

SYNTHESIS AND BIOLOGICAL ACTIVITY OF SOME 2-AMINO-4,6-SUBSTITUTED-DIARYLPYRIMIDINES: REACTION OF SUBSTITUTED CHALCONES WITH GUANIDINIUM CARBONATE

Vandana Sharma* and K. V. Sharma

Department of Engineering Chemistry,
Mahakal Institute of Technology, Ujjain 456664 Madhya Pradesh, INDIA

*E-mail: vandanak_sharma@yahoo.co.in

ABSTRACT

A series of substituted 2-Amino-4,6-diarylpyrimidines were synthesized by the reaction of appropriately substituted chalcones and guanidinium carbonate in DMF. The synthesized pyrimidines have been characterized on the basis of their chemical properties and spectroscopic data. These compounds were screened for biological activity against a variety of test organisms.

Keywords: Substituted Chalcones, Guanidinium Carbonate, pyrimidines, 2-Amino-4,6- diarylpyrimidines.

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INTRODUCTION

The nitrogen containing heterocycles are an important class of compounds in the medicinal chemistry and also contributed to the society from biological and industrial point which helps to understand life processes¹. The chemistry of pyrimidines and its derivatives have been studied since past century due to their close pharmacological association with diverse pharmacological properties. This seems to be because pyrimidines represents one of the most active class of compounds possessing wide spectrum of biological activity *viz.* significant *in vitro* activity against unrelated DNA and RNA, viruses including polio herpes viruses, diuretic, antitumor, anti HIV, cardiovascular². The biodynamic property of the pyrimidine ring system prompted us to account for their pharmacological properties especially as anti-infective agents³.

In view of the significant biological activities⁴⁻¹¹ of the compounds having pyrimidine nucleus, and pyrimidines having an amino or a substituted amino group at C-2 and C-4 position¹²⁻¹⁵ we have synthesized some new substituted 2-Amino-4,6-diarylpyrimidines by action of chalcones with guanidinium carbonate in DMF.

EXPERIMENTAL

General

Melting points were determined by the open tube capillary method and are uncorrected. The purity of the compounds was controlled by thin layer chromatography (TLC). IR spectra were recorded as KBr pellets on Perkin-Elmer spectrum RX1 spectrophotometer. Carbon, hydrogen, and nitrogen were estimated by Thermo Finnigan FLASH EA 1112 elemental analyzer. ¹H-NMR spectra were recorded on Bruker DRX-300 spectrometer at room temperature. Mass spectra were measured on JEOL SX 102/DA-6000 mass spectrometer. 2-Amino-4,6-diarylpyrimidines derivatives were prepared according to the reported methods.

General procedure for synthesis of 2-amino-4,6-substituted-diphenylpyrimidine(1-24)

To a mixture of substituted chalcone and guanidinium carbonate (1:1 molar ratio) in DMF was refluxed for 3 hours. The reaction mixture was poured in cold water. The solid thus separated was filtered, washed with water and dried at 80°C. The product was crystallized from ethanol to afford light yellow crystals.

2-Amino-4,6-diphenylpyrimidine(1)

Obtained as light yellow crystals in 85% yield, m.p. 164-65°C; IR(ν) max: 3480, 3300, 1640, 1600, 1585, 1565, 1450, 1370, 1235, 1070, 1025, 930, 840, 770, 710,700, 630, 590 and 440 cm^{-1} . MS,m/z: 247, 232, 170, 164, 155, 87. Anal. Calcd. for $\text{C}_{16}\text{H}_{13}\text{N}_3$: C, 77.73; H, 5.26; N, 17.00, Found: C, 77.71; H, 5.27; N, 17.02%.

2-Amino-4-(4'-chlorophenyl)-6-phenylpyrimidine(2)

Obtained as light yellow crystals in 95% yield, m.p. 151-52°C; IR(ν) max: 3490, 3300, 3200, 1630, 1590, 1580, 1560, 1540, 1490, 1460, 1360, 1100, 1020, 830, 815, 775, 700, 650 and 480 cm^{-1} . MS,m/z: 281, 266, 204, 189, 168, 153, 121,85. Anal. Calcd. for $\text{C}_{16}\text{H}_{12}\text{ClN}_3$: C,68.32; H, 4.27; N, 14.94, Found: C, 68.34; H, 4.26; N, 14.93%.

2-Amino-4-(4'-methoxyphenyl)-6-phenylpyrimidine(3)

Obtain as light yellow crystals in 80% yield, m.p. 159-60°C; IR(ν) max: 3340, 3200, 1640, 1580, 1560, 1530, 1460, 1360, 1305, 1260, 1180, 1030, 1000, 825, 770, 690, 640, 580, 510 and 460 cm^{-1} . MS,m/z: 277, 262, 151, 136, 108, 78. Anal. Calcd. for $\text{C}_{17}\text{H}_{15}\text{N}_3\text{O}$: C,73.64; H, 5.41; N, 15.16, Found: C, 73.65; H, 5.38; N, 15.12%.

2-Amino-4-(2'-hydroxyphenyl)-6-phenylpyrimidine(4)

Obtain as light yellow crystals in 70% yield, m.p. 169-70°C; IR(ν) max: 3500, 3400, 1570, 1540, 1500, 1420, 1360, 1300, 1230, 1040, 890, 800, 760, 700, 660 and 550 cm^{-1} . MS,m/z: 263, 248, 246, 156, 122, 94,65. Anal. Calcd. for $\text{C}_{16}\text{H}_{13}\text{N}_3\text{O}$: C,73.00; H, 4.94; N, 15.96, Found: C, 73.01; H, 4.93; N, 15.92%.

2-Amino-4-(2'-hydroxyphenyl)-6-(2-hydroxyphenyl)pyrimidine(5)

Obtain as light yellow crystals in 80% yield, m.p. 169-70°C; IR(ν) max: 3500, 3360, 1630, 1570, 1540, 1500, 1460, 1420, 1360, 1310, 1230, 1140, 1040, 1000, 890, 860, 840, 800, 760, 700, 640, 550 and 470 cm^{-1} . MS,m/z: 279, 264, 262, 186, 118,93, 85. Anal. Calcd. for $\text{C}_{16}\text{H}_{13}\text{N}_3\text{O}_2$: C,68.81; H, 4.65; N, 15.05, Found: C, 68.78; H, 4.64; N, 15.12%.

2-Amino-4-(2'-hydroxy-5'methylphenyl)-6-phenylpyrimidine(6)

Obtain as light yellow crystals in 68% yield, m.p. 170-71°C; IR(ν) max: 3500, 3300, 3180, 1640, 1580, 1540, 1500, 1440, 1400, 1370, 1300, 1230, 840, 810, 765, 740, 700, 650, 540 and 470 cm^{-1} . MS,m/z: 277, 262, 247, 245, 155, 106, 78,49. Anal. Calcd. for $\text{C}_{17}\text{H}_{15}\text{N}_3\text{O}$: C,73.64; H, 5.40; N, 15.15, Found: C, 73.65; H, 5.38; N, 15.17%.

2-Amino-4-phenyl-6-(2-hydroxyphenyl)pyrimidine(7)

Obtain as light yellow crystals in 65% yield, m.p. 168-69°C; IR(ν) max: 3480, 3400, 3200, 1640, 1570, 1540, 1500, 1465, 1420, 1360, 1300, 1230, 855, 800, 770, 750, 700 and 650 cm^{-1} . MS,m/z: 263, 248, 246, 156, 122, 94,65. Anal. Calcd. for $\text{C}_{16}\text{H}_{13}\text{N}_3\text{O}$: C,73.00; H, 4.94; N, 15.95, Found: C, 73.02; H, 4.93; N, 15.97%.

2-Amino-4-(4'-chlorophenyl)-6-(2-hydroxyphenyl)pyrimidine(8)

Obtain as light yellow crystals in 71% yield, m.p. 229-30°C; IR(ν) max: 3500, 3340, 1640, 1580, 1545, 1510, 1400, 1310, 1235, 1090, 1015, 860, 840, 800, 750, 740, 650 and 480 cm^{-1} . MS,m/z: 297, 282, 280, 139, 128, 111, 78. Anal. Calcd. for $\text{C}_{16}\text{H}_{12}\text{ClN}_3\text{O}$: C,64.64; H, 4.04; N, 14.14, Found: C, 64.65; H, 4.07; N, 14.16%.

2-Amino-4-(4'-methylphenyl)-6-(2-hydroxyphenyl)pyrimidine(9)

Obtain as light yellow crystals in 68% yield, m.p. 169-70°C; IR(ν) max: 3500, 3360, 1630, 1570, 1540, 1500, 1450, 1420, 1300, 1230, 890, 760, 700, 640 and 470 cm^{-1} . MS,m/z: 277, 262, 260, 185, 172, 119,

117, 100, 92, 91, 78. Anal. Calcd. for C₁₇H₁₅N₃O: C,73.64; H, 5.40; N, 15.16, Found: C, 73.65; H, 5.38; N, 15.18%.

2-Amino-4-(4'-methoxyphenyl)-6-(2-hydroxyphenyl)pyrimidine(10)

Obtain as light yellow crystals in 66% yield, m.p. 193-94°C; IR(ν) max: 3480, 3340, 1630, 1600, 1580, 1535, 1515, 1420, 1300, 1230, 1180, 1035, 830, 760 and 590cm⁻¹. MS,m/z: 293, 278, 276, 187, 172, 135, 107, 104, 87, 79, 78. Anal. Calcd. for C₁₇H₁₅N₃O₂: C,69.62; H, 5.11; N, 14.33, Found: C, 69.65; H, 5.10; N, 14.32%.

2-Amino-4-phenyl-6-(4-chlorophenyl)pyrimidine(11)

Obtain as light yellow crystals in 65% yield, m.p. 152-53°C; IR(ν) max: 3495, 3305,3200, 1630, 1595, 158, 1560, 1490, 1460, 1360, 1220, 1100, 1020, 830, 815, 775, 700, 645 and 485cm⁻¹. MS,m/z: 281, 266, 246, 204, 136, 111, 101. Anal. Calcd. for C₁₆H₁₂ClN₃: C,68.32; H, 4.27; N, 14.94, Found: C, 68.36; H, 4.26; N, 14.93%.

2-Amino-4-(2'-hydroxyphenyl)-6-(4-chlorophenyl)pyrimidine(12)

Obtain as light yellow crystals in 61% yield, m.p. 230-31°C; IR(ν) max: 3500, 3350, 1640, 1580, 1555, 1500, 1420, 1310, 1235, 1090, 1015, 860, 800, 750, 650 and 480cm⁻¹. MS,m/z: 297, 282, 262, 190, 121, 93, 78. Anal. Calcd. for C₁₆H₁₂ClN₃O: C,64.64; H, 4.04; N, 14.14, Found: C, 64.65; H, 4.07; N, 14.16%.

2-Amino-4-(4'-chlorophenyl)-6-(4-chlorophenyl)pyrimidine(13)

Obtain as light yellow crystals in 62% yield, m.p. 207-08°C; IR(ν) max: 3480, 3310, 3200, 1640, 1600, 1580, 1530, 1490, 1460, 1370, 1230, 1100, 1015, 810, 730, 590 and 490cm⁻¹. MS,m/z: 215, 300, 280, 204, 190, 139, 111, 101, 78. Anal. Calcd. for C₁₆H₁₁Cl₂N₃: C,60.95; H, 3.49; N, 13.13, Found: C, 60.92; H, 3.91; N, 13.16%.

2-Amino-4-(4'-methylphenyl)-6-(4-chlorophenyl)pyrimidine(14)

Obtain as light yellow crystals in 68% yield, m.p. 149-50°C; IR(ν) max: 3500, 3320, 3200, 1630, 1595, 1565, 1540, 1490, 1660, 1360, 1300, 1240, 1175, 1100, 1020, 930, 850, 830, 815, 775, 700, 645, 580, 480 and 400cm⁻¹. MS,m/z: 295, 280, 260, 204, 190, 136, 119, 111, 101, 91, 78. Anal. Calcd. for C₁₇H₁₄ClN₃: C,69.15; H,4.74 ;N, 14.23, Found: C, 69.18; H, 4.74; N, 14.25%.

2-Amino-4-(4'-methoxyphenyl)-6-(4-chlorophenyl)pyrimidine(15)

Obtain as light yellow crystals in 62% yield, m.p. 156-57°C; IR(ν) max: 3340, 3210, 1640, 1580, 1560, 1530, 1490, 1400, 1360, 1240, 1175, 1090, 1030, 1010, 820, 580 and 510cm⁻¹. MS,m/z: 311, 296, 276, 259, 203, 190, 135, 118, 110, 101, 93, 90,78. Anal. Calcd. for C₁₇H₁₄ClN₃O: C,65.59; H,4.50 ;N, 13.50, Found: C, 65.63; H, 4.52; N, 13.45%.

2-Amino-4-phenyl-6-(4-methoxyphenyl) pyrimidine(16)

Obtain as light yellow crystals in 72% yield, m.p. 145-46°C; IR(ν) max: 3340, 3190, 1640, 1600, 1580, 1560, 1530, 1400, 1360, 1260, 1240, 1180, 1030, 820, 770, 690, 580 and 510cm⁻¹. MS,m/z: 277, 262, 243, 169, 101, 78. Anal. Calcd. for C₁₇H₁₅N₃O: C,73.64; H,5.41 ;N, 15.61, Found: C, 73.63; H, 5.39; N, 15.20%.

2-Amino-4-(2'-hydroxyphenyl)-6-(4-methoxyphenyl)pyrimidine(17)

Obtain as light yellow crystals in 62% yield, m.p. 194-95°C; ¹H NMR(δ): 3.90(3H,s,-OCH₃), 5.24(2H,s,-NH₂), 6.90 to 8.10(9H,m,ArH), 11.80(1H,s,-OH); IR(ν)max: 3500, 3330, 1620, 1575, 1530, 1510, 1415, 1300, 1250, 1230, 1180, 1030, 860, 760, 635 and 590cm⁻¹. MS,m/z: 293, 278, 276, 200, 135, 132, 107, 101, 78. Anal. Calcd. for C₁₇H₁₅N₃O₂:C,69.62; H,5.11 ;N, 14.33, Found: C, 69.68; H, 5.10; N, 14.30%.

2-Amino-4-(4'-chlorophenyl)-6-(4-methoxyphenyl)pyrimidine(18)

Obtain as light yellow crystals in 65% yield, m.p. 155-56°C; IR(ν)max: 3340, 3210, 1640, 1580, 1560, 1530, 1490, 1400, 1360, 1240, 1175, 1090, 1030, 1010, 820, 580 and 510 cm^{-1} . MS,m/z: 311, 296, 276, 259, 203, 190, 135, 118, 110, 101, 93, 90, 78. Anal. Calcd. for $\text{C}_{17}\text{H}_{14}\text{ClN}_3\text{O}$: C,65.59; H,4.50 ;N,13.50, Found: C, 65.61; H,4.51; N, 13.49%.

2-Amino-4-(4'-methylphenyl)-6-(4-methoxyphenyl)pyrimidine(19)

Obtain as light yellow crystals in 63% yield, m.p. 160-61°C; IR(ν)max: 3460, 3320, 1640, 1585, 1565, 1535, 1400, 1360, 1260, 1240, 1180, 1030, 825, 770, 690, 580 and 510 cm^{-1} . MS,m/z: 291, 276, 199, 168, 135, 107, 101, 78. Anal. Calcd. for $\text{C}_{18}\text{H}_{17}\text{N}_3\text{O}$: C,74.22; H,5.84 ;N, 14.43, Found: C,74.20; H,5.83; N,14.46%.

2-Amino-4-(4'-methoxyphenyl)-6-(4-methoxyphenyl)pyrimidine(20)

Obtain as light yellow crystals in 70% yield, m.p. 159-60°C; IR(ν)max: 3360, 3200, 1650, 1600, 1560, 1535, 1510, 1440, 1400, 1365, 1310, 1260, 1240, 1180, 1030, 850, 820, 800, 580 and 520 cm^{-1} . MS,m/z: 307, 292, 276, 200, 135, 132, 107, 101. Anal. Calcd. for $\text{C}_{18}\text{H}_{17}\text{N}_3\text{O}_2$: C,70.35; H,5.53 ;N, 13.68, Found: C, 70.35; H,5.50; N, 13.70%.

2-Amino-4-(2'-hydroxyphenyl)-6-(3,4-dimethoxyphenyl)pyrimidine(21)

Obtain as light yellow crystals in 60% yield, m.p. 210-11°C; IR(ν)max: 3440, 3300, 3180, 1640, 1600, 1570, 1540, 1520, 1460, 1420, 1370, 1310, 1260, 1180, 1140, 1030, 820, 760 and 620 cm^{-1} . MS,m/z: 323, 308, 306, 292, 276, 230, 200, 199, 168, 101, 78. Anal. Calcd. for $\text{C}_{18}\text{H}_{17}\text{N}_3\text{O}_3$:C,66.87; H,5.26 ;N, 13.00, Found: C, 66.84; H,5.27; N, 13.00%.

2-Amino-4-(4'-chlorophenyl)-6-(3,4-dimethoxyphenyl)pyrimidine(22)

Obtain as light yellow crystals in 86% yield, m.p. 185-86°C; IR(ν)max: 3500, 3380, 1620, 1590, 1580, 1530, 1490, 1440, 1360, 1310, 1270, 1140, 1090, 1030, 850, 800, 770 and 600 cm^{-1} . MS,m/z: 341, 326, 306, 230, 204, 165, 136, 137, 111, 101. Anal. Calcd. for $\text{C}_{18}\text{H}_{16}\text{ClN}_3\text{O}_2$:C,63.34; H,4.69 ;N, 12.31, Found: C, 63.32; H,4.67; N, 12.33%.

2-Amino-4-(4'-methylphenyl)-6-(3,4-dimethoxyphenyl)pyrimidine(23)

Obtain as light yellow crystals in 66% yield, m.p. 144-45°C; ^1H NMR(δ): 2.40(3H,s,-CH₃), 3.90-4.10(6H,2s,-OCH₃), 5.24(2H,s,-NH₂), 6.86 to 8.00(9H,m,ArH), 11.80(1H,s,-OH); IR(ν)max: 3440, 3320, 3200, 1630, 1600, 1565, 1530, 1510, 1490, 1450, 1400, 1370, 1325, 1260, 1210, 1180, 1140, 1030, 860, 815, 770, 690, 615, 530, 500 and 460 cm^{-1} . MS,m/z: 321, 306, 230, 204, 165, 137, 136, 111, 101. Anal. Calcd. for $\text{C}_{19}\text{H}_{19}\text{N}_3\text{O}_2$:C,71.02; H,5.91 ;N, 13.08, Found: C, 71.04; H,5.90; N, 13.10%.

2-Amino-4-(4'-methoxyphenyl)-6-(3,4-dimethoxyphenyl)pyrimidine(24)

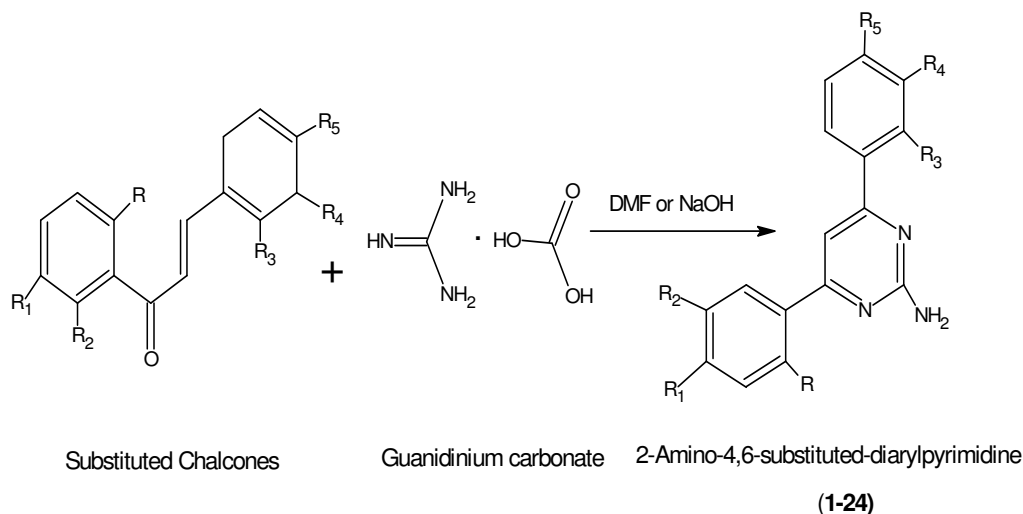
Obtain as light yellow crystals in 65% yield, m.p. 157-58°C; ^1H NMR(δ): 3.80 to 4.10 (9H,3s,-OCH₃), 5.25(2H,s,-NH₂), 6.90 to 8.10(8H,m,ArH); IR(ν)max: 3420, 3320, 3200, 1630, 1600, 1585, 1570, 1510, 1440, 1375, 1270, 1220, 1185, 1140, 1030, 820, 760, 590 and 510 cm^{-1} . MS,m/z: 337, 322, 306, 216, 204, 165, 136, 137, 111, 101. Anal. Calcd. for $\text{C}_{19}\text{H}_{19}\text{N}_3\text{O}_3$:C,67.65; H,5.63 ;N, 12.46, Found: C, 67.62; H,5.65; N, 12.49%.

RESULTS AND DISCUSSION

Substituted 2-Amino-4,6-diarylpyrimidines(**1-24**) have been prepared by the reaction of variedly substituted chalcones with guanidinium carbonate in DMF. The Structures of all new compounds have been elucidated by elemental analyses, ^1H NMR, Mass spectral and IR measurements.

IR spectra of substituted 2-Amino-4,6-diarylpyrimidines shows two peaks in the region 3500-3180 cm^{-1} due to $-\text{NH}_2$ and no $>\text{C}=\text{O}$ stretching. N-H bending vibrations are also observed in the region 1650-1590 cm^{-1} .The stretching vibrations due to intermolecular hydrogen bonded $-\text{OH}$ group gives absorption in the region 3100-2700 cm^{-1} . A group of three absorption peaks were found in the region 1600-1500 cm^{-1} . This is due to the absorption of aromatic nucleus and $>\text{C}=\text{N}$ group.

The NMR (CDCl₃) spectra of substituted 2-Amino-4,6-diarylpyrimidines(**17,23,24**) shows multiplates in the range δ 8.1 to 6.9 owing to aromatic protons. Singlets at δ 5.2, δ 4.1 to 3.8 and δ 2.4 due to the –NH₂,-OCH₃ and –CH₃ groups observed respectively.



- | | |
|--|---|
| 1: R=R ₁ =R ₂ =R ₃ =R ₄ =R ₅ =H | 2: R ₁ =Cl, R=R ₂ =R ₃ =R ₄ =R ₅ =H |
| 3: R ₁ =OCH ₃ , R ₂ =R ₃ =R ₄ =R ₅ =H | 4: R=OH, R ₁ =R ₂ =R ₃ =R ₄ =R ₅ =H |
| 5: R=R ₃ =OH, R ₁ =R ₂ =R ₄ =R ₅ =H | 6: R=OH, R ₂ =CH ₃ , R ₁ =R ₃ =R ₄ =R ₅ =H |
| 7: R ₃ =OH, R=R ₁ =R ₂ =R ₄ =R ₅ =H | 8: R ₁ =Cl, R ₃ =OH, R=R ₂ =R ₄ =R ₅ =H |
| 9: R ₁ =CH ₃ , R ₃ =OH, R=R ₂ =R ₄ =R ₅ =H | 10: R ₁ =OCH ₃ , R ₃ =OH, R=R ₂ =R ₄ =R ₅ =H |
| 11: R=R ₁ =R ₂ =R ₃ =R ₄ =H, R ₅ =Cl | 12: R=OH, R ₁ =R ₂ =R ₃ =R ₄ =H, R ₅ =Cl |
| 13: R ₁ =Cl, R=R ₂ =R ₃ =R ₄ =H, R ₅ =Cl | 14: R ₁ =CH ₃ , R=R ₂ =R ₃ =R ₄ =H, R ₅ =Cl |
| 15: R ₁ =OCH ₃ , R=R ₂ =R ₃ =R ₄ =H, R ₅ =Cl | 16: R=R ₁ =R ₂ =R ₃ =R ₄ =H, R ₅ =OCH ₃ |
| 17: R=OH, R ₁ =R ₂ =R ₃ =R ₄ =H, R ₅ =OCH ₃ | 18: R ₁ =Cl, R=R ₂ =R ₃ =R ₄ =H, R ₅ =OCH ₃ |
| 19: R ₁ =CH ₃ , R=R ₂ =R ₃ =R ₄ =H, R ₅ =OCH ₃ | 20: R ₁ =OCH ₃ , R=R ₂ =R ₃ =R ₄ =H, R ₅ =OCH ₃ |
| 21: R=OH, R ₁ =R ₂ =R ₃ =H, R ₄ =R ₅ =OCH ₃ | 22: R ₁ =Cl, R=R ₂ =R ₃ =H, R ₄ =R ₅ =OCH ₃ |
| 23: R ₁ =CH ₃ , R=R ₂ =R ₃ =H, R ₄ =R ₅ =OCH ₃ | 24: R ₁ =OCH ₃ , R=R ₂ =R ₃ =H, R ₄ =R ₅ =OCH ₃ |

Scheme-1: Synthesis of 2-Amino-4,6-diarylpyrimidines derivatives (**1-24**).

Biological activity

The synthesized substituted 2-Amino-4,6-diarylpyrimidines (**1-24**) have been subjected to *in vitro* antimicrobial activity against various plant and human pathogenic bacteria and fungi.

Antimicrobial activity was carried out against gram positive coccus *Staphylococcus aureus*, *Micrococcus luteus*, gram positive rod *Bacillus megatherium* and gram negative rod *Pseudomonas aeruginosa*, *Candida albicans*, *Saccharomyces cerevisiae* yeast fungus and *Aspergillus niger*, *Penicillium notatum* soil fungi were used for microbial activity. The results are summarized in the Table 1.

It can be concluded from the observation that these substituted 2-Amino-4,6-diarylpyrimidines have moderate to high antimicrobial and antifungal activity. Moderate activity was observed when all these synthesized pyrimidines tested against *Staphylococcus aureus*, *Bacillus megatherium*, *Candida albicans*, *Pseudomonas aeruginosa*, *Saccharomyces cerevisiae* and *Aspergillus niger*. All compounds possess wide range of activity against *Micrococcus luteus* and *Penicillium notatum*.

In conclusion, we have synthesized a systematically substituted series of substituted 2-Amino-4,6-diarylpyrimidines derivatives for structure-activity relationship studies. These substituted derivatives are very stable compounds, which renders them beneficial substances for biological or pharmacological trials.

Table-1: Antimicrobial activity of substituted 2-amino-4,6-diarylpyrimidines

Compound No.	Culture							
	A	B	C	D	E	F	G	H
1	8	-	-	-	-	-	4	4
2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
5	-	8	-	-	-	-	-	4
6	-	-	-	-	-	-	-	-
7	-	-	-	-	-	4	5	-
8	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	5	-	-	-	-	-	-
12	-	7	-	-	-	-	-	4
13	-	-	-	-	-	-	5	-
14	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	5
16	-	5	4	-	-	4	5	5
17	-	8	-	4	4	4	-	8
18	-	8	-	4	-	-	-	8
19	-	-	-	-	-	-	-	10
20	-	8	-	-	-	-	-	-
21	-	-	-	4	-	-	-	5
22	-	9	-	-	-	-	-	-
23	-	8	-	4	-	-	-	-
24	-	-	-	4	-	4	-	5

(Diameter of inhibition zone measured in mm, paper disc 5 mm, inhibition zone measured excluding paper disc diameter)

A= *Staphylococcus aureus*; B= *Micrococcus luteus*; C= *Bacillus megatherium*;
D= *Pseudomonas aeruginosa*; E= *Candida albicans*; F= *Saccharomyces cerevisiae*;
G= *Aspergillus niger*; H= *Penicillium notatum*.

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