An Efficient Synthesis of Bio Active Azetidinones and Thiazolidinones of 3-METHYL-1-PHENYL-1H-PYRAZOL-5-OL

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Abstract- A series of Azetidinone; 3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9), 3(7), 5,10-tetraen-2-yl]phenyl}-4-aryl azetidin-2-one **(3a-e)** and thiazolidinones; 3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9), 3(7), 5,10-tetraen-2-yl]phenyl}-2-aryl-1,3-thiazolidin-4-one **(4a-e)** were synthesized using new schiff base; 2-(6,10-dimethyl-4,12-diphenyl-2-{4-[(E)-(arylmethylidene)amino]phenyl}-2,4,5,11,12-pentaazatricyclo [7.3.0.0^{3,7}]dodeca-1(9), 3(7), 5,10-tetraen-8-yl)-5-methyl phenol **(2a-e)**. The schiff base were synthesized by the reaction of aromatic aldehyde and 2-[2-(4-aminophenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9), 3(7), 5,10-tetraen-8-yl]-5-methyl phenol (1) under microwave and conventional methods. Our results show that the synthesis of schiff bases under solvent free microwave conditions is the most efficient method of synthesis having highest yield than both conventional method and microwave with solvent. The newly synthesized compounds were characterized on the basis of different spectroscopic (IR, ^{1}HNMR, Mass) and elemental (C, H, N) analysis techniques. Compounds (3a-e and 4a-e) were screened for their biological activities against the panel of nine bacterial strains.

Index Terms- Antibacterial activity, azetidinones derivatives, microwave method, thiazolidinones derivatives,.

I. INTRODUCTION

Microwave assisted heterocyclic synthesis is an efficient and eco-friendly synthetic strategy and has now become a power full tool for green chemistry. Microwave irradiation has been applied to organic reactions in the absence of solvent and or in the presence of a solid support such as clay, alumina and silica, resulting in shorter reaction time and better product yields than those obtained by using conventional heating [(1-7)]. Much attention has been paid to the synthesis of heterocyclic compounds [(8-11)].

Thiazolidinone is one of the most important pharmacores. 4-thiazolidinone derivatives exhibit a broader spectrum of biological activity [(12)]. In recent years 4-thiazolidinones are the most extensively investigated class of compounds, and its derivatives have been found to have potentially chemotherapic activities such as anticonvulsant, antibacterial, antifungal, antinflammatory[(13)], anticancer, and antipsychotic properties[(14)]. With a view to further assess the pharmacological profile of this class of compounds contains nitrogen and sulphur, we thought to synthesize some Azetidinone and thiazolidinones moieties in a single molecular frame work. Conventional methods are used for the synthesis of compounds (1). It was prepared by the reaction of 3-methyl-1-phenyl-5-pyrzolone, p-phenylene diamine and 4-methyl-salicylaldehyde in ethanol condensation of compounds in ethanol gave the corresponding schiff base (2). Compound (2) was prepared by both methods conventional and microwave procedures. Cyclisation of schiff basses (2) with chloroacetic acid, $POCl_3$ in presence of triethylamine and with thioglycolic acid in dichloromethane afforded azetidinones and thiazolidinones respectively. Purity of the compounds was checked by TLC, and characterized by elemental analysis, IR, ^{1}H-NMR and mass spectrometric techniques. . The antibacterial activities of the title compounds were evaluated against the different bacterial strains [(15-18)].

II. RESEARCH ELABORATIONS

All solvents and alcohols employed were distilled once before use and purchased form S.D. fine chemicals Ltd. India., Qualigens fine chemical, India. Melting points were taken in an open capillary in an electro thermal apparatus and are uncorrected. IR (KBr) Spectra were recorded on a Perkin-Elmer spectrophotometer. 1H-NMR spectra were recorded on a Brucker AMX 560 MHz in DMSO-d_6 using TMS as internal standard. Samsung microwave oven (Model No.M1630N, 2450MHz) was used for irradiation. The microwave assisted synthesis of schiff base compounds were carried out in a Samsung laboratory microwave reactor. EL-MS spectra were determined on a LCQ ion tap mass spectrometer. (Thermo Fisher, San Jose, CA. USA) equipped with an El-Source.

2-[2-(4-aminophenyl)-6,10-dimethyl-4,12-dipheneyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl]-5-methylphenol (1): A mixture of 5-methyl-2-phenyl-1H-pyrazol-3-one (0.2 mol), 4-methyl Salicylaldehyde (0.1 mol) in ethanol (10 ml) was refluxed for about 3-4 hours. After cooling, the reaction mixture was poured in ice cold water,

the solid precipitate was obtained and then filtered, dried and crystallized from chloroform to give light yellow solid.

2-(6,10-dimethyl-4,12-diphenyl-2-{4-[(E)-(arylmethylidene)amino]phenyl}-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2a-e):

Microwave method with solvent: 0.01 mol of 2-[2-(4-aminophenyl)-6,10-dimethyl-4,12-dipheneyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl]-5-methylphenol (1), and aromatic aldehyde and ethanol were taken in a glass tube which was loosely closed and irradiated in microwave oven for 2 minutes. The completion of the reaction was monitored by TLC. The reaction mixture was allowed to attain room temperature. The solvent was removed and the crude product was recrystallized with chloroform. **(figure -1)**

Classical method: 0.01 mol of 2-[2-(4-aminophenyl)-6,10-dimethyl-4,12-dipheneyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl]-5-methylphenol (1), and aromatic aldehyde and 2-3 drops of acetic acid in ethanol(10 ml) was refluxed for 4-5 hours. The reaction was monitored by TLC. After completion of the reaction, the reaction mixture was set in one side to cool. Then the reaction mixture was poured in ice cold water and solid precipitate was separated out, filtered and recrystallized from chloroform.

2-(6,10-dimethyl-4,12-diphenyl-2-{4-[(E)-(phenylmethylidene)amino]phenyl}-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2a): m. p.: 165^{0}C, IR(KBr); 760(1-2 disubtituted benzene ring), 1285 (C-N), 1572(C=C), 1618(C=N), 2920(Ar-CH), 2998 cm^{-1}(Ar-OH); ^{1}H-NMR: δ=2.23(m, 6H, Ar-CH); 3.08 (s, 6H, (N-CH_3)$_2$); 4.12 (s, 1H, Ar-CH); 4.47 (d, J=8.5 Hz, 2H, Ar-CH); 6.72-6.94 (m, 6H, Ar-CH), 7.08 (m, 6H, Ar-CH); 7.27-7.37 (m, 6H, Ar-CH); 7.51 (t, J=7.12 Hz, 3H, Ar-CH), 7.80 (d, J=8.24 Hz, 2H, Ar-CH); 8.33(s, 1H, N=CH); 9.61 (s, 1H, Ar-OH); Analysis Calculated for $C_{41}H_{34}N_6O$: C, 78.50; H, 5.42; N, 13.40; Found: C, 78.07; H, 4.37; N, 12.97; Mass spectra, m/z = 644 (100%).

2-(2-{4-[(E)-[(2-hydroxyphenyl)methylidene]amino]phenyl}-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2b): m. p.: 185^{0}C, IR(KBr); 733 (1-2 disubtituted benzene ring), 1210 (C-N), 1553 (C=C), 1605 (C=N), 2850 (Ar-CH), 3015 cm^{-1}(Ar-OH); ^{1}H-NMR: δ=2.63(m, 6H, Ar-CH); 3.35 (s, 6H, (N-CH_3)$_2$); 4.17 (s, 1H, Ar-CH); 4.64 (d, J=8.2 Hz, 2H, Ar-CH); 6.82-7.24 (m, 6H, Ar-CH), 7.45 (m, 8H, Ar-CH); 7.47-7.64 (m, 7H, Ar-CH); 7.71 (s, 1H, Ar-CH); 8.38 (s, 1H, N=CH); 9.74 (s, 1H, Ar-OH); 11.24 (s, 1H, Ar-OH); Analysis Calculated for $C_{41}H_{34}N_6O_2$; C, 76.55; H, 5.29; N, 13.40; Found: C, 75.81; H, 4.37; N, 12.97; Mass spectra, m/z = 660 (100%).

2-(2-{4-[(E)-[(4-hydroxyphenyl)methylidene]amino]phenyl}-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2c): m. p.: 135^{0}C, IR(KBr); 775 (1-2 disubtituted benzene ring), 1293 (C-N), 1523 (C=C), 1635 (C=N), 2935 (Ar-CH), 3035 cm^{-1}(Ar-OH); ^{1}H-NMR: δ=1.93(m, 6H, Ar-CH); 3.18 (s, 6H, (N-CH_3)$_2$); 3.95 (s, 1H, Ar-CH); 4.34 (d, J=8.5 Hz, 2H, Ar-CH); 6.52-7.14 (m, 8H, Ar-CH); 7.25-7.45 (m, 6H, Ar-CH); 7.55-7..71 (m, 6H, Ar-CH); 7.83 (d, J = 8.2 Hz, 2H, Ar-CH); 8.64 (s, 1H, N=CH); 9.54 (s, 1H, Ar-OH); 9.94 (s, 1H, Ar-OH); Analysis Calculated for $C_{41}H_{34}N_6O_2$; C, 76.55; H, 5.29; N, 13.07; Found: C, 76.01; H, 5.09; N, 12.75; Mass spectra, m/z = 660 (100%).

2-(2-{4-[(E)-[(4-methoxyphenyl)methylidene]amino]phenyl}-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2d): m. p.: 175^{0}C, IR(KBr); 762 (1-2 disubtituted benzene ring), 1253 (C-N), 1513 (C=C), 1655 (C=N), 2915 (Ar-CH), 3065 cm^{-1}(Ar-OH); ^{1}H-NMR: δ=2.33 (m, 6H, Ar-CH); 3.42 (s, 6H, (N-CH_3)$_2$); 3.85 (s, 3H, Ar-OCH_3); 4.24 (s, 1H, Ar-CH); 4.48 (d, J=8.5 Hz, 2H, Ar-CH); 6.32-6.94 (m, 6H, Ar-CH); 7.05-7.25 (m, 8H, Ar-CH); 7.34-7.41 (m, 6H, Ar-CH); 7.88 (d, J = 8.3 Hz, 2H, Ar-CH); 8.54 (s, 1H, N=CH); 9.74 (s, 1H, Ar-OH); Analysis Calculated for $C_{42}H_{36}N_6O_2$; C, 76.74; H, 5.48; N, 12.79; Found: C, 75.81; H, 5.01; N, 12.44; Mass spectra, m/z = 674 (100%).

2-(2-{4-[(E)-[(3-nitrophenyl)methylidene]amino]phenyl}-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2e): m. p.: 145^{0}C, IR(KBr); 752 (1-2 disubtituted benzene ring), 1273 (C-N), 1583 (C=C), 1613 (C=N), 2914 (Ar-CH), 3054 cm^{-1}(Ar-OH); ^{1}H-NMR: δ=2.43(m, 6H, Ar-CH); 3.32 (s, 6H, (N-CH_3)$_2$); 3.83 (s, 1H, Ar-CH); 4.24 (d, J=8.3 Hz, 2H, Ar-CH); 6.62-7.04 (m, 6H, Ar-CH); 7.12-7.25 (m, 6H, Ar-CH); 7.41-7..59 (m, 7H, Ar-CH); 7.73 (s, 1H, Ar-CH); 8.08 (d, J = 8.2 Hz, 2H, Ar-CH); 8.62 (s, 1H, N=CH); 8.84 (s, 1H, Ar-OH); 9.34 (s, 1H, Ar-OH); Analysis Calculated for $C_{41}H_{37}N_7O_3$; C, 73.24; H, 4.91; N, 14.59; Found: C, 72.71; H, 4.31; N, 14.15; Mass spectra, m/z = 689 (100%).

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-arylazetidin-2-one (3a-e): A mixture of schiff base (0.002 mols) chloroacetic acid (0.002 mols) was dissolved in dichloromethane (15 ml.) in stoppered conical flask, cooled and stirred. The reaction mixture, triethylamine (TEA, 0.002 mols) was added in it, which is followed by dropwise addition of $POCl_3$ in dichloromethane (0.002 mols) with vigorous stirring. The reaction mixture was then stirred for additional 18 hrs. The completion of the reaction was monitored by TLC. The reaction mixture was washed with water and dried over sodium sulphate. The products that were obtained after removing the solvent were purified from chloroform.

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-phenylazetidin-2-one (3a). Yield: 61%; m. p.: 185 ^{0}C, IR (KBr):764 (1, 2 disubtituted benzene ring),1285 (C-N), 1318 (C-N, β-lactam ring), 1573 (C=C), 1738 (C=O, β-lactam), 2920 (Ar-CH), 2999cm^{-1} (Ar-

OH); ^{1}H NMR: δ = 2.22 (m, 6H, Ar-CH); 3.09 (s, 6H, (N-CH3)$_2$); 4.10 (s, 1H, Ar-CH); 4.46 (d, J = 8.3 Hz, 2H, Ar-CH); 5.12 (s, 1H, Ar-CH); 5.38 (s, 1H, CH-Cl); 6.52 (d, J = 8.4 Hz, 2H, Ar-CH); 6.72-6.89 (m, 6H, Ar-CH); 7.02-7.19 (m, 6H, Ar-CH); 7.26-7.42 (m, 9H, Ar-CH); 9.58 (s, 1H, Ar-OH); Analysed Calculated For $C_{43}H_{35}N_6O_2Cl$: C, 73.38; H, 4.98; N, 11.94; Found: C, 73.01; H, 4.45; N, 11.24 ; Mass spectra, m/z = 720 (100%).

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-(2-hydroxyphenyl) azetidin-2-one (3b). Yield: 55%; m. p.: 212 ^{0}C, IR (KBr):723 (1, 2 disubtituted benzene ring), 1212 (C-N), 1338 (C-N, β-lactam ring),1554 (C=C), 1718 (C=O, β-lactam), 2851 (Ar-CH), 3013 cm^{-1} (Ar-OH); ^{1}HNMR: δ = 2.29 (m, 6H, Ar-CH); 2.92 (s, 6H, (N-CH$_3$)$_2$); 3.84 (s, 1H, Ar-CH); 4.37 (d, J = 8.3 Hz, 2H, Ar-CH); 5.22 (s, 1H, Ar-CH); 5.48 (s, 1H, CH-Cl); 6.61 (d, J = 8.2 Hz, 2H, Ar-CH); 6.62-6.71 (m, 8H, Ar-CH); 6.98-7.22 (m, 8H, Ar-CH); 7.49 (m, 4H, Ar-CH); 9.58 (d, J = 8.5 Hz, 2H, Ar-OH); Analysis Calculated For $C_{43}H_{35}N_6O_3Cl$: C, 71.74; H, 4.87; N, 11.68; Found: C, 71.16; H, 4.26; N, 11.08 ; Mass spectra, m/z = 730 (100%).

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-(4-hydroxyphenyl) azetidin-2-one (3c). Yield: 67%; m. p.: 175 ^{0}C, IR (KBr):769 (1, 2 disubtituted benzene ring), 1287 (C-N), 1334 (C-N, β-lactam ring), 1520 (C=C), 1729 (C=O, β-lactam), 2943 (Ar-CH), 3028 cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.03 (m, 6H, Ar-CH); 3.08 (s, 6H, (N-CH$_3$)$_2$); 4.02 (s, 1H, Ar-CH); 4.18 (d, J = 8.3 Hz, 2H, Ar-CH); 5.11 (s, 1H, Ar-CH); 5.48 (s, 1H, CH-Cl); 6.53 (d, J = 8.5 Hz, 2H, Ar-CH); 6.72 (d, J = 8.4 Hz, 2H, Ar-CH); 6.78-6.88 (m, 6H, Ar-CH); 7.13 (m, 8H, Ar-CH); 7.31 (m, 4H, Ar-CH); 9.39 (s, 1H, Ar-OH); 9.68 (s, 1H, Ar-OH); Analysis Calculated For $C_{43}H_{35}N_6O_3Cl$: C, 71.74; H, 4.87; N, 11.68; Found: C, 71.06; H, 4.36; N, 11.38 ; Mass spectra, m/z = 731 (100%).

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-(4-methoxyphenyl) azetidin-2-one (3d). Yield: 70%; m. p.: 248 ^{0}C, IR (KBr):758 (1, 2 disubtituted benzene ring), 1248 (C-N), 1362 (C-N, β-lactam ring), 1518 (C=C), 1752 (C=O, β-lactam), 2920 (Ar-CH), 3065 cm^{-1} (Ar-OH); ^{1}HNMR: δ = 2.32 (m, 6H, Ar-CH); 3.18 (s, 6H, (NCH$_3$)$_2$); 3.92 (s, 3H, Ar-CH$_3$); 4.28 (s, 1H, Ar-CH); 4.48 (d, J = 8.5 Hz, 2H, Ar-CH); 5.25 (s,1H, Ar-CH); 5.35 (s, 1H, CH-Cl); 6.35 (d, J = 8.5 Hz, 2H, Ar-CH); 6.75-6.95 (m, 8H, Ar-CH); 7.10-7.25 (m, 8H, Ar-CH); 7.42 (m, 4H, Ar-CH); 9.18 (s, 1H, Ar-OH); Analysis Calculated For $C_{44}H_{37}N_6O_3Cl$: C, 72.01; H, 5.05; N, 11.46; Found: C, 71.27; H, 4.18; N, 11.07 ; Mass spectra, m/z = 750 (100%).

3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-(3-nitrophenyl) azetidin-2-one (3e). Yield: 72%; m. p.: 228 ^{0}C, IR (KBr):752 (1, 2 disubtituted benzene ring), 1275 (C-N), 1355 (C-N, β-lactam ring), 1585 (C=C), 1765 (C=O, β-lactam), 2915 (Ar-CH), 3050 cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.12 (m, 6H, Ar-CH); 3.02 (s, 6H, (N-CH$_3$)$_2$); 3.85 (s, 1H, Ar-CH); 4.25 (d, J = 8.7 Hz, 2H, Ar-CH); 4.89 (s, 1H, Ar-CH); 5.15 (s, 1H, CH-Cl); 6.25 (d, J = 8.3 Hz, 2H, Ar-CH); 6.45-6.85 (m, 6H, Ar-CH); 7.15-7.25 (m, 6H, Ar-CH); 7.55 (m, 4H, Ar-CH); 7.75 (d, J = 8.3 Hz, 2H, Ar-CH); 8.05 (s, 1H, Ar-CH); 8.25 (s, 1H, Ar-CH); 9.45 (s, 1H, Ar-OH); Analysed Calculated. For $C_{43}H_{34}N_7O_4Cl$: C, 68.96; H, 4.54; N, 13.10; Found: C, 67.99; H, 4.18; N, 12.40; Mass spectra, m/z = 767 (100%).

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-aryl-1,3-thiazolidin-4-one (4a-e). A Mixture of Schiff base (0.002 mols) and thioglycolic acid (0.002 mols) was dissolved in ethanol (10 ml) and the reaction mixture was refluxed for 14-16 hrs. The completion of the reaction was monitored by TLC. After the completion of reaction, it was poured in ice cold water and the solid precipitate was separated out. Collect the solid deposit by filtration and the crude product was recrystallized from chloroform.

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-phenyl-1,3-thiazolidin-4-one (4a). Yield: 60 %; m. p.: 212 ^{0}C, IR (KBr): 620 (C-S-C, 4-thiazolidinone), 758 (1, 2 disubtituted benzene ring), 1275 (C-N), 1576 (C=C), 1616 (C=O, thiazolidinone), 2920 (Ar-CH), 3000 cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.25 (m, 6H, Ar-CH); 3.15 (s, 6H, (N-CH$_3$)$_2$); 3.95-4.05 (d, J = 8.7 Hz, 2H, Ar-CH, thiazolidinone); 4.05 (s, 1H, Ar-CH); 4.42 (d, J = 8.3 Hz, 2H, Ar-CH); 6.45 (s, 1H, Ar-CH, thiazolidinone); 6.58 (d, J = 8.6 Hz, 2H, Ar-CH); 6.75-6.85 (m, 6H, Ar-CH); 7.20-7.40 (m, 6H, Ar-CH); 7.42-7.72 (m, 9H, Ar-CH); 9.65 (s, 1H, Ar-OH); Analysis Calculated For $C_{43}H_{36}N_6O_2S$: C, 73.62; H, 5.14; N, 11.99; S, 4.57; Found: C, 73.01; H, 4.45; N, 11.50 ; S, 4.11; Mass spectra, m/z = 720 (100%).

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-(2-hydroxyphenyl)-1,3-thiazolidin-4-one (4b). Yield: 60 %; m. p.: 263 ^{0}C, IR (KBr): 640 (C-S-C,4-thiazolidinone), 737 (1,2 disubtituted benzene ring), 1210 (C-N), 1540 (C=C), 1650 (C=O, thiazolidinone), 2850 (Ar-CH), 3020 cm^{-1} (Ar-OH); 1H NMR: δ = 2.60-2.62 (m, 6H, Ar-CH); 3.20 (s, 6H, (N-CH$_3$)$_2$); 4.10 (s, 2H, Ar-CH, thiazolidinone); 4.16-4,20 (d, J = 8.5 Hz, 2H, Ar-CH); 4.50 (d, J = 8.1 Hz, 2H, Ar-CH); 6.50 (s, 1H, Ar-CH, thiazolidinone); 7.00-7.70 (m, 2H, Ar-CH); 9.80 (s, 1H, Ar-OH); 10.90 (s, 1H, Ar-OH); Analysed Calculated For $C_{43}H_{36}N_6O_3S$: C, 71.98; H, 5.02; N, 11.72; S, 4.46; Found: C, 71.17; H, 4.56; N, 11.38 ; S, 4.05; Mass spectra, m/z = 728 (100%).

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-(4-hydroxyphenyl)-1,3-thiazolidin-4-one (4c). Yield: 70 %; m. p.: 242 ^{0}C, IR (KBr):

625 (C-S-C, 4-thiazolidinone),780 (1, 2 disubtituted benzene ring), 1280 (C-N), 1530 (C=C), 1610 (C=O, thiazolidinone), 2950 (Ar-CH), 3020 cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.20 (m, 6H, Ar-CH); 2.80 (s, 6H, $(N\text{-}CH_3)_2$); 3.95 (s, 1H, Ar-CH, thiazolidinone); 4.15 (s, 1H, Ar-CH); 4.30 (d, J = 8.1 Hz, 2H, Ar-CH); 6.40 (s, 1H, Ar-CH, thiazolidinone); 6.40-6.50 (m, 5H, Ar-CH); 6.75-7.05 (m, 6H, Ar-CH); 7.10-7.40 (m, 6H, Ar-CH); 7.60 (m, 4H, Ar-CH); 7.80 (d, J = 8.3 Hz, 2H, Ar-CH); 9.50 (s, 1H, Ar-OH); 9.70 (s, 1H, Ar-OH); Analysed Calculated For $C_{43}H_{36}N_6O_3S$: C, 71.98; H, 5.02; N, 11.72; S, 4.46; Found: C, 71.27; H, 4.66; N, 11.28 ; S, 4.05; Mass spectra, m/z = 725 (100%).

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-(4-methoxyphenyl)-1,3-thiazolidin-4-one (4d). Yield: 70 %; m. p.: 272 ^{0}C, IR (KBr): 620 (C-S-C, 4-thiazolidinone), 770 (1, 2- disubtituted benzene ring), 1260 (C-N), 1520 (C=C), 1660 (C=O, thiazolidinone), 2920 (Ar-CH), 3060 cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.32 (m, 6H, Ar-CH); 3.10 (s, 6H, $(N\text{-}CH_3)_2$); 3.70 (s, 3H, Ar-OCH_3); 4.20 (s, 1H, Ar-CH, thiazolidinone); 4.30 (s, 1H, Ar-CH); 4.40 (d, J = 8.7 Hz, 2H, Ar-CH); 6.40 (s, 1H, Ar-CH, thiazolidinone); 6.60 (d, J = 8.2 Hz, 2H, Ar-CH); 6.70-6.80 (m, 7H, Ar-CH); 7.20-7.30 (m, 8H, Ar-CH); 7.40-7.50 (m, 4H, Ar-CH); 7.80 (d, J = 8.4 Hz, 2H, Ar-CH); 9.60 (s, 1H, Ar-OH); Analysed Calculated For $C_{44}H_{38}N_6O_3S$: C, 72.24; H, 5.20; N, 11.49; S, 4.38; Found: C, 71.77; H, 4.43; N, 11.37 ; S, 4.25; Mass spectra, m/z = 750 (100%).

3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-(3-nitrophenyl)-1,3-thiazolidin-4-one (4e). Yield: 68%; m. p.: 242 ^{0}C, IR (KBr): 660 (C-S-C, 4-thiazolidinone), 760 (1, 2- disubtituted benzene ring), 1260 (C-N), 1590 (C=C), 1660 (C=O, thiazolidinone), 2920 (Ar-CH), 3050cm^{-1} (Ar-OH); ^{1}H NMR: δ = 2.40 (m, 6H, Ar-CH); 3.30 (s, 6H, (N-CH3)2); 4.10 (s, 1H, Ar-CH, thiazolidinone); 4.10 (s, 1H, Ar-CH); 4.40 (d, J = 8.3 Hz, 2H, Ar-CH); 6.10 (s, 1H, Ar-CH, thiazolidinone); 6.80 (d, J = 8.5 Hz, 2H, Ar-CH); 6.70-6.90 (m, 5H, Ar-CH); 7.10 (m, 4H, Ar-CH); 7.40-8.00 (m, 8H, Ar-CH); 8.10 (s, 1H, Ar-CH); 8.00 (s, 1H, Ar-CH); 8.20-8.30 (d, J = 8.1 Hz, 2H, Ar-CH); 9.90 (s, 1H, Ar-OH); Analysed Calculated For $C_{43}H_{35}N_7O_4S$: C, 69.18; H, 4.38; N, 13.14; S, 4.29; Found: C, 68.50; H, 4.38; N, 12.61 ; S, 3.99; Mass spectra, m/z = 764 (100%).

III. RESULTS

2-[2-(4-aminophenyl)-6,10-dimethyl-4,12-dipheneyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl]-5-methylphenol (1): was prepared in quantitative yield. By the reaction of compound 1 with different aldehydes, we have synthesized 2-(6,10-dimethyl-4,12-diphenyl-2-{4-[(E)-(arylmethylidene)amino]phenyl}-2,4,5,11,12-pentaazitricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-8-yl)-5-methylphenol (2a-e), in good yields by using neat conditions under microwave irradiation in presence of solvent as well as solvent free as compared to that of conventional reflux reactions in ethanol (**Figure 1**). The comparison of isolated yields and reaction time of the three conditions employed showed *microwave-assisted reactions as the most efficient synthetic method in terms of energy and time consumption* (**Table 1**). The comparison of the isolated yield by different methods has been depicted graphically as shown in **Figure 2**.

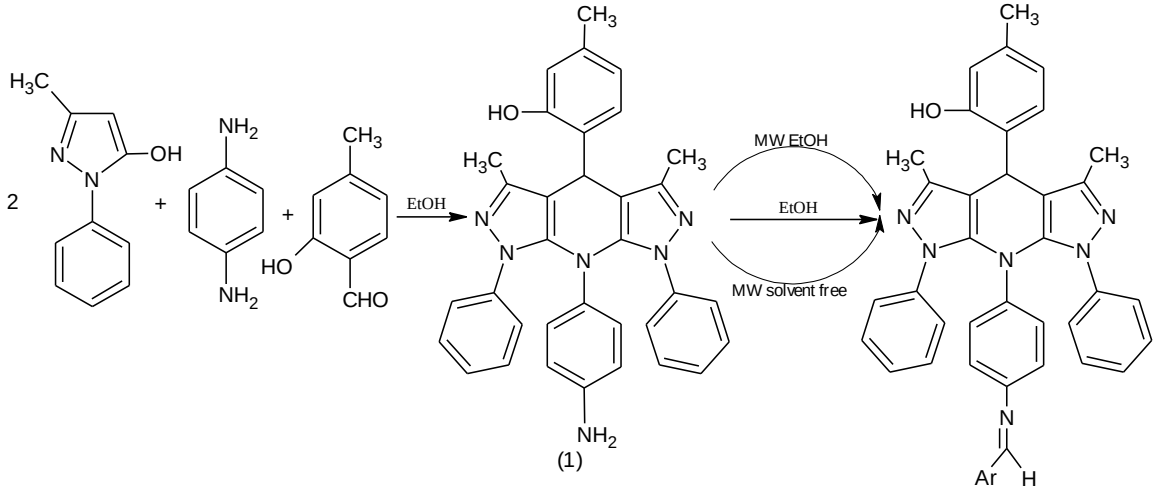

Figure – 1
Synthesis of Schiff bases (2a-e) by MW, MW Solvent free and classical technique.

Table – 1: Time and yield comparison between classical and MW Irradiation.

Compds.	Ar	Reaction time (min/sec)			Yield (%)[a]		
		MWI (Solvent free)	MWI (EtOH)	Classical (EtOH)	MWI (Solvent free)	MWI (EtOH)	Classical (EtOH)
2a	$-C_6H_5$	2 min	2 min	300 min	92	87	77
2b	$2\text{-}OHC_6H_4$	2 min	2 min	300 min	85	73	65
2c	$4\text{-}OHC_6H_4$	2 min	2 min	300 min	82	67	62
2d	$4\text{-}OCH_3C_6H_4$	2 min	2 min	300 min	87	77	72
2e	$3\text{-}NO_2C_6H_4$	2 min	2 min	300 min	79	72	64

[a] **Isolated Yield**

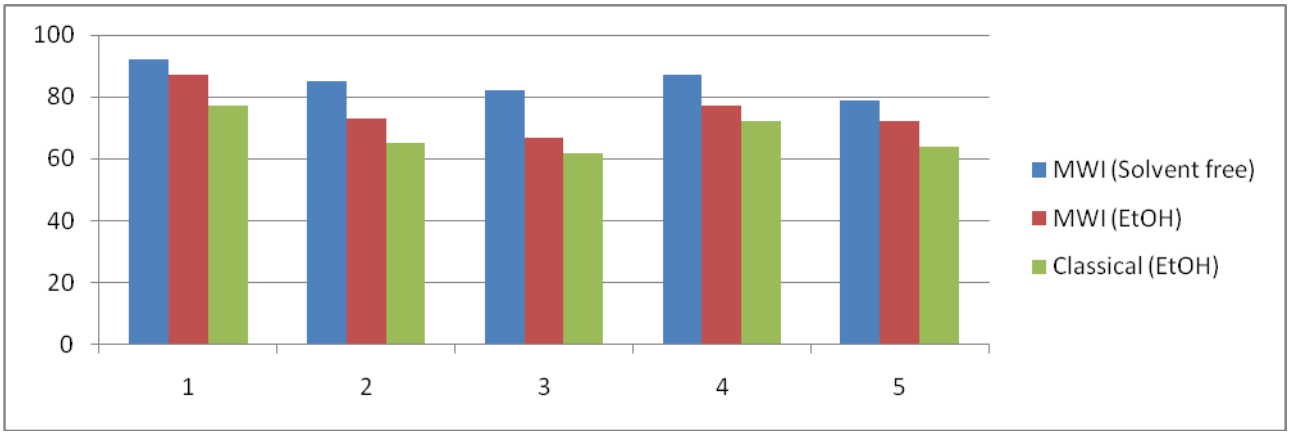

Figure – 2: Comparison of the yields of compounds (2a-e) using different methods.

Compounds **2** reacts with chloroacetic acid in presence of triethylamine, POCl3 and mercaptoacetic acid to afford 3-chloro-1-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}]dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-4-arylazetidin-2-one and 3-{4-[8-(2-hydroxy-4-methylphenyl)-6,10-dimethyl-4,12-diphenyl-2,4,5,11,12-pentaazatricyclo[7.3.0.0^{3,7}] dodeca-1(9),3(7),5,10-tetraen-2-yl]phenyl}-2-aryl-1,3-thiazolidin-4-one respectively (**Figure 3**).

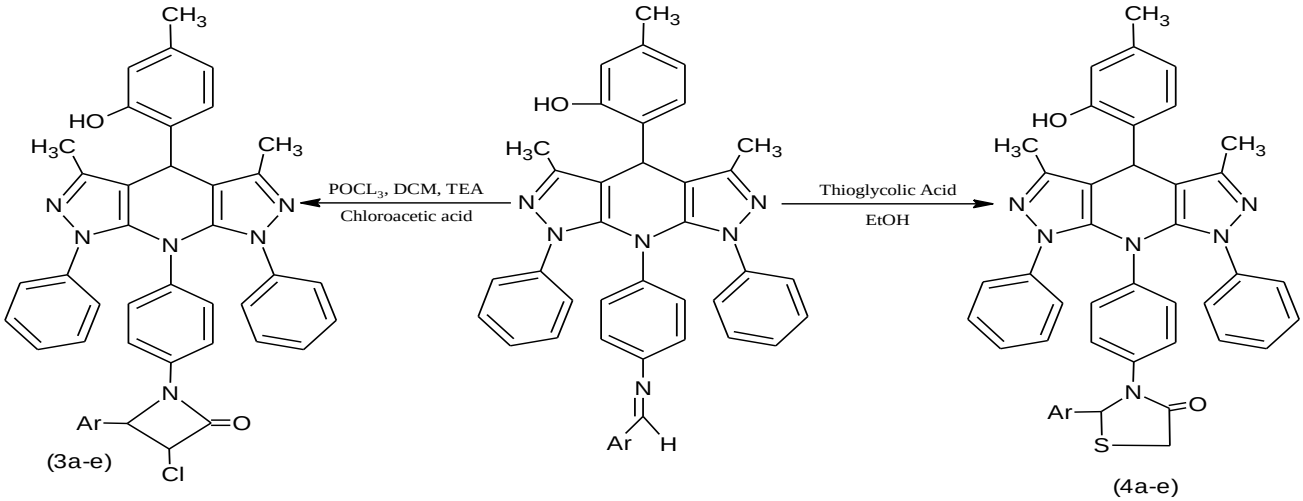

Figure – 3: Synthesis of azetidinones (3a-e) and thiazolidinones (4a-e).

IV. ANTIBACTERIAL ACTIVITY

Antibacterial activities of all the compounds were studied against nine different bacterial strains [E. coil (mixed), B. subtilis, Pseudomonas sp., S.aureus, P.vulageris, Salmonella sp. , E. coil (+ve strain), Rhodococci, B. stearothermopelus] by measuring the zone of inhibition on agar plates. The compounds possess moderate to good activity against all stains in comparison with standard drug (**Table 2**). It can be observed from these results that compounds **3a-e and 4a-e** have shown positive bacterial activity against different bacterial species, which are also known as human pathogenic bacteria. It was also observed that within the synthesized compound extracts, all compounds show good activity against all bacterial strains

Table – 2: Biological activities of azetidinones and thiazolidinones.

Bacterial strain	Zone of inhibition in mm along without well diameter (5mm)										
	Chemical Compounds										
	3a	3b	3c	3d	3e	4a	4b	4c	4d	4e	Std. Nystatin
E. coil (mixed)	14	13	8	12.8	–	8	15	10	9	10	16
B. subtilis	3	3.5	5	-	4	4	5	3	10	6	6
Pseudomonas sp.	9	5	12	10.2	8	7	8	11	7	3.6	12
S. aureus	4	-	5.5	6.6	4	7.9	9	7.5	6	8.8	9
P. vulageris	11	14	10.6	14.5	16	12.5	6.5	12	15	9	16
Salmonella sp.	11	15	16.5	18	14	16	11	13	10	16	18.8
E. coil (+ve strain)	-	8	7.2	5.3	10	6.5	10	5	-	4	10
Rhodococci	2	-	-	3	4.5	4.8	5	3.8	4	2.6	6
B. Stearothermopelus	4	3	5.1	6.4	3.6	6.4	4.8	3	11	5.8	7.2

"-"represent "not active"

V. CONCLUSION

Microwave irradiation technique is becoming a popular method of heating and replaces the classical chemical route, because of its features like clean, cheap & convenience. Often, it affords higher yields and results within short reaction times. In this paper we have reported synthesis of imines **2a-e** using microwave irradiation, which are far superior over existing procedures. In microwave synthesis the yield of all the products are more and the reaction time is considerably reduced to 2 minute instead of 5 hours in the classical way. From data of antimicrobial activity of the compounds of the series, **3a-e** and **4a-e** show good comparable activity against standard drugs.

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