SYNTHESIS AND CHARACTERIZATION OF NOVEL TRIAZINE COMPOUND AND THEIR BIOLOGICAL STUDIES

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ABSTRACT

Novel organic derivatives of 2,4,6 trichloro-1,3,5-triazine (cyanuric chloride) (**2**) moiety using condensation with various amines to get trisubstituted triazine (**3a-h** and **4a-h**) have been reported. All the newly synthesized compounds are characterized by analytical and spectral tools. The novel synthesized compounds are accessed for their microbial activity.

Keywords: Cyanuric chloride, Simazine, Atrazine, Antimicrobial Activity, Spectral Studies.

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INTRODUCTION

Triazine (**1**) is a class of agrochemical active ingredients that comprise derivatives having the same backbone with different functionalities to exhibit various herbicidal activities. Simazine, Atrazine, Propazine, Cyanazine are well-known and largely produced herbicide derivatives. These derivatives are helpful for the better growth of crops like Corn and Sugarcane. It also inhibits the growth of unwanted weeds and annual grass. The potential activity of Triazine derivatives is due to various substituent groups attached to a 1,3,5-triazine moiety. Towards the search for new active derivatives of the Triazine class, we wish to report the synthesis and characterization of novel derivatives of Triazine along with their biological activity. Instead of basic Triazine moiety, further derivatization of existing potential herbicides like Simazine and Atrazine has been evaluated.¹⁻²

Amongst all Triazine backbones, 1,3,5-Triazine derivatives are more active and extensively studied because of their symmetrical geometry. These Triazine derivatives can be synthesized using Cyanuric acid, melamine and cyanuric chloride as a key starting raw materials.³⁻⁵

Cyanuric chloride (**2**) is produced by the trimerization of chlorinated hydrocyanic acid. (Scheme-1) and the prompt reactivity towards nucleophilic aromatic substitution (S_NAr) leads us to novel derivatives of the Triazine class.⁶⁻⁹

Scheme-1: Industrial Production of Cyanuric Chloride

Numerous reports are available in the literature on the diversity of biological activities of substituted -1,3,5-triazine like anti-bacterial, anti-fungal, anti-HIV and other microbial activity.¹⁰⁻¹⁸

Cyanuric chloride has temperature-oriented differential reactivity for displacement during aromatic nucleophilic substitution reaction. Generally, the first chlorine is a substitute at 0-5°C, the second chlorine is a substitute at 25-35°C and the third chlorine is a substitute at 80-110°C. This property allows the

substitution of three different nucleophiles on the same triazine core, which provides a vast variety of possible triazine derivatives and their application. Disubstituted triazines like Simazine and atrazine are a very important herbicide. It is used for preventing pre and postmergence broadleaf weeds in a crop like maize and sugarcane.

EXPERIMENTAL

Material and Methods

Laboratory solvents were purchased from a commercial supplier, Ahmedabad in their pure form. The remaining facilitation was received from Suyog dye chime Pvt. Ltd Ankleshwar. Precoated silica aluminium plates of Merck were used for TLC.

Characterization

Melting points were determined in open capillary tubes and were uncorrected. The IR spectra were recorded in KBr pellets on a Shimadzu spectrometer and ^1H NMR and ^{13}C NMR spectra were recorded in CDCl_3 with TMS as internal standard on a Bruker spectrometer at 400 MHz. ESI-MS of selected samples taken on Thermo Scientific Orbitrap Velos ProTM.

General Procedure

The compound 2, 4, 6-trichloro-1, 3, 5-triazine (cyanuric chloride) is prepared industrially by chlorination of hydrogen cyanide followed by cyclization. This compound is available commercially.

Preparation of N, N'-Diethyl-N''-alkyl-[1,3,5]triazine-2,4,6-triamine (Compound-3 a-h)

A flowing reaction scheme (Scheme-2) is adopted for the synthesis of N, N'-Diethyl-N''-alkyl-[1,3,5]triazine-2,4,6-triamine (compound-3 a-h).

Scheme-2

Stage-1: Preparation of 6-Chloro-N, N'-diethyl-1,3,5-triazine-2, 4-diamine (Simazine)

Charge 25 gm (0.136 mole) of cyanuric chloride and 100 ml of dioxane in 3 N RBF. Charge 30 gm (0.297 mole) of Tri ethyl amine. Cool to 0-5°C and stir for 15 minutes. Start addition of 15.5 gm (0.34 mole) of ethyl amine through addition funnel. After completion of addition stir reaction mass at 0-10°C for 3 hrs then stir it at 30-40°C for 6 hrs. The reaction is monitored by TLC (Mobile phase: Toluene: Ethyl acetate: 7:3). After completion of reaction dump reaction mixture. stir it for 3 hrs at 25-35°C. Filter the product and wash with 100 ml water. Dry the product at 70-80°C for 6 hrs in a hot air oven.

Stage-2: Preparation of N, N'-Diethyl-N''-alkyl - [1,3,5]triazine-2,4,6-triamine (Compound-3a-h)

Charge 5 gm (0.025 mole) of Simazine and 50 ml of dioxane in 3 N RBF under stirring. Charge 10 gm (0.1 mole) of Triethylamine and stir for 10 min. Start addition of alkyl amine (0.03 mole) at 25-35°C. Slowly raise temperature to 100-105°C and maintain above temperature for 6 hrs. The reaction is monitored by TLC (Mobile phase: Toluene: Ethyl acetate::7:3). After completion of reaction cool to 25-35°C and quench reaction mass in 100 ml water. stir it for 2 hrs and filter it. dry it at 60-70°C in hot air oven to get N, N'-Diethyl-N''-alkyl-[1,3,5]triazine-2,4,6-triamine (Compound-3a-h).

Preparation of N-Ethyl-N'-isopropyl-N''-propyl-[1,3,5]triazine-2,4,6-triamine (compound-4 a-h)

Flowing reaction scheme (Scheme-3) is adopted for synthesis N-Ethyl-N'-isopropyl-N''-propyl-[1,3,5]triazine-2,4,6-triamine (compounds 4a-h).

Scheme-3

Stage-1: Preparation of 6-Chloro-N-ethyl N'- Isopropyl -1,3,5-triazine-2,4-diamine (Atrazine)

Charge 25 gm (0.136 mole) of cyanuric chloride and 100 ml of dioxane in 3 N RBF. Charge 30 gm (0.297 mole) of Triethylamine. Cool to 0-5°C and stir for 15 minutes. Start addition of 6.1 gm (0.136 mole) of ethyl amine through the addition funnel. After completion of addition stir reaction mass at 0-10°C for 3 hrs then allow coming at 25-35°C. Start addition of 8 gm (0.136 mole) of Isopropyl amine. stir it at 30-40°C for 6

hrs. The reaction is monitored by TLC (Mobile phase: Toluene: Ethylacetate:: 7:3). After completion of reaction dump reaction mixture. Stir it for 3 hrs at 25-35°C. filter the product and wash with 100 ml water. Dry the product at 70-80°C for 6 hrs in a hot air oven.

Stage-2: Preparation of N-Ethyl-N'-isopropyl-N''-alkyl -[1,3,5]triazine-2,4,6-triamine (Compound-4a-h)

Charge 5 gm (0.023 mole) of Atrazine and 50 ml of dioxane in 3 N RBF under stirring. Charge 5 gm (0.05 mole) of Triethylamine and stir for 10 min. Start addition of Alkyl amine (0.03 moles) at 25-35 °C slowly raise temperature to 100-105°C and maintain above temperature for 6 hrs. The reaction is monitor by TLC (Mobile phase: Toluene: Ethylacetate:: 7:3). After completion to reaction cool to 25-35°C and quench reaction mass in 100 ml water, stir it for 2 hrs and filter it .dry it at 60-70 c in hot air oven to get N-Ethyl-N'-isopropyl-N''-alkyl -[1,3,5]triazine-2,4,6-triamine (Compound-4a-h).

Yield and Spectroscopic Data of Synthesized Compounds (3a-h and 4a-h)

N, N'-Diethyl-N''-propyl-[1,3,5]triazine-2,4,6-triamine (Compound-3a)

Yield: 57%, solid, m.p.93-97°C. M.W.: 224.31; m/z : 225 ¹H NMR (400 MHz,CDCl₃): δ 0.907-0.956 (t,3H), 1.137-1.185 (t,6H),1.498-1.615 (t,2H),3.293-3.396 (q,6H), 5.126 (s,1H)¹³C NMR (400 MHz,CDCl₃): δ 11.42,15,23,35.48,42.47,165.48.FT-IR (In cm⁻¹): 1335.61 (C-H); 1516.91(C-N); 2356.85 (C=N); 2965.35(Aliphatic C-H); 3525.63(N-H) Anal. Calcd. for C₁₀H₂₀N₆: C, 53.55; H, 8.99; N, 37.47; Found: C, 53.48; H, 8.91; N, 37.41.

N, N'-Diethyl-N''-phenethyl-[1,3,5]triazine-2,4,6-triamine (Compound-3b)

Yield: 61%, solid, m.p.104-107°C. M.W.: 286.38;m/z : 287¹H NMR (400 MHz,CDCl₃): δ 0 1.105-1.113 (t,6H),2.78 (s,2H), 3.10 (t,4H),7.1-7.21(m,5H),¹³C NMR (400 MHz,CDCl₃): δ 15.5,37.3,44.4,53.7,125.4,127.4,128.6,140.2,175.2,. FT-IR (In cm⁻¹): 1335.61 (C-H); 1516.91(C-N); 2356.85 (C=N); 2965.35(Aliphatic C-H);3030 (Aromatic C-H) 3525.63(N-H), Anal. Calcd. for C₁₅H₂₂N₆: C, 62.91; H, 7.74; N, 29.35; Found: C, 62.83; H, 7.69; N, 29.49.

N, N'-Diethyl-N''-benzyl-[1,3,5]triazine-2,4,6-triamine (Compound-3c)

Yield: 63%, solid, m.p.114-116°C. M.W.: 272.35, m/z : 273¹H NMR (400 MHz,CDCl₃): δ 1.105-1.113 (t,6H), 3.10 (q,4H),4.4 (s,2H)7.1-7.21(m,5H),¹³C NMR (400 MHz,CDCl₃): δ 15.5,44.4,57.1,126.5,127.1,128.3,142.2,175.2,. FT-IR (In cm⁻¹): 1330.61 (C-H); 1518.91(C-N); 2335.85 (C=N); 2930.35(Aliphatic C-H);3030 (Aromatic C-H) 3525.63(N-H), Anal. Calcd. for C₁₅H₂₂N₆: C, 61.74; H, 7.40; N, 30.86; Found: C, 61.68; H, 7.31; N, 30.81.

N,N'-Diethyl-N''-butyl-[1,3,5] triazine-2,4,6-triamine(Compound-3d)

Yield: 68%, solid, m.p.122-124°C. M.W.: 238.33; m/z : 239¹H NMR (400 MHz,CDCl₃): δ 1.105-1.113 (t,9H),1.3-1.5 (m,4H) 3.10-3.20 (m,6H),¹³C NMR (400 MHz,CDCl₃): δ 14,15.5,20.5,34,44.4,51.3,175.2FT-IR (In cm⁻¹): 1331.61 (C-H); 1518.91(C-N); 2335.85 (C=N); 2930.35(Aliphatic C-H);3030 3525.63(N-H), Anal. Calcd. for C₁₁H₂₂N₆: C, 55.43; H, 9.30; N, 35.26; Found: C, 55.38; H, 9.22; N, 35.21.

N,N'-Diethyl-N''-(4-methoxy-benzyl)-[1,3,5]triazine-2,4,6-triamine (Compound-3e)

Yield: 72%, solid, m.p.132-136°C. M.W.: 302.37; , m/z : 303¹H NMR (400 MHz,CDCl₃): δ 1.105-1.113 (t,6H), 3.10 (q,4H),3.73 (s,3H),6.8-7.2(m,4H),¹³C NMR (400 MHz,CDCl₃): δ 15.5,44.4,56,57.2,113.9,128.1,134.7,160,175.2,. FT-IR (In cm⁻¹): 1320.61 (C-O); 1518.91(C-N); 2335.85 (C=N); 2935.35(Aliphatic C-H); 3035 (Aromatic C-H) 3535.63(N-H), Anal. Calcd. for C₁₅H₂₂N₆O: C, 59.58; H, 7.33; N, 27.79; Found: C, 59.51; H, 7.24; N, 27.71.

N, N'-Diethyl-N''-[2-(4-methoxy-phenyl)-ethyl]-[1, 3, 5] triazine-2,4,6-triamine (Compound-3f)

Yield: 69%, solid, m.p.141-143°C. M.W.: 316.40;m/z : 317,¹H NMR (400 MHz,CDCl₃): δ 1.105-1.113 (t,6H),2.75-2.8 (m,2H) 3.10 (q,4H),3.35-3.4(t,2H)3.73 (s,3H),6.8-7.1(m,4H),¹³C NMR (400 MHz,CDCl₃):

815.5, 37.3, 44.4, 53.7, 56.1, 113.9, 128.3, 132.7, 159.4, 175.2. FT-IR (In cm^{-1}): 1322.61 (C-O); 1518.91 (C-N); 2335.85 (C=N); 2935.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3535.63 (N-H), Anal. Calcd. for $\text{C}_{15}\text{H}_{22}\text{N}_6\text{O}$: C, 60.74; H, 7.65; N, 26.56; Found: C, 60.68; H, 7.59; N, 26.51.

N, N'-Diethyl-N''-[2-(3,4-dimethoxy-phenyl)-ethyl]-[1,3,5]triazine-2,4,6-triamine (Compound-3g)

Yield: 61%, solid, m.p. 121-127°C. M.W.: 346.4; m/z : 347, ^1H NMR (400 MHz, CDCl_3): δ 1.105-1.113 (t, 6H), 2.75-2.8 (m, 2H) 3.10 (q, 4H), 3.73 (s, 6H), 6.6-6.8 (m, 3H), ^{13}C NMR (400 MHz, CDCl_3): 815.5, 37.4, 44.4, 53.7, 56.3, 114.5, 115.1, 121.2, 133.4, 144.8, 147.5, 175.2. FT-IR (In cm^{-1}): 1325.61 (C-O); 1518.91 (C-N); 2335.85 (C=N); 2935.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3535.63 (N-H), Anal. Calcd. for $\text{C}_{16}\text{H}_{24}\text{N}_6\text{O}_2$: C, 57.81; H, 7.28; N, 25.28; Found: C, 57.74; H, 7.21; N, 25.21.

N, N'-Diethyl-N''-[2-(4-hydroxy-phenyl)-ethyl]-[1,3,5]triazine-2,4,6-triamine (Compound-3h)

Yield: 63%, solid, m.p. 139-143°C. M.W.: 302.37; m/z : 303, ^1H NMR (400 MHz, CDCl_3): δ 1.105-1.113 (t, 6H), 2.75-2.8 (m, 2H) 3.10 (q, 4H), 3.37-3.40 (t, 2H), 6.7-7.01 (m, 4H), ^{13}C NMR (400 MHz, CDCl_3): 815.5, 37.4, 44.4, 53.7, 115.6, 129.3, 132.8, 175.2. FT-IR (In cm^{-1}): 1320.5 (C-O); 1516.91 (C-N); 2356.85 (C=N); 2965.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3525.63 (N-H), 3610 (O-H), Anal. Calcd. for $\text{C}_{15}\text{H}_{22}\text{N}_6\text{O}$: C, 59.58; H, 7.33; N, 27.79; Found: C, 59.51; H, 7.27; N, 27.71.

N-Ethyl-N'-isopropyl-N''-propyl-[1,3,5]triazine-2,4,6-triamine (Compound-4a)

Yield: 70%, solid, m.p. 97-99°C. M.W.: 238.33; m/z : 239 ^1H NMR (400 MHz, CDCl_3): δ 0.916-0.965 (t, 3H), 1.145-1.191 (d, 6H), 1.504-1.625 (t, 3H), 2.332 (q, 4H), 3.270-3.419 (sq, 1H) 4.092-4.156 (b, 1H), 4.726 (b, 1H), 4.872 (b, 1H) ^{13}C NMR (400 MHz, CDCl_3): δ 11.43, 15.04, 22.94, 23.04, 35.48, 42.11, 42.45, 165.05, 165.82. FT-IR (In cm^{-1}): 1335.61 (C-H); 1515.94 (C-N); 2964.39 (Aliphatic C-H); 3311.55 (N-H), Anal. Calcd. for $\text{C}_{11}\text{H}_{22}\text{N}_6$: C, 55.43; H, 9.30; N, 35.26; Found: C, 55.38; H, 9.22; N, 35.21.

N-Ethyl-N'-isopropyl-N''-phenethyl-[1,3,5]triazine-2,4,6-triamine (Compound-4b)

Yield: 63%, solid, m.p. 105-108°C. M.W.: 300.40; m/z : 301 ^1H NMR (400 MHz, CDCl_3): δ 0.934-0.965 (t, 3H), 1.112-1.137 (d, 6H), 2.78 (t, 2H), 3.10 (q, 2H) 3.270-3.419 (sq, 1H), 3.4 (t, 2H), 7.08 (t, 1H) 7.12-7.22 (d, 4H) ^{13}C NMR (400 MHz, CDCl_3): 815.5, 23.8, 37.3, 44.4, 49.8, 53.7, 125.7, 127.9, 128.4, 140.2, 165.05, 165.82, 166.2 FT-IR (In cm^{-1}): 1335.61 (C-H); 1515.94 (C-N); 2964.39 (Aliphatic C-H); 3020 (Aromatic C-H) 3311.55 (N-H), Anal. Calcd. for $\text{C}_{16}\text{H}_{24}\text{N}_6$: C, 63.97; H, 8.05; N, 27.98; Found: C, 63.91; H, 7.99; N, 27.92.

N-Benzyl-N'-ethyl-N''-isopropyl-[1,3,5]triazine-2,4,6-triamine (Compound-4c)

Yield: 67%, solid, m.p. 111-113°C. M.W.: 286.38; m/z : 287 ^1H NMR (400 MHz, CDCl_3): δ 0.934-0.965 (t, 3H), 1.102-1.117 (d, 6H), 3.10 (q, 2H) 3.270-3.419 (sq, 1H), 4.32 (s, 2H) 7.08-7.14 (m, 5H) ^{13}C NMR (400 MHz, CDCl_3): 815.5, 23.8, 44.4, 49.8, 57.1, 126.5, 127.1, 128.3, 142.4, 165.05, 165.82, 166.2 FT-IR (In cm^{-1}): 1335.61 (C-H); 1515.94 (C-N); 2964.39 (Aliphatic C-H); 3022 (Aromatic C-H) 3311.55 (N-H), Anal. Calcd. for $\text{C}_{15}\text{H}_{22}\text{N}_6$: C, 62.91; H, 7.74; N, 29.35; Found: C, 62.89; H, 7.69; N, 29.32.

N-Butyl-N'-ethyl-N''-isopropyl-[1,3,5]triazine-2,4,6-triamine (Compound-4d)

Yield: 74%, solid, m.p. 118-121°C. M.W.: 252.36; m/z : 253 ^1H NMR (400 MHz, CDCl_3): δ 0.934-0.965 (t, 6H), 1.102-1.117 (d, 6H), 1.30-1.33 (m, 2H), 1.50-1.52 (t, 2H) 3.10 (q, 2H) 3.270-3.419 (sq, 1H), 4.32 (s, 2H) 7.08-7.14 (m, 5H) ^{13}C NMR (400 MHz, CDCl_3): 813.5, 15.5, 20.5, 23.8, 31.8, 44.4, 49.8, 51.3, 165.05, 165.82, 166.2 FT-IR (In cm^{-1}): 1335.61 (C-H); 1515.94 (C-N); 2964.39 (Aliphatic C-H), 3311.55 (N-H), Anal. Calcd. for $\text{C}_{12}\text{H}_{24}\text{N}_6$: C, 57.11; H, 9.59; N, 33.30; Found: C, 57.08; H, 9.51; N, 35.21.

N-Ethyl-N'-isopropyl-N''-(4-methoxy-benzyl)-[1,3,5]triazine-2,4,6-triamine (Compound-4e)

Yield: 72%, solid, m.p. 131-133°C. M.W.: 316.40; m/z : 317 ^1H NMR (400 MHz, CDCl_3): δ 0.934-0.965 (t, 3H), 1.102-1.117 (d, 6H), 3.10 (q, 2H) 3.270-3.419 (sq, 1H), 3.73 (s, 3H), 4.32 (s, 2H) 6.8-7.02 (m, 4H) ^{13}C

NMR (400 MHz, CDCl₃): δ 15.5, 23.8, 44.4, 49.8, 56.1, 57.1, 113.9, 128.1, 134.7, 154.7, 165.05, 165.82, 166.2 FT-IR (In cm⁻¹): 1320.61 (C-O); 1518.91 (C-N), 2935.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3535.63 (N-H), Anal. Calcd. for C₁₂H₂₄N₆: C, 60.74; H, 7.65; N, 26.56; Found: C, 60.68; H, 7.62; N, 26.52.

N-Ethyl-N'-isopropyl-N''-[2-(4-methoxy-phenyl)-ethyl]-[1,3,5]triazine-2,4,6-triamine(Compound-4f)

Yield: 61%, solid, m.p. 139-141°C. M.W.: 330.43; m/z : 330.2¹H NMR (400 MHz, CDCl₃): δ 0.934-0.965 (t, 3H), 1.102-1.117 (d, 6H), 2.76-2.79 (t, 2H) 3.10 (q, 2H), 3.39 (t, 2H) 3.270-3.419 (sq, 1H), 3.73 (s, 3H), 6.8-7.02 (m, 4H) ¹³C NMR (400 MHz, CDCl₃): δ 15.5, 23.8, 37.3, 44.4, 56, 114, 128.9, 132.5, 165.05, 165.82, 166.2 FT-IR (In cm⁻¹): 1320.61 (C-O); 1518.91 (C-N), 2935.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3535.63 (N-H), Anal. Calcd. for C₁₇H₂₆N₆O: C, 61.79; H, 7.93; N, 25.43; Found: C, 61.72; H, 7.87; N, 25.41.

N-[2-(3,4-Dimethoxy-phenyl)-ethyl]-N'-ethyl-N''-isopropyl-[1,3,5]triazine-2,4,6-triamine(Compound-4g)

Yield: 67%, solid, m.p. 118-122°C. M.W.: 360.45; m/z : 361¹H NMR (400 MHz, CDCl₃): δ 0.934-0.965 (t, 3H), 1.102-1.117 (d, 6H), 2.76-2.79 (t, 2H) 3.10 (q, 2H), 3.39 (t, 2H) 3.270-3.419 (sq, 1H), 3.73 (s, 6H), 6.8-7.02 (m, 3H) ¹³C NMR (400 MHz, CDCl₃): δ 15.5, 23.8, 37.6, 44.4, 49.8, 53.7, 56.3, 114.5, 115, 121.2, 133.6, 165.05, 165.82, 166.2 FT-IR (In cm⁻¹): 1320.61 (C-O); 1518.91 (C-N), 2935.35 (Aliphatic C-H); 3035 (Aromatic C-H) 3535.63 (N-H), Anal. Calcd. for C₁₈H₂₈N₆O₂: C, 59.98; H, 7.83; N, 23.32; Found: C, 59.91; H, 7.73; N, 23.31.

4-[2-(4-Ethylamino-6-isopropylamino-[1,3,5]triazin-2-ylamino)-ethyl]-phenol (Compound-4h)

Yield: 70%, solid, m.p. 138-142°C. M.W.: 316.40; m/z : 317, ¹H NMR (400 MHz, CDCl₃): δ 0.934-0.965 (t, 3H), 1.102-1.117 (d, 6H), 2.76-2.79 (t, 2H) 3.10 (q, 2H), 3.39 (t, 2H) 3.270-3.419 (sq, 1H), 6.72-6.85 (m, 4H) ¹³C NMR (400 MHz, CDCl₃): δ 15.5, 23.8, 37.6, 44.4, 49.8, 53.7, 56.3, 115.6, 129.3, 132.8, 154.5, 165.05, 165.82, 166.2 FT-IR (In cm⁻¹): 1335.61 (C-H); 1515.94 (C-N); 2964.39 (Aliphatic C-H); 3020 (Aromatic C-H), 3311.55 (N-H), Anal. Calcd. for C₁₆H₂₄N₆O: C, 60.74; H, 7.65; N, 26.56; Found: C, 60.68; H, 7.58; N, 26.51.

Biological Screening

Antibacterial Activity

Antibacterial activities of all the compounds were studied against gram-positive bacteria (*Staphyloco*) and gram-negative bacteria (*E.coli*, and *p.aeruginosa*) at a concentration of 50 µg/ml by agar cup plate method. The methanol system was used as a control in this method. Under similar conditions using streptomycin as a standard for comparison carried out control experiment. The area of inhibition of zone measured in mm. and found value is tabulated in Table (Tabel-1).

Table-1: Antibacterial Activity of Compounds (3a-h and 4a-h)

Compound	Minimal Inhibition Concentration of Bacterial Strains (MIC) in µg/ml			
	Gram Negative Strains		Gram Positive Strains	
	<i>E. coli</i> MTCC-443	<i>P. aeruginosa</i> MTCC-1688	<i>B. subtilis</i> MTCC-441	<i>S.aureus</i> MTCC-96
3a	1.0	8.0	16.0	16.0
3b	4.0	4.0	16.0	32.0
3c	0.5	8.0	16.0	16.0
3d	4.0	8.0	32.0	16.0
3e	4.0	8.0	4.0	16.0
3f	4.0	4.0	8.0	8.0
3g	2.0	2.0	8.0	4.0
3h	8.0	4.0	4.0	16.0
4a	4.0	4.0	8.0	16.0
4b	1.0	1.0	2.0	2.0
4c	8.0	8.0	16.0	8.0

4d	2.0	2.0	8.0	4.0
4e	4.0	8.0	4.0	0.8
4f	4.0	4.0	8.0	4.0
4g	1.0	1.0	8.0	4.0
4h	4.0	8.0	8.0	16.0
Streptomycin	0.25	0.5	0.25	0.25

Antifungal Activity

The fungicidal activity of all the compounds was studied at 1000 ppm concentration in vitro. Plant pathogenic organisms used were (*Aspergillumsniger*) The antifungal activity of all the compounds (3a-h and 4-h) was measured and tabulated in the table (Tabel-2).

Table-2: Antifungal Activity of Compounds (3a-h and 4a-h)

Compound	Minimal Inhibition Concentration of Bacterial Strains (MIC) in µg/ml
	Fungal Strains
	<i>A. niger</i> MTCC-282
3a	256.0
3b	128.0
3c	512.0
3d	128.0
3e	512.0
3f	128.0
3g	256.0
3h	256.0
4a	512.0
4b	64.0
4c	512.0
4d	256.0
4e	128.0
4f	256.0
4g	64.0
4h	64.0
Kanamycin	4.0

RESULTS AND DISCUSSION

It was observed that 2,4,6 –trichloro 1,3,5-triazine (1) on condensation with a various amine to get tri substituted triazine (compound 3 a-h and 4a-h). The is confirmed by various analysis like elemental analysis and spectroscopical analysis (ESI-MS, ¹H NMR, ¹³C NMR and IR). The C, H, N analysis and ¹H-NMR data of all compounds are presented above.

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