GREEN SYNTHESIS AND BIOLOGICAL SCREENING OF IMIDAZO [2,1-B] THIAZOLE PYRIMIDINES AS POTENT ANTI-BACTERIAL AGENTS

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ABSTRACT:

A series of Imidazo[2,1-b]thiazole pyrmidine derivatives (3a-g-) were designed, synthesized from imidazo[2,1-b]thiazole chalcone derivatives. (2a-g) and Urea in PEG-400 and evaluated for their anti-bacterial potency. Characterization of newly synthesized compounds was done using IR and ^{1}H NMR and Mass spectroscopy. Further Imidazo [2,1-b]thiazole pyrimidine derivatives were subjected to check their anti-bacterial activities against four different strains, viz two Gram +ve bacteria Staphylococcus aureus & Bacillus subtilis and two Gram -ve bacteria Escherichia coli & Pseudomonas aeruginosa by using Well diffusion method for the determination of zone of inhibition as antibacterial activity of the synthesized compounds.

KEY WORDS: *Imidazo[2,1-b]thiazole Chalcones, Imidazo[2,1-b]thiazole 4-carbaldehyde, Imidazo[2,1-b]thiazole pyrimidines, PEG-400, anti-inflammatory activity.*

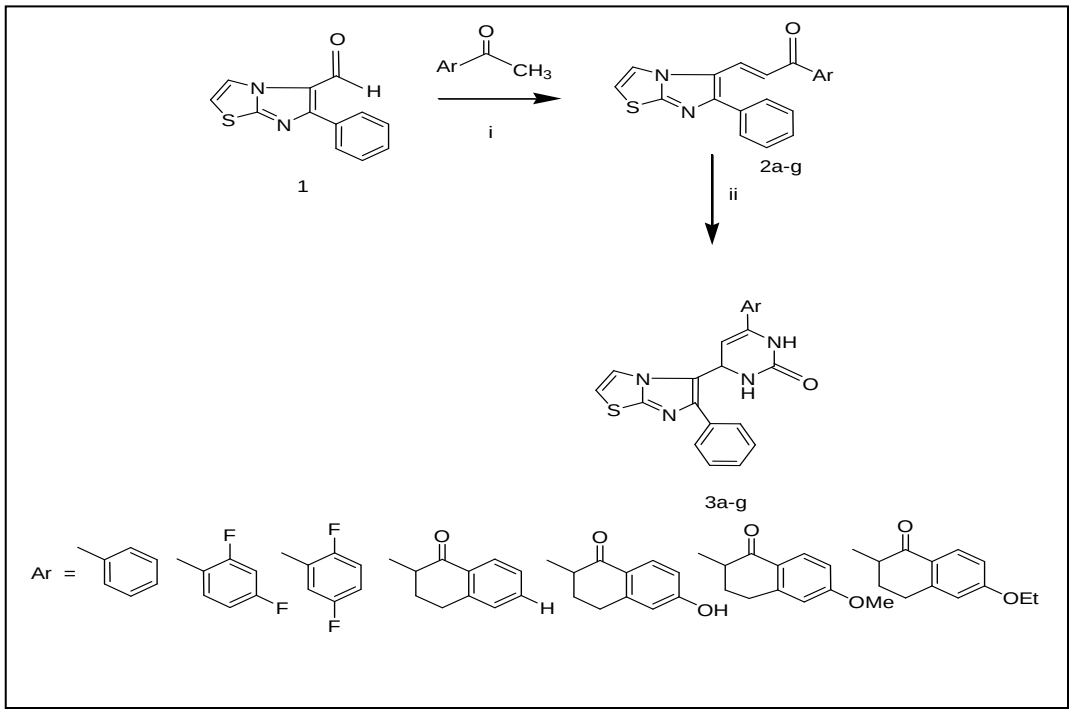
Introduction:

The nitrogen containing heterocyclics are crucial category of compounds in therapeutic chemistry which helps to recognize diverse life processes. In recent years the chemistry of pyrimidine synthesis has been widely studied. Pyrimidine was firstly discovered in 1899 by Gabriel and Colman. Pyrimidine plays an important role in different biological processes and hence gained prominent space in pharmaceutical area. Pyrimidine derivatives are a key component of various useful drugs which are having different biological and therapeutical activities[1-2]. Pyrimidine base forms uracil[3], thymine[4], cytosine[5] and which are the essential building blocks of DNA and RNA hence these are having such important biological activities. In addition to this differents analogs of pyrimidines have been detected to posses anti-inflammatory[6], antibacterial[7-8], analgesic[9], antifungal[10], antiallerggic[11], antileishmanial[12], antipyretic[13], antiviral[14], antidiabetic[15], anticancer activities[16] and anti-malarial agents[17].

We have synthesized series of imidazo [2,1-b] thiazole pyrimidines by action of imidazo [2,1-b] thiazole chalcones with urea in PEG-400 as green solvent. Pyrimidine derivatives mainly synthesized from chalcones moiety in which the enone group contribute mainly in functionality like biological activity as antimalarial[18-19], antiviral[20-21], UV absorbers[22] antidiabetic[23], anticonvulsants[24], analgesic[25] and anti- bacterial[26] etc. The significance of pyrimidines and its analogous compounds in pharmaceutical as well as biological fields is well known.[27-28] Recently the noticeable interest in synthetic manipulations of pyrimidine derivatives has been developed based on its antiviral, antihelmintics property[29]. Pyrimidines ring is also present in vitamin B_2 and folic acid having different biological activities.[30-31] The wide spectrum pharmacological effects of different pyrimidine derivatives prompted us to design the pyrimidines synthesis by treating guanidine hydrochloride as well as urea in presence of basic catalyst with various chalcones to obtain a series of substituted pyrimidine derivatives. The presence of nitrogen in synthesized compounds might impact for their antimicrobial activity.

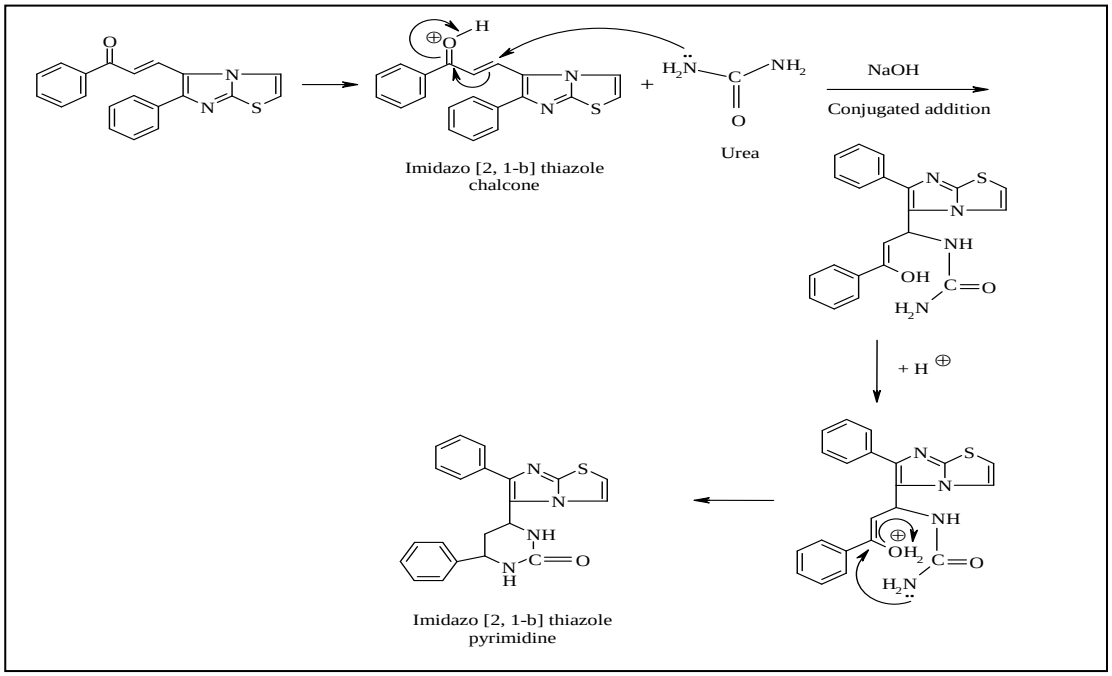
Experimentle Section :

General scheme: Synthesis of Imidazo [2,1-b] Thiazole Pyrimidine Derivatives:



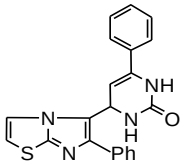
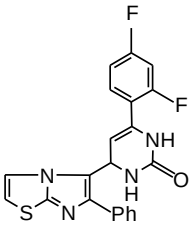
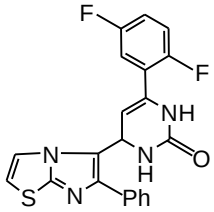
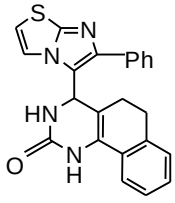
Scheme 4: Reagents and Conditions : (i) Substituted acetoplenones NaOH, PEG- 400, Stirr, 40-50°C. (ii) $NH_{2..}CO.NH_2$, PEG-400, Heat 70-80^{0}C, 5-8 hours.

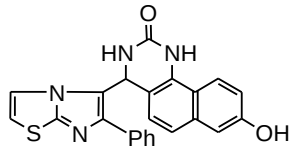
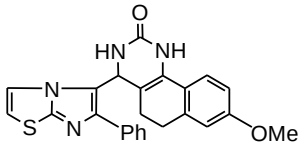
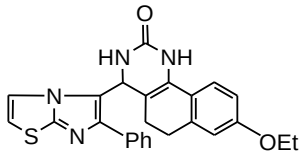
Plausible Mechanism:



Imidazo[2,1-b]thiazole chalcones **(1-7)** (0.01 mmol) was dissolved in PEG-400 (30 mL) and urea (0.01mol) was added to it. To this reaction mixture, NaOH (4.0 mmol) was added and the reaction mixture was heated up to 70-80^{o}C for 5-8 h. After completion of reaction (TLC), the reaction mixture was cooled to room temperature and was poured into ice cold water (15 ml), solid product started to separate out. The solid product obtained was collected by filteration and purified on silica column using ethyl acetate and hexane as solvents. Finally recrystallized using ethanol to afford pure compound Imidazo [2,1-b] thiazole pyrimidine (**3a-g)**.

Table 1 : Derivatives of Imidazo [2,1-b] thiazole pyrimidine using substituted Imidazo [2,1-b] thiazole chacones and urea.

Sr. No.	Imidazo [2,1-b] thiazole pyrimidines	Structure	Derivatives		
			M.F	M.W	M.P.^{0}C
1	**3a**		$C_{21}H_{16}N_4OS$	372.42	194-195
2	**3b**		$C_{21}H_{14}F_2N_4OS$	408.42	204-205
3	**3c**		$C_{21}H_{14}F_2N_4OS$	408.42	209-210
4	**3d**		$C_{23}H_{16}N_4OS$	396.46	198-199

5	**3e**		$C_{23}H_{16}N_4O_2S$	412.43	187-189
6	**3f**		$C_{24}H_{18}N_4O_2S$	426.49	190-191
7	**3g**		$C_{25}H_{20}N_4O_2S$	440.52	244-245

BIOLOGICAL EVALUATION:

ANTIBACTERIAL ACTIVITY:

Many antimicrobial agents exist, for use against a wide range of infectious diseases. Today one of the major problems against world to control infectious diseases because of increased resistance power to antibacterial agents is a challenge since from last thirty years.[32-33] Antimicrobial agent which either inhibits the growth of microorganism or kills microorganisms.[34-35] Antimicrobial agents can be classified based on their use against either fungal infections or bacterial infections. However, antifungal agents which are used against fungi and antibacterial agents which are used against bacteria. Use of various synthetic chemical compounds with antibacterial and antifungal activities is known to have been common practice since from last 2000 years.

The anti-bacterial activities of various synthesized imidazo [2,1-b]thiazole pyrimidine derivatives scaffold (3a-g) were screened by agar well diffusion method at inhibitory concentration 1mg/ml compared with standard drug. Agar disk-diffusion testing developed in 1940 is the official method used in many clinical microbiology laboratories for routine antimicrobial susceptibility testing[36]. Nowadays, many accepted and approved standards are published by the Clinical and Laboratory Standards Institute CLSI) for bacteria and yeasts testing.[37-38]

Table 2 - Anti bacterial activity Imidazo [2,1-b] thiazole Pyrimidines (3a-g)

Sr. No.	**Imidazo [2,1-b] thiazole Pyrimidines**	**Anti bacterial Activity** (Activity against Bacterial pathogens) Zone of Inhibition in mm			
		Gram-positive pathogens		**Gram-negative pathogens**	
	Pathogens	**Staphallococus aureus**	**Bacillus subtil**	**E Coli**	**Peudomae urogenosa**
1	**Standard Streptomycin**	18	16	15	12
2	3a	05	06	05	06
3	3b	06	07	06	06
4	3c	07	07	06	06
5	3d	06	06	05	07
6	**3e**	**10**	**09**	**08**	**08**
7	**3f**	**15**	**14**	**13**	**09**
8	**3g**	**12**	**11**	**10**	**07**

Minimum Inhibitory Concentration of all the synthesized compounds resolve against four different strains, viz two Gram +ve bacteria Staphylococcus aureus & Bacillus subtilis and two Gram -ve bacteria Escherichia coli & Pseudomonas aeruginosa by using Well diffusion method for the determination of zone of inhibition as antibacterial activity of the synthesized compounds against Gram-positive bacteria and Gram-negative bacteria[39-40].

Antibacterial activity of three series of imidazo[2,1-b]thiazole pyrimidines results 31-37, reveals that the imidazo[2,1-b]thiazol pyrimidines shows the highest antibacterial activity. Out of these imidazo[2,1-b]thiazol pyrimidine derivatives 3e, 3f & 3g showed potent antibacterial activity, while 3a, 3b, 3c & 3d showed moderate antibacterial activity as comparable with standard drug against tested Gram-positive pathogens (Staphylococcus aureus Bacillus subtil) and Gram-negative pathogens (E./Coli and Pseudomonas aeruginosa). Graphical representation is as shown in (Fig.4). Antibacterial activity has been carried out by measuring the diameters of the zone of inhibitions (ZI) by Well diffusion method [41-42].

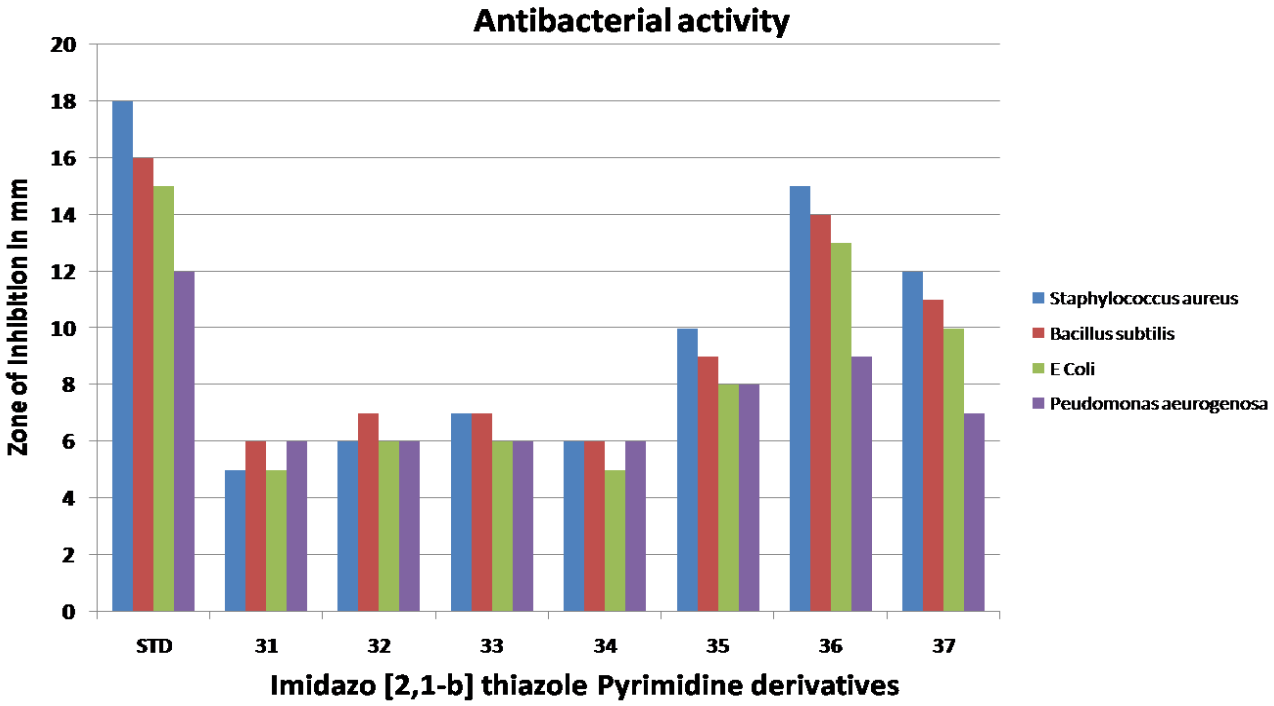


Fig. 1: Comparison of anti-bacterial activity of imidazo [2,1-b]thiazole pyrimidine derivative (3a-g) against Gram-positive and Gram-negative pathogen with standard drug.

RESULT AND DISCUSSON :

Synthesis of 3,4-dihydro-6-phenyl-4-(6-phenylimidazo[2,1-b]thiazol-5-yl) pyrimidin-2(1H)-one 3a:

IR(KBr Cm^{-1}) : Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S - 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440

cm^{-1}, NH_2 of pyrimidine 3363, 3133cm^{-1}, -C=N- 1581 cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1},1956cm^{-1},1391cm^{-1},1146cm^{-1},1034cm^{-1},1380, 1142 cm^{-1}, -C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 159 2cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S,& δ 7.95 (d, 1H), near to N, δ 7.46 (d, 1H), δ 07.3 (d, 1H), δ 7.20 (d, 1H), δ 7.30 (d, 1H), δ 7.46 (d 1H), δ 5.5 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH, δ 5.45 (s, 1H) . δ 7.30 (d, 1H), δ 7.20 (d,1H), δ 7.20 (d, 1H), δ 7.30 (d, 1H), δ 7.12 (d, 1H).

^{13}C NMR (100 MHz, $CDCl_3$, δ in ppm):

119, 143, 135, 145, 136. 133, 127,, 129, 128.5, 129.5, 127.5, 133.2. 43, 150, 135, 97. 134, 125, 128.5, 128, 128.7, 126. Elemental analysis : C, 67.72; H, 4.33; N, 15.04; O, 4.30; S, 8.61. **MS :** m/z 373.11 $(M)^+$ Melting Point: 195 ^{0}C, Yield : 72% .

Synthesis of 6-(2,4-difluorophenyl)-3,4-dihydro-4-(6-phenylimidazo[2,1-b] thiazol-5-yl)pyrimidin-2(1H)-one 3b :

IR (KBr Cm^{-1}) :

Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S - 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440 cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1},C=N-1581 cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1},1391cm^{-1},1146 cm^{-1}, 1034 cm^{-1},1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}, C-F 1400-1000 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S,& δ 7.95 (d, 1H), near to N, δ 7.46 (d, 1H), δ 07.3 (d, 1H), δ 7.20 (d, 1H), δ 7.30 (d, 1H), δ 7.46 (d 1H), δ 5.54 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH, δ 5.3 (s, 1H) . δ 6.64 (d, 1H) near to F, δ 6.68 (d,1H)) near to F, δ 7.25 (d, 1H).

^{13}C NMR(100 MHz, $CDCl_3$, δ in ppm): 119, 143, 135, 145, 136. 133, 127,, 129, 128.5, 129.5, 127.5, 133.2. 43, 150, 135, 97. 117, 158, 105, 162, 110, 129. Elemental analysis : C, 61.76; H, 3.46; F, 9.30; N, 13.72; O, 3.92; S, 7.85.

MS: m/z 409.09 (M),$^+$ **Melting Point: 205^{0}C, Yield : 72%**

Synthesis of 6-(2,5-difluorophenyl)-3,4-dihydro-4-(6-phenylimidazo[2,1-b] thiazol-5-yl)pyrimidin-2(1H)-one 3c:

IR (KBr, cm^{-1}) : Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S - 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440

cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1},C=N-1581 cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1},1391cm^{-1},1146 cm^{-1},1034 cm^{-1},1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}, C-F 1400-1000 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S,& δ 7.95 (d, 1H), near to N, δ 7.4 (d, 1H), δ 07.31 (d, 1H), δ 7.20 (d, 1H), δ 7.31 (d, 1H), δ 7.46 (d 1H), δ 5.6 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH, δ 5.3 (s, 1H). δ 69 (d, 1H) near to F, δ 6.85 (d,1H)) near to F, δ 7.0 (d, 1H).

^{13}C NMR(100 MHz, $CDCl_3$, δ in ppm):

119, 143, 135, 145, 136. 133, 127,129, 128.5, 129.5, 127.5, 133.2. 43, 150, 135, 97. 124,153, 115, 116, 158, 112. Elemental analysis : C, 61.76; H, 3.46; F, 9.30; N, 13.72; O, 3.92; S, 7.85.

MS : m/z 409 $(M)^+$. Melting Point: 210^{0}C, Yield : 72% .

Synthesis of 3,4- dihydro-4-(6-phenylimidazo[2,1-b]thiazol-5-yl) benzo[h] quina zolin-2(1H)-one 3d:

IR (KBr, cm^{-1}) :

Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S - 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440 cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1},C=N-1581 cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1}, 1391cm^{-1},1146 cm^{-1}, 1034 cm^{-1}, 1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S,& δ 7.95 (d, 1H), near to N, δ 7.4 (d, 1H), δ 07.31 (d, 1H), δ 7.20 (d, 1H), δ 7.31 (d, 1H), δ 7.46 (d 1H), δ 6.1 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH . δ 7.4 (d, 1H), δ 7.1 (d,1H), δ 7.6 (d, 1H), δ 7.2 (d, 1H), δ 7.3 (d,1H)) , δ 7.6 (d, 1H).

^{13}C NMR (100 MHz, $CDCl_3$, δ in ppm):119, 143, 135, 145, 136, 133, 127, 129, 128, 129, 126, 44,157, 140, 118. 128, 118, 128,124, 125, 121, 125, 132. Elemental analysis : C, 69.68; H, 4.07; N, 14.13; O, 4.04; S, 8.09.

MS: m/z 397.11 $(M)^+$ **, Melting Point: 198 ^{0}C, Yield : 72%**

Synthesis of 3,4-dihydro-8-hydroxy-4-(6-phenylimidazo[2,1-b]thiazol-5-yl) benzo[h]quinazolin-2(1H)-one 3e :

IR (KBr, cm^{-1}) :

Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440 cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1}, C=N-1581cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1}, 1391cm^{-1},1146 cm^{-1},1034 cm^{-1}, 1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1},1569 cm^{-1},744 cm^{-1}.Hydroxy tetralone O-H -3323-3512 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S & δ 7.95 (d, 1H), near to N. δ 7.4 (d, 1H), δ 07.31 (d, 1H), δ 7.20 (d, 1H), δ 7.31 (d, 1H), δ 7.46 (d 1H). δ 6.1 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH. δ 7.4 (d, 1H), δ 6.9 (d,1H)) , δ 6.9 (d, 1H), δ 5.0 (s, 1H) due to OH, δ 6.9 (d,1H)) , δ 7.5 (d, 1H).

^{13}C NMR (100 MHz, $CDCl_3$, δ in ppm):

119, 143, 135,145, 136. 133, 127, 129, 128, 129, 126. 44, 157, 140, 118. 128, 118, 128, 124, 125, 121,125, 132.

Elemental analysis : C, 66.97; H, 3.91; N, 13.58; O, 7.76; S, 7.77. **MS:** m/z- 413.10 $(M)^+$ Melting Point : 189^{0}C, Yield : 75% .

Synthesis of 3,4-dihydro-8-methoxy-4-(6-phenylimidazo[2,1-b]thiazol-5-yl) benzo[h]quinazolin-2(1H)-one 3f :

IR (KBr, cm^{-1}) :

Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440 cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1}, C=N-1581cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1}, 1391cm^{-1},1146 cm^{-1},1034 cm^{-1}, 1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}, O-Me 1225-1214 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S & δ 7.95 (d, 1H), near to N. δ 7.4 (d, 1H), δ 07.31 (d, 1H), δ 7.20 (d, 1H), δ 7.31 (d, 1H), δ 7.46 (d 1H). δ 6.1 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH . δ 7.4 (d, 1H), δ 7.0 (d,1H)) , δ 6.9 (d, 1H), δ 3.7 (q, 2H) due to – OCH_3 , δ 7.0 (d, 1H), δ 7.5 (d, 1H).

^{13}C NMR(100 MHz, $CDCl_3$, δ in ppm):

119, 143, 135, 145, 136. 133, 127, 129, 128, 129, 126. 44, 157, 140, 117. 126, 118, 106, 156, 56, 14, 118, 121. Elemental analysis : C, 67.59; H, 4.25; N, 13.14; O, 7.50; S, 7.52. **MS:** m/z 427.12 $(M)^+$**,** Melting Point: 190^0C, Yield: 72%.

Synthesis of 8-ethoxy-3,4-dihydro-4-(6-phenylimidazo[2,1-b]thiazol-5-yl) benzo[h]quinazolin-2(1H)-one 3g :

IR (KBr, cm^{-1}) :

Imidazo[2,1-b] thiazole N-H at 3300-3233 cm^{-1}, 2928 cm^{-1}, C=S 1248-1255 cm^{-1}, C-S 1240 cm^{-1}, 1119 cm^{-1}, -(C–H) at 2938 cm^{-1}, pyrimidine C=N 1666 cm^{-1}, -N-H 3440 cm^{-1},-NH_2 of pyrimidine 3363, 3133cm^{-1}, C=N-1581cm^{-1}, Ar-H, 3133cm^{-1}, 1982 cm^{-1}, 1956 cm^{-1}, 1391cm^{-1},1146 cm^{-1},1034 cm^{-1}, 1380 cm^{-1}, 1142cm^{-1}, C=O from pyrimidine 1644 cm^{-1}, 1614 cm^{-1}, 1592cm^{-1}, 1569 cm^{-1}, 744 cm^{-1}, O-Et 1223-1257 cm^{-1}.

^{1}H NMR (300 MHz, $CDCl_3$):

δ 7.4 (d, 1H), Near to S & δ 7.95 (d, 1H), near to N. δ 7.4 (d, 1H), δ 07.31 (d, 1H), δ 7.20 (d, 1H), δ 7.31 (d, 1H), δ 7.46 (d 1H). δ 6.1 (s, 1H), δ 6.0 (s, 1H) due to NH, δ 6.0 (s, 1H) due to NH. δ 7.4 (d, 1H), δ 7.0 (d,1H)) , δ 6.9 (d, 1H), δ 4.0 (q, 2H) due to - OCH_2, δ 1.3 (t,3H)) due to -CH_2CH_3 , δ 7.0 (d, 1H), δ 7.5 (d, 1H).

^{13}C NMR(100 MHz, $CDCl_3$, δ in ppm): 119, 143, 135, 145, 136. 133, 127, 129, 128, 129, 126. 44, 157, 140, 117. 126, 118, 106, 156, 65 due to OCH_2 , 14, 118, 121. Elemental analysis : C, 68.16; H, 4.58; N, 12.72; O, 7.26; S, 7.28. MS: m/z 441.13 $(M)^+$ Melting Point: 245^0C , Yield : 72% .

CONCLUSION:

All the synthesized pyrimidine derivatives (3a-g) has been proved on the basis of IR, ^{1}HNMR, ^{13}CNMR and mass spectroscopy the spectral data were in full concurrence with projected structures. The FTIR of Imidazo[2,1-b]thiazole pyrimidine derivatives exhibited sharp band due to the presence of Imidazo[2,1-b]thiazole moeity at 3300-3233 cm^{-1} for NH stretching and 2928 cm^{-1}. ^{1}H-NMR spectra of compounds were studied in $CDCI_3$ showed characteristic signals. Imidazo[2,1-b]thaizole nucleus containing two hydrogens one appear at δ7.41 and other one appear at δ7.98 adjucent to the electronegative nitrogen, hence goes to the downfield region. In Imidazo[2,1-b]thaizole pyrimidine derivative number 3a, 3b, 3c, 3d and 3h pyrimidine ring protons appears at δ5.20 (s, 1H) is in unsaturaton with the aromatic benzene and other protons

appears at δ4.59 (s,1H) which is adjacent to the electronegative Nitorgen. NH proton of pyrimidine nucleus appears at δ 2.0 (s,1H). ^{13}CNMR spectrum shows signals due to Imidazo [2,1-b]thiazole nucleus exbhits the sharp band at 119, 143, 135, 145, 136. Aromatic benzene nucleus attached to pyrimidine nucleus shows various band due to aromatic carbons at 126.4, 128.7, 128, 128.7, 126.4, 139. The mass spectrum of compounds exhibited corresponding molecular ion peak $[M]^+$. The spectral data indicate agreement with proposed structure of Imidazo[2,1-b]thaizole pyrimidine derivatives. Hence these spectral data were in full agreement with projected structures of Imidazo[2,1-b]thaizole pyrimidine derivatives.

All the synthesized Imidazo[2,1-b]thaizole pyrimidine derivatives (3a-e) were screened for their in vitro, anti-bacterial activities were tested against standard drug against tested Gram-positive pathogens (Staphylococcus aureus, Bacillus subtil) and Gram-negative pathogens (E./Coli and Pseudomonas aeruginosa). Among the compounds screened some of the compounds were found to be significant anti-bacterial agents. In case of evaluation of antibacterial activity of Imidazo [2,1-b]thiazole pyrimidine derivatives number 3e, 3f, and 3g, showed potent activity, while 3a-3d showed moderate activity as comparable with standard drug against tested Gram-positive pathogens (Staphylococcus aureus, Bacillus subtil) and Gram-negative pathogens (E./Coli and Pseudomonas aeruginosa).

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CONFLICT OF INTEREST:

The authors confirm that this article content has no conflict of interest.

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