,1H,NH);11.09(s,1H,OH).^{1}H-NMRdata spectrum of compound (21) 3.88(s,2H,N-CH2);5.01(s,1H,N-CH);7.26-8.01(m,18H,Ar-H);10.46(s,1H,NH).^{1}H-NMRdata spectrum of compound (22)3.00(s,6H,N-(CH3)2);5.01(s,2H,N-CH2);6.72-8.72(m,11H,Ar-H);10.22(s,1H,NH). Table 5 displays all of the information from the 1H- and 13C-NMR spectra for the Schiff base.

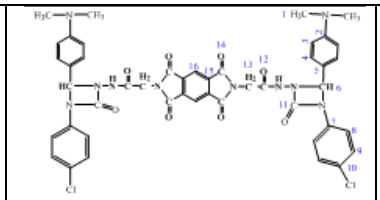


Scheme (2) synthesis compounds (8-22)

Table 5 ^{1}H-NMR spectral data ($^{\delta}$ppm)

No.	Compounds structure	^{1}H-NMR spectral data ($^{\delta}$ppm)	^{13}C-NMR spectral data ($^{\delta}$ppm)
1		1.25(t,3H, CH_3); 3.42(q,2H, O-CH_2); 4.20(S,2H,N-CH_2); 8.07-8.37(m,2H,Ar-H).	14.42(C1); 40.77(C2); 62.06(C4); 125.80(C7); 136.82(C6,C8) ;165.82(C5) ;168.01(C3).
2		3.77(b,2H,NH_2); 3.97(S,2H,N-CH_2); 8.34-8.94(s,2H,Ar-H); 10.72(t,1H,NH).	62.00(C2); 125.55(C5); 135.56(C4,C6); 163.86(C3); 170.01(C1).
4		3.61(s,2H,N-CH_2); 6.23(S,1H,N=CH); 8.11-8.64(m,10H,Ar-H); 10.72(S,1H,NH).	56.45(C7); 123.93(C5); 124.30(C2,C3); 125.42(C10); 135.71(C9); 139.87(C4); 144.01(C5);153.11(C1); 163.54(C8); 171.11(C6).
5		3.64(s,2H,N-CH_2); 6.86(s,1H,N=CH); 7.69-8.57(m,10H,Ar-H); 9.7(s,1H,OH); 10.52(s,1H,NH).	60.21(C7); 116.22(C2); 125.55(C10)128..92(C4); 130.56(C3) 135.53(C9); 144.01(C5); 160.77(C1); 168.24(C8);171.11(C6).
7		3.11(s,6H, N-$(CH_3)_2$); 3.84(s,2H,N-CH_2); 6.91(s,1H, N=CH); 7.68-8.92(m,10H,Ar-H); 11.01(s,1H,NH).	44.46(C1); 60.21(C8); 125.55(C11); 131.58(C3,C4,C5); 133.17(C10); 153.60(C2,C6); 163.43(C9); 170.0(C7).

8		4.30(s,2H,N-CH_2); 5.10(s,2H,H-adiazitidine); 6.92-7.50(m,22H,Ar-H); 10.80(s,1H,NH).	65.21(C12); 88.01(C5); 124.14(C3,C14); 126.92(C1); 128.67(C2,C7,C8,C9); 140.17(C6); 144.00(C4); 153.11(C15); 163.44(C10,C13); 168.40(C11).
12		3.05(s, 6H , N-$(CH_3)_2$; 3.83(s,2H,N-CH_2); 5.69(s,1H, N-CH-diazitidine); 6.91-8.88(m,20H,Ar-H); 11.09(s,1H,NH).	41(C1); 60.01(C13); 88.22(C6);114.94(C3);125.79(16);128.69(C9,C10);133.01(C5); 140.09(C7);153.13(C2); 156.30(C11); 163.46(C11,C14); 170.11(C12).
14		3.36(s,2H,N-CH_2); 5.30(s,1H,N-CH-azid ring); 7.01-8.39(m,20H,Ar-H); 10.52(s,1H,NH).	60.01;(C12); 96.23(C5); 124.72(C15)128.66(C2,C3); 128.88(C9); 129.20(C8); 131.14(C7); 135.22(C14); 140.22(C6); 163.45(C13); 170.11(C11); 176.01(C10).
15		3.09(s,2H,N-CH_2); 5.61(s,1H,N-CH); 6.92-7.75(m,20H,Ar-H); 9.36(s,2H,OH); 10.52(s,1H,NH).	40.46(C12); 96.01(C5); 116.12(C2); 125.12(C15); 128.68(C3,C9); 129.23(C8); 132.58(C7); 136.71(C14); 137.78(C4); 140.15(C6); 156.01(C1); 163.45(C13); 170.11(C11); 176.00(C10).
16		3.29(s,2H,N-CH_2); 5.22(s,2H,H-azid ring); 6.95-8.84(m,18H,Ar-H); 10.40(s,1H,NH).	40.83(C12); 96.01(C5); 125.19(C15);128.34(C2,C3); 128.34(C9);129.52(C8); 130.11(C8);134.12(C1,C7); 136.86(C14); 140.24(C4,C6); 163.45(C13); 170.11(C11); 176.01(C10).
20		3.37(s,2H,N-CH_2); 6.79(s,1H,N-CH); 6.88-8.93(m,18H,Ar-H); 10.35(s,1H,NH); 11.09(s,2H,OH).	40.81(C12); 96.01(C5); 120.28(C2);125.94(C7,C15); 128.53(C3);129.71(C8); 130.11(C9); 135.86(C14); 137.01(C4,C6); 156.21(C1,C10); 163.40(C13); 170.11(C11).
21		3.88(s,2H,N-CH_2); 5.01(s,1H,N-CH); 7.26-8.01(m,18H,Ar-H); 10.46(s,1H,NH).	40.80(C12); 96.01(C5); 122.36(C1); 125.92(C3,C7,C15); 128.67(C2);130.10(C8); 134.12(C9); 135.86(C14); 138.36(C6); 145.22(C4); 156.21(C10);163.40(C13); 170.11(C11).

22		3.00(s,6H,N-$(CH_3)_2$); 5.01(s,2H,N-CH_2); 6.72-8.72(m,11H,Ar-H); 10.22(s,1H,NH).	36.68(C1); 60.45(C13); 88.10(C6);125.94(C16); 126.30(C4);128.72(C3); 130.10(C8);135.22(C15); 136.86(C7); 139.04(C9); 143.12(C5);152.83(C2); 155.30(C11) 156.21(10); 163.45(C14); 170.11(C12).

Anti-microbial activity

It comprises testing chemicals against two Gram-negative bacteria (Escherichia coli and Pseudomonas aeruginosa) and two Gram-positive bacteria (Enterococcus faecalis and Staphylococcus aureus), as well as yeast-like pathogenic fungi (Candida) that are listed in Table 6. Compounds (1, 6, 11, 15, 16, 20, and 22) demonstrated very strong antibacterial activity against (Pseudomonas aeruginosa, Staphylococcus aureus, Escherichia coli, and Enterococcus faecalis),according to the results of the antibacterial activity test. Compound (2) demonstrated strong antibacterial activity against (Pseudomonas aeruginosa), and Compounds (8 and 10) demonstrated strong antibacterial activity against (Escherichia coli).Compound (14) exhibits significant antibacterial action against (Staphylococcus aureus and Enterococcus faecalis).No inhibition was seen by compounds (4,5,9, and 12) against the bacteria (Enterococcus faecalis, Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa).Compounds (1, 2, and 6) demonstrated extremely potent antifungal (Candida) action. Compounds (3, 8, and 20) demonstrated robustand Compounds(5,7,9,10,11,12,13,14,15,16,21and 22) showed no inhibition against fungi.

Table 6: tests the antimicrobial activity of certain produced substances.

No.	Staphylococcus aureus	Enterococcus faecalis	Pseudomonas aeruginosa	E.coli	Candida albican
1	45 mm	49mm	46mm	40mm	31mm
2	44mm	44mm	22mm	34mm	34mm
3	46mm	52mm	-	-	24mm
4	-	-	-	-	12mm
5	-	-	-	-	-
6	45mm	49mm	39mm	36mm	35mm
7	-	-	42mm	39mm	-
8	-	-	35mm	28mm	24mm
9	-	-	-	11mm	-
10	-	-	39mm	29mm	-
11	49mm	52mm	35mm	32mm	-
12	-	-	-	-	-
13	12mm	12mm	-	-	-
14	23mm	21mm	-	-	-
15	41mm	51mm	41mm	34mm	-
16	43mm	48mm	36mm	36mm	-
17	-	39mm	-	-	13mm
18	12mm	12mm	-	-	11mm
19	15mm	15mm	29mm	-	12mm
20	40mm	52mm	40mm	42mm	26mm
21	-	54mm	44mm	31mm	-
22	52mm	52mm	49mm	33mm	-
Ceftriaxone	30	35	30	35	-
Fluconazole	-	-	-	-	25

DMSO is the Solvent; [C]: 800µg/ml.

Zone of inhibition: (-) no inhibition zone; (10-15) weak; (16-20) moderate; (21-30) strong; (31-40) very strong.

CONCLUSION

The synthesis of 1,3diazetidine from pyromellitic diimide and the subsequent determination of its antibacterial activity are illustrated in this paper. These substances' antibacterial activity was assessed against fungus, bacteria, and Gram-positive and Gram-negative organisms. The target compounds (1,6,11,15,1620, and 22) demonstrated strong antibacterial activity against (Enterococcus faecalis, Staphylococcus aureus, Escherichia

coli, and pseudomonas aeruginosa). The majority of the compounds, however, show slightly appreciable antibacterial activity.

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