Synthesis of Biological Active Benzothizole Substited Coumarins By Green Solvent Route

Sharad S. Sankhe and Jitendra B. Patil, Prashant Kamble
Organic Research Laboratory,
Patkar-Varde College of Science,
Goregaon (West), Mumbai 400062, India.
Email: drjbpatil74@gmail.com

Abstract: Green chemistry is new field for utilization of maximum possible resources in such way that there is negligible or minimum production of waste. Few derivatives of biological active Benzothizole substited coumarins were synthesized by using green synthesis method.

Key Words: *Green synthesis, Green chemistry, Benzothizole, atom economy.*

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I. INTRODUCTION [1,2]

'Green Chemistry' is the new branch of chemistry which involves utilization new tools, techniques and technologies. It is helpful to chemists and chemical engineers in research, development of more eco-friendly and efficient. It is now going to become an essential tool in the field of synthetic chemistry. In addition, a desirable green solvent should be natural, nontoxic, cheap and readily available with additional benefits of aiding the reaction, separation or catalyst recycling. Of the various principles of green chemistry, the important one is maximizing the % Atom Economy which evaluates the efficiency of chemical transformation and is calculated as:

$$\% \text{ Atom Economy} = \frac{MW \text{ of product}}{\text{Total MW of reactant}} \text{ X } 100$$

In the present study, few derivatives of Benzothizole substited coumarins **6-10** are synthesized by conventional method as well as green synthesis method. The synthesized compounds are characterized by their physical constants and Mass. Both the method gives the desired products, but by applying the green synthesis method, we can able to avoid the use of Hydrogen peroxide, Cerric ammonium nitrate and formation of by products. Moreover, the atom economy was obtained in the range of 72% to 82% . Thus the concept of green chemistry can be applied to various synthetic methods. This may leads to generation of eco-friendly synthetic chemistry.

Materials and Method:

Apparatus:

The melting points were determined by open capillary method and are uncorrected.

Mass spectra were obtained on a Micromass-Q-Tofmicro(YA-105) spectrometer.

Chemicals and Reagents:

2-aminothiophenol, H_2O_2, Cerric ammonium nitrate and acetic acid from Loba Chem Pvt. Limited, Mumbai.

Synthesis of compounds (6-10) by conventional method: (4)

Bahrami et al.[214] have reported a convenient method for the synthesis of 2-substituted benzimidazoles and benzothizoles offers short reaction times, large-scale synthesis, easy and quick isolation of the products and excellent chemoselectivity.

Synthesis of compounds (6-10) by green chemistry method [5a-b]:

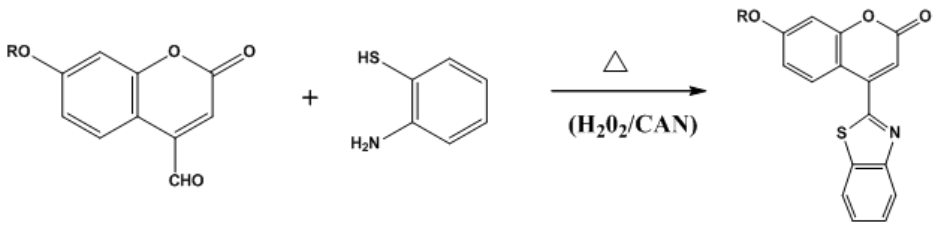
We also have attempted to explore the possibility of generation of antimicrobial activity in 2-(2H-1-benzopyran-2-one-4-yl)benzo[d]thiazole.The method involves the action of coumarin aldehyde and o-aminophenol in acetic acid resulting into in situ formation of the thiol substituted Schiff's base and its cyclization to coumarins substituted benzothiazole upon prolonged heating. The final product **6-10** crystallized with appropriate solvent as depicted in scheme.

Green context: Minimize waste by-products, avoids use of hydogen Peroxide and Cerric ammonium Nitrate.

 ISSN: 2321-8169
641 - 643

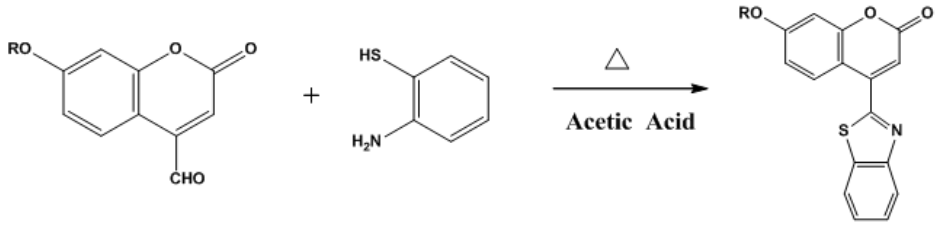
Scheme of Synthesis:

Scheme of Synthesis and Mechanism by conventional method [4]:



1-5 2-aminobenzenethiol 6-10

Scheme of Synthesis and Mechanism by green chemistry method [5a-b]:



1-5 2-aminobenzenethiol 6-10

II. RESULTS AND DISCUSSION

The synthesis of Benzothizole substited coumarins was carried out successfully by using both conventional method as well as green chemistry method. The synthesized products were recrystallized and melting point was taken which are compatible with the reported melting points. The percent yield obtained by green chemistry method was found to be more than that of conventional method. All the compounds were characterized by Mass spectra were obtained on a Micromass-Q-Tofmicro(YA-105) spectrometer and melting point. The atom economy was calculated on basis of the molecular weight of desired product and the molecular weight of all the products. From this calculation, it was seen that the atom economy is more in case of green chemistry than by the conventional method of synthesis. The found values signify the utility of method in which atom economy was obtained in the range of 70% to 82%.

The detail results summarized in **Table I and antibacterial activity** summarized **in table II:**

Table I :

Comp. No.	R	Green Synthesis method			Conventional method	
		%Yield	M. P. (°C)	Molecular ion (M^{+1})	%Yield	M. P. (°C)
6	CH_3	79.54	190	309	55.67	192
7	COC_6H_5	81.15	138	401	75.67	137-139
8	COC_6H_4Cl	72.15	156-158	436	64.78	158
9	$CH_2C_6H_5$	76.25	182	387	62.16	182-183
10	$CH_2C_6H_4Cl$	72.08	189-191	422	59.13	190

Antibacterial Screening[6]

Compounds **6-10** were evaluated for their antimicrobial activity by using concentration level of 50 µg/ml to 800 µg/ml. The test organisms employed were S.aureus and E.coli. The minimum inhibitory concentration at which compound showed on growth are summarized in **Table II.**

Table II:

Comp. No.	Minimum inhibitory conccentration against	
	S.aureus (µg/ml)	E.coli (µg/ml)
6	50	50
7	400	500
8	400	500
9	300	400
10	400	500

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