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Review Article

GREEN SYNTHESIS, BIOLOGICAL EVALUATION, AND DENSITY FUNCTIONAL THEORY CALCULATIONS OF THIAZOLIDINONE DERIVATIVES – A REVIEW

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ABSTRACT

Objective: Green chemistry articulates an area of research, developing from scientific discoveries about pollution awareness and it exploits a set of principles that reduces or eliminates the usage or generation of hazardous materials in all steps of synthetic progression. Hence, successful introduction of microwave technology is the current exhilarating field in green chemistry, generally classified as microwave-assisted organic synthesis of heterocyclic compounds exclusively thiazolidinone derivatives. Thiazolidinone nucleus especially the 4-thiazolidinone moiety has engaged a distinctive place in the field of medicinal chemistry due to widespread range of biological activities. This variety in the biological response profile has fascinated the consideration of many researchers to discover this skeleton to its manifold potential against numerous activities. This review is complementary to earlier reviews and aims to review the work reported on various biological activities of thiazolidinone derivatives from the year 1991 to the beginning of 2017. Statistics are presented for active compounds, some of which have passed the preclinical testing stage.

Methods: An easy and efficient microwave-assisted protocol has been developed for the green synthesis of thiazolidinone derivatives, and reviewed their inhibitory effects on the activity of various pathogens and was optimized by density functional theory.

Results: All compounds were found to possess various biological activities such as antibacterial, antitubercular, anticancer, antifungal and activities, respectively.

Conclusion: These thiazolidinone derivatives can be believable as new candidates for the treatment of various diseases. Final thoughts attracted from this analysis can perform crucial function shaping the way our team believes concerning existing as well as future projects.

Keywords: Green synthesis, Microwave irradiation, Biological evaluation, Thiazolidinone derivatives

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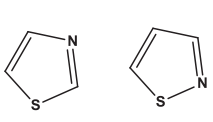
INTRODUCTION

In the new millennium, we have novel biological targets which are defined at the molecular level, which have incredible success in comprehending human illness. On the other hand, the drug design processes are largely including pharmaceutical research study, scientific intuition, reaction, and expertise to drive. With its origins rooted in natural synthesis as well as medicinal chemistry, heterocyclic compounds are existed themselves as a fundamental department of organic chemistry. International Union of Pure and Applied Chemistry defined "cyclic compounds possessing ring members with atoms of at least two distinct elements" [1]. Heterocyclic ring structures are core substances made up of components aside from carbon, where one of the most usual substituents is oxygen, nitrogen as well as sulfur [2,3]. According to the heteroatom(s) existing in the ring structure, heterocyclic could be recorded as oxygen, nitrogen, or sulfur based and within each and every class of compound is based on the size of the ring structure, determined by the total number of atoms [4]. The type and size of the ring structures, as one with the substituent groups of the core scaffold, impact are strongly on the physicochemical properties [5].

Heating responses with conventional devices, such as oil bath and also home heating mantles, are not only slow but also, additionally, it produces a hot surface area on the reaction vessel where reagents, items, and substrates are frequently disintegrate after at some time. Microwave power alternatively is brought right into the chemical reactor from another location and travels through the walls of the response vessel, warming the catalysts, and solvents directly. Microwave dielectric heating drives chain reactions by manipulating the benefit of the potential of some solids and liquids to change electromagnetic radiation into warm. Recently, a new technique has actually concerned the leading edge of chemical investigation, that is, microwave dielectric heating. In a similar method to the introduction of the isomantle, this technical advancement will no question need an adjustment in the drug store's mindset. In the future, the drug store will make use of fast blasts of microwave power to heat and also increase chemical reactions, as opposed to an alternate application in the very first circumstances for the mantle or hot plate. High-speed synthesis with microwaves has actually attracted a significant quantity of rate of interest in most recent years [6]. Considering that, the very first reports on the usage of microwave home heating by Gedye and also Giguere/Majetich groups in speeding up organic chemical conversion in 1986, far more than 2000 write-ups have been released in the area of microwave-assisted organic synthesis [7,8].

Thiazole is heterocyclic derivatives highlight both nitrogen in addition to sulfur atom as significant aspect of the aromatic five-membered ring. Thiazole, derivative **1** was first reported by Hantzsch [9] in 1887. They are usually isomeric with 1, 2-azoles. The derivative with nitrogen and sulfur are referred as isothiazole **2**. A thiazole ring is discovered naturally inside the essential vitamin thiamine **3**.



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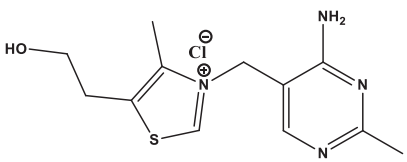
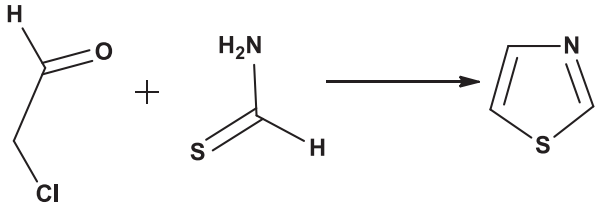


3

Typically, the chemistry of thiazole draws the attention of synthetic organic chemists due to their varied biological activities [10-13] such as antibacterial, antitubercular, anticancer, and antifungal activities. Recently, the usage of thiazole has been uncovered in drug development for the treatment of allergy [14], hypertension [15], inflammation [16], schizophrenia [17], bacterial [18], HIV infections [19], hypnotics [20], and more recently for the treatment of pain [21], as fibrinogen receptor with antithrombotic activity and as new inhibitors of bacterial DNA gyrase B [22].

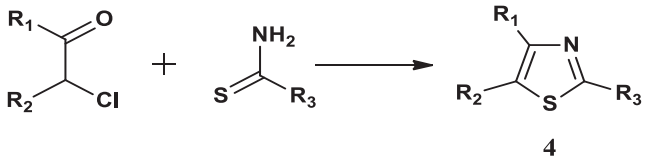
DISCOVERY OF THIAZOLE

The initial synthesis of thiazole has been described by Hantzsch and Weber [23] in 1887. This five membered ring system comprising sulfur and nitrogen hetero atoms at positions-1 and -3, is involved in many of the natural products. In its most basic form, the reaction is provided in Scheme 1 which involves utilization of α-halocarbonyl compound with reactants composed of N-C-S linkage.



Scheme 1: Synthesis of thiazole

The reaction may also be carried out in the presence of all three carbon atoms being substituted with suitable alkyl or aryl groups. Besides, it reacts with thiourea rather than thioamide to yield the related thiazole **4**.



4

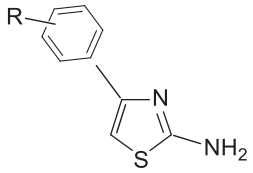
Typically, the mechanism of this cyclization has been postulated to be as shown below wherein a more intermediate **I** is formed through displacement of the halide, after which the nucleophilic nitrogen in **II** provides intramolecularly across the activated carbonyl to form hydroxyl intermediate **III**, and thiazole [24] is obtained by dehydration of **IV**.

This specific review deals with typically the primary innovations regarding nitrogen, oxygen, and sulfur-centered heterocyclic scaffolds stressing out there their main roles inside pharmaceutical compounds. To meet typically the pressure on the requirement, within this endeavor, we prepared to synthesize thiazole that contains heterocyclic compounds by microwave condition.

ADVANTAGE OF MICROWAVE IRRADIATION

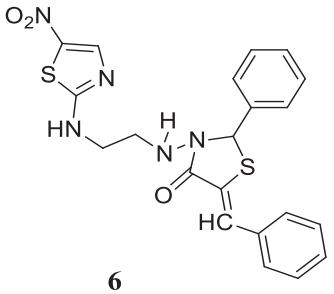
In the past decade, microwave irradiation has grabbed hugeness as a powerful tool for quick and efficient synthesis of numerous compounds due to selective absorption of microwave energy by the polar molecules [25]. The application of microwave irradiation to provide improved reaction rate and increased product in the field of chemical synthesis plus, it is quite successfully used in the organization of a variety of carbon-heteroatom bonds. During modern times, microwaves have been extensively utilized to carry out chemical reactions and possess become a beneficial nonconventional energy source for executing organic synthesis [26,27]. This is maintained an awesome number of journals in recent years especially in the year 2003, related to the application of microwaves as a result of an incredible accessibility of reliable microwave instrumentation [7,28-32].

Al-Shamkhani and Al-Hazam [33] reported a series of substituted 2-amino thiazole **5**, by the reaction of acetophenone with thiourea and iodine in microwave oven.



5

Samadhiya *et al.* [34] made an attempt to design by conventional as well as microwave strategies from 2-amino-5-nitrothiazole as a starting material to synthesize N-[2-2(substituted phenyl)-4-oxo-5-(substituted benzylidene)-1,3-thiazolidineiminoethyl]-2-amino-5-nitrothiazole.



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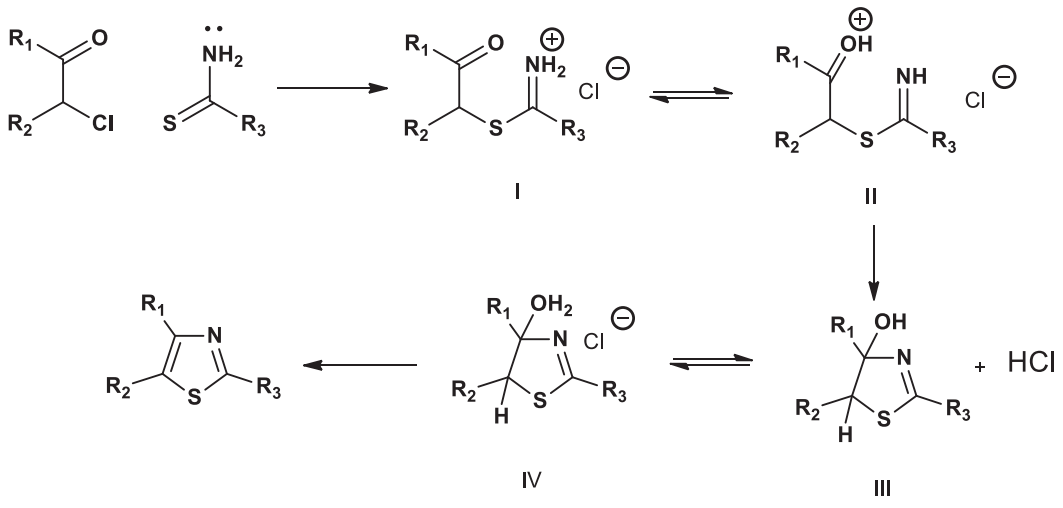
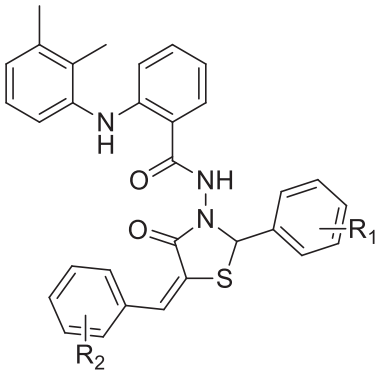


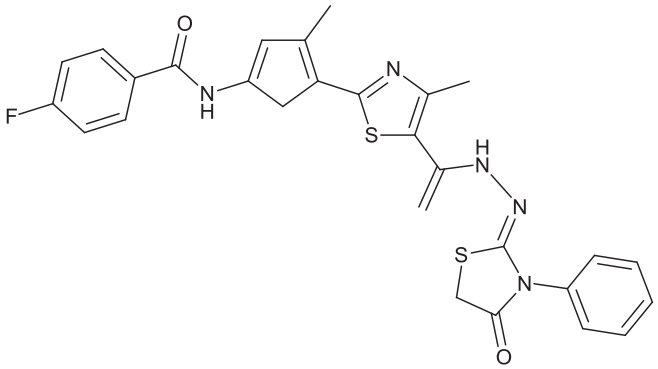
I II III IV

Al-Shamkhani *et al*. [35] synthesized novel heterocyclic compounds with thaizolidinone derivative **7**.



7

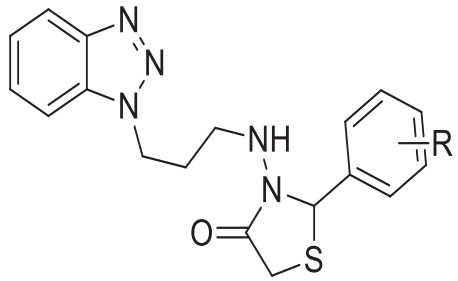
Desai *et al.* [36] synthesized 5-arylidene derivatives **8**, which bear a fluorine atom in the 4th site of typically the benzoyl group as starting



8

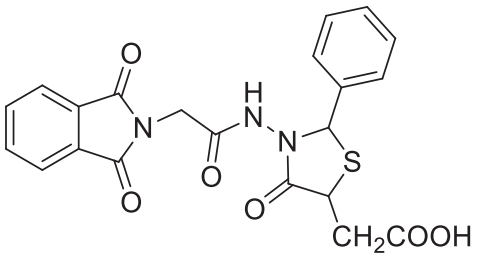
compound, by the condensation method using conventional and microwave strategies.

Dubey *et al.* [37] synthesized new varieties of thiazolidine derivatives of benzotriazole **9**. The reaction was carried out there by both conventional in addition to microwave strategies.



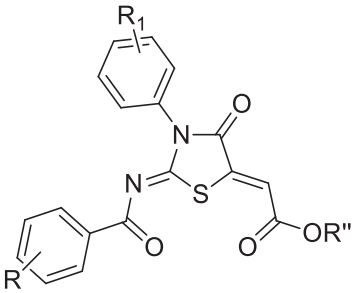
9

Nikalje *et al.* [38] synthesized a series of new 2-(3-(2-(1,3-dioxoisoin dolin- 2-yl)acetamido)-4-oxo-2-phenylthaizolidin-5-yl) acetic acid **10** using microwave irradiation.



10

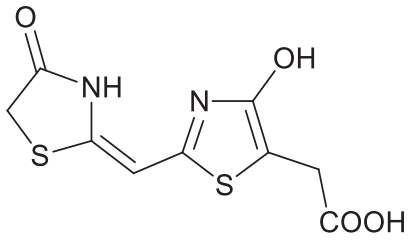
Mahmoodi *et al.* [39] synthesized several 1,3-thiazolidine-4-ones **11** by cycloaddition reaction of N-aryl, N'-acyl thiourea with acetylenic esters under microwave irradiation in solvent free conditions.



11

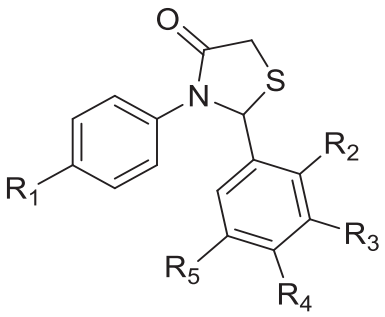
LITERATURE REVIEW OF THIAZOLIDINE-4-ONE DERIVATIVES

Atobe *et al.* [40] reported as noncompetitive inhibitors of (ADAMTS-5) A disintegrin and metalloproteinase with thrombospondin motifs – 5 for several thiazole bearing thiazolidin-4-ones **12**. Compound **12** is apparently the best ADAMTS-5 inhibited and good selectivity over other metalloproteases.



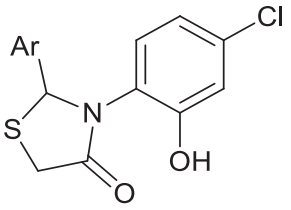
12

Sala *et al.* [41] produced a library of 2, 3-thiazolidin-4-one derivatives **13** inside which thiazolidinone nucleus attaches two aromatic rings. Several of these compounds revealed strong inhibitory effects on breast cancer cell growth.



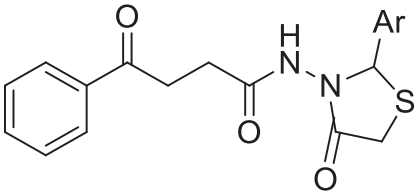
13

Pansare *et al.* [42] synthesized one-pot, three-component, and microwave-assisted preparation of new 3-(4-chloro-2-hydroxyphenyl)-2-(substituted)thiazolidin-4-one **14**. This research exhibits that all these compounds were non-cytotoxic in nature and established for their antimicrobial specificity separate from any standard cytotoxicity.



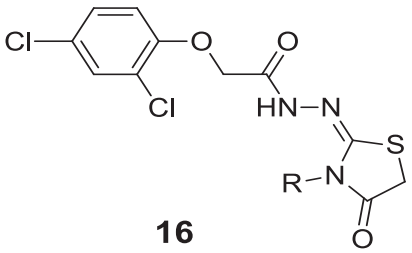
14

Nikalje *et al.* [43] synthesized N-(2-oxo-2((4-oxo-2-substituted thiazolidin-3yl)amino)ethyl)benzamide derivatives **15** under microwave irradiation. Typically, the synthesized compound was found to be the most active in maximal electroshock (MES) type. The anticonvulsant screening data exhibit that 65% regarding the compounds were found for their activity in against to MES model when compared to 35% sc-Pentilene - Tretrazol (PTZ) type.



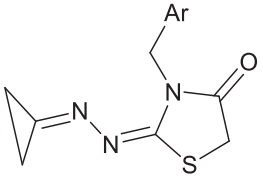
15

Ali *et al.* [44] synthesized 2-imino-4-thiazolidinone derivatives **16** and evaluated their *in vivo* anti-inflammatory activity and their effect on *ex vivo* cyclooxygenase-2 (COX-2) and tumor necrosis factor. The synthesized derivatives revealed a reduction of 68.32% in typically the level of COX-2 in comparison with the indomethacin which displayed 66.23% inhibition.



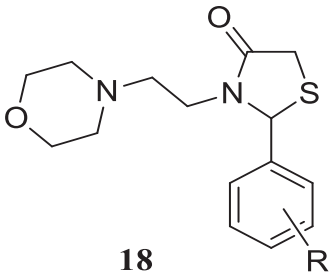
16

Gidaro *et al.* [45] synthesized N-substituted 1,3-thiazolidin-4-ones derivatives **17**. These compounds were evaluated to found their lowest inhibitory concentration (minimum inhibitory concentration) against several clinical *Candida* spp. with respect to topical and systemic reference drugs.



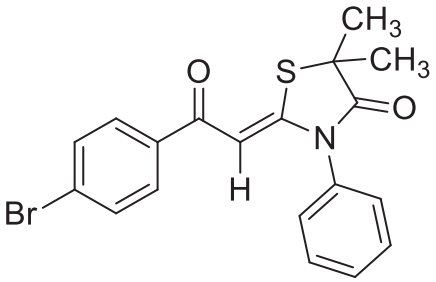
17

Pires Gouvea *et al.* [46] synthesized 4-thiazolidinones **18** bearing the morpholine moiety. Thiazolidin-4-ones *in vivo* anti-inflammatory actions were determined using a croton oil-induced ear edema model of inflammation in BALB C sufferers. Best results were found for the synthesized compounds.



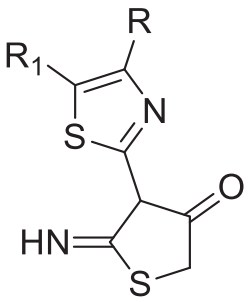
18

Verma *et al.* [47] synthesized a series of 1,3-thiazolidin-4-ones derivatives **19**. The attractive characteristics of this strategy include metal-free mild reaction conditions, fast reaction time and efficiency of forming consecutive C-S and C-N bonds, and a single ring in one synthetic operation.



19

Ostapiuk [48] synthesized 2-[(5-benzyl-1, 3-thiazol-2-yl)imino]-1,3-thiazolidin-4-ones **20, 21,** and **22** derivatives. The investigation of antibacterial and antifungal verification data revealed that all the tested compounds showed moderate to higher activity in comparison with standard drugs.



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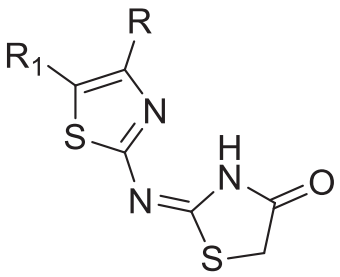

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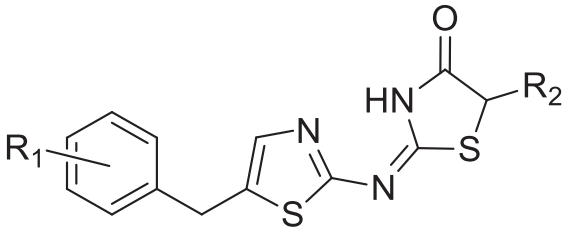
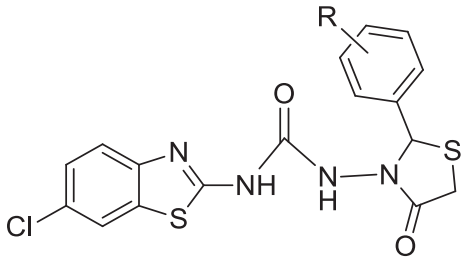


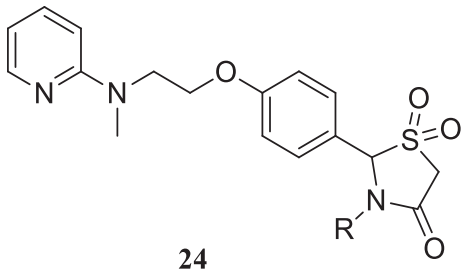
22

Gilani *et al.* [49] synthesized several novel thiazolidin-4-one derivatives **23** of the benzothiazole moiety. An antimicrobial property of the derivatives was investigated against bacteria and fungus. Typically, the investigation of antibacterial and antifungal screening data says that all the tested compounds showed reasonable to higher inhibition.



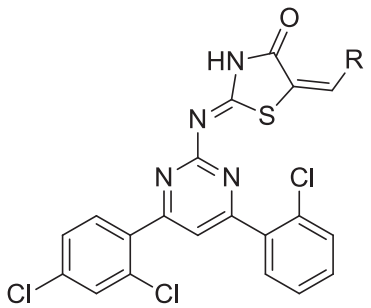
23

Raza *et al.* [50] synthesized thiazolidin-4-one derivatives **24**. In *in vitro* and *in vivo* assay systems, these were evaluated for their antihyperglycemic activity. Most of the compounds with thiazolidin-4-one moieties exhibited higher antihyperglycemic activity.



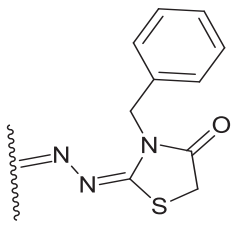
24

Raza *et al.* [51] synthesized pyrimidine derivatives clubbed with thiazolidin-4-one **25** and their *in vitro* anticancer activities were screened. The produced compound exhibited amazing growth inhibition at single dosage.



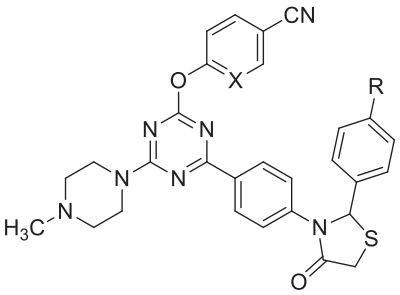
25

D'Ascenzio *et al.* [52] have incorporated innumerable novel thiazolidin-4-one subsidiaries **26** for the assessment of their anti-toxoplasma gondii action. The results showed that thiazole-based compounds were assessed favorably to control parasite growth.



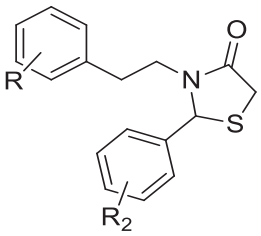
26

Patel *et al.* [53] synthesized thiazolidin-4-one fused with s-triazines **27**. The synthesized analogs were further screened for their *in vitro* antibacterial as well as anticancer efficacy against prostate cancer PC3 cells. Some derivatives possessed impressive antimicrobial activity and noticeable anticancer activity.

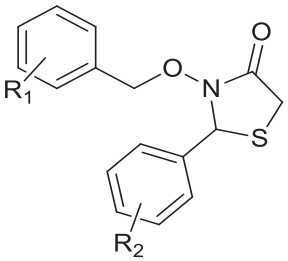


27

Jackson *et al.* [54] synthesized thiazolidinones **28** and **29** derivatives in a 3-component one-pot reaction with mercaptoacetic acid, phenethylamine, and aryl aldehyde.

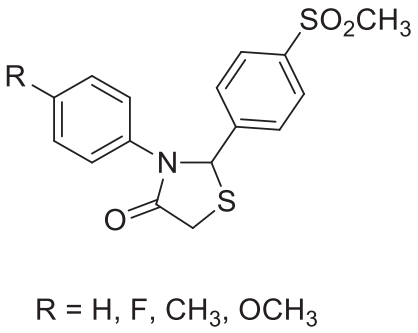


28



29

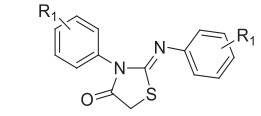
Zarghi *et al.* [55] reported an enormous number of 2,3-diaryl-1, 3-thiazolidine-4-ones **30** possessing a methyl sulfonyl pharmacophore and analyzed their biological activities for COX-2 inhibitory activity.



R = H, F, CH_3, OCH_3

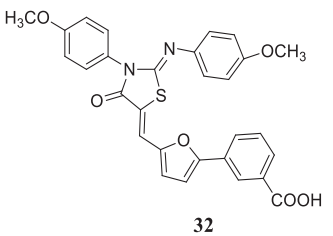
30

Pan *et al.* [56] synthesized 2-arylimino-3-aryl-thiazolidine-4-ones **31** and **32**. All these consequences revealed that the thiazolidinone scaffold was noticeably an exceptional chemotype for the searching of antibiofilm drugs.



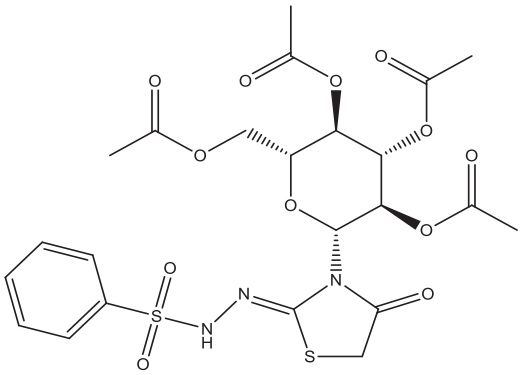
R_1 = H, 2-CH_3, 2-Et, 4-CH_3, 4-OCH_3

31



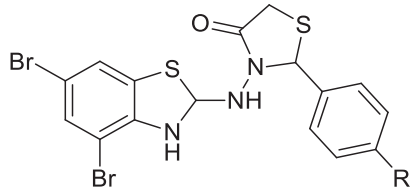
32

Li *et al.* [57] synthesized a 2-phenylsulfonylhydrazono-3-(2',3',4',6'-tetra-O-acetyl-b-D-glucopyranosyl)thiazolidine-4-one **33**. Bioassay results indicated that this compound exhibits good fungicidal and herbicidal activities.



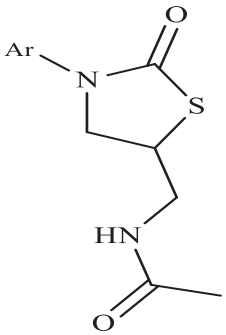
33

Gürsoy *et al.* [58] reported 4-thiazolidinones **34.** It was reported that existence of phenolic, hydroxyl, and aryl-substituted methoxy groups improved antibacterial activity.



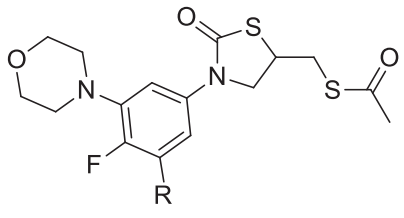
34

Sattigeri *et al.* [59] synthesized thiazolidin-2-one derivatives **35** and antimicrobial activities of the two new thiazole derivatives were also reported.



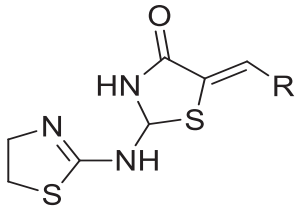
35

Dash *et al.* [60] synthesized 2-substituted-phenyl-3-(1-cyclopropyl-6-fluoro-7-[4-(2,3-dichlorophenylpiperazin-1-yl]-1,4dihydroquinoline] carboxamido -1, 3-thiazolidin-4-ones **36**. Compounds with 2-Cl, 3-Cl and 4-Cl were found to have better bacterial activity compared with standard drug ampicillin.



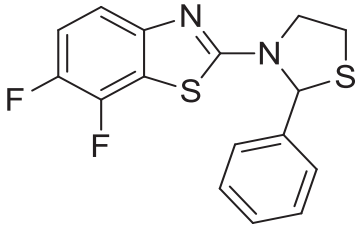
36

Vicini *et al.* [61] reported new 2-thiazolylimino-5-arylidene-4-thiazolidinones **37** and indicating that the substituted and unsubstituted 5-arylidene moiety plays a crucial role in improving antimicrobial properties of this class of derivatives.



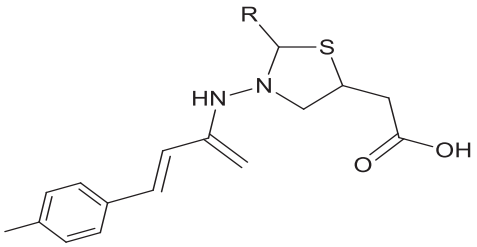
37

Jayachandran *et al.* [62] synthesized 3-[6'-fluoro-7'-chloro(1',3') benzothiazol-2'-yl]-m-nitrophenyl thiazolidine-4-one **38**. A few of these derivatives indicated shows potential antimicrobacterial activity.



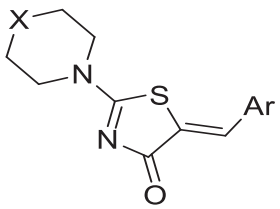
38

Chatrabhuji *et al.* [63] synthesized 4-thiazolidinones **39**. These biheterocycles and their precursors were examined for antimicrobial activity toward specific strains and they also screened for their antitubercular activity.



39

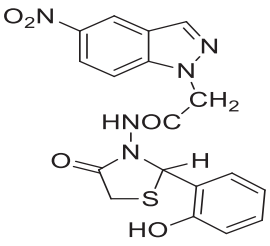
Alizadeh *et al.* [64] synthesized 1,3-thiazolidine-2-thiones **40** for their possible synthetic and pharmacological importance by utilizing simple and affordable starting materials.



40

BIOLOGICAL REVIEW OF THIAZOLIDINE DERIVATIVES

Several new derivatives N-[(4-oxo-2-substituted aryl-1,3-thiazolidine)-acetamidyl]-5-nitroindazoles **41** and **42** prepared by Upadhyay *et al.* [65]. About three potent compounds **43, 44,** and **45** were acknowledged as effective in killing prostatic cancer cells with increased selectivity compared to serine amide phosphates.



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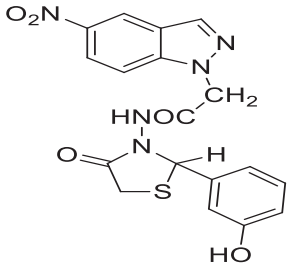
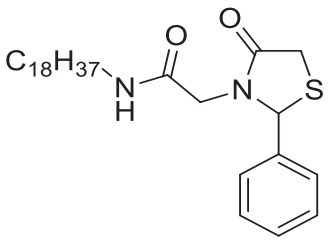


42



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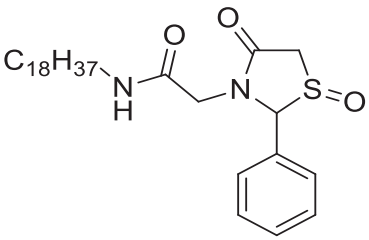

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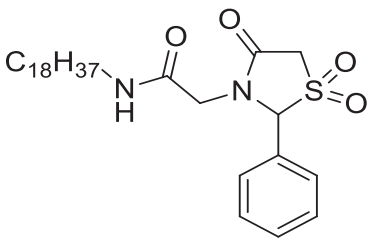
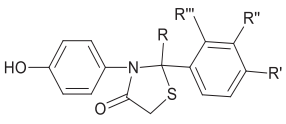
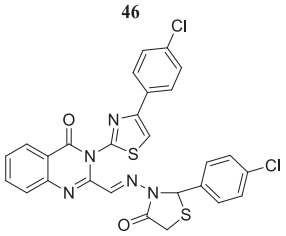


45

Taranalli *et al.* [66] synthesized thiazolidine-4-one derivatives **46** and evaluated their anti-inflammatory, analgesic in addition to antiulcer activities. The produced compound was discovered as the most active for each activity.

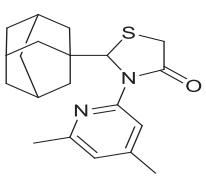


46

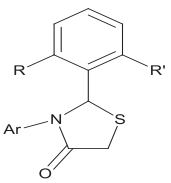


47

Balzarini *et al.* [67] synthesized thiazolidin-4-ones **48**. Several derivatives of those compounds exhibited modest anti-HIV-1 activity. The anti-HIV process of 2,3-diaryl-1,3-thiazolidin-4-ones derivatives **49** was studied by Abhinit *et al.* [68] and reported as a new class of antiviral agent with minimal cytotoxicity.

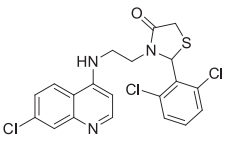


48



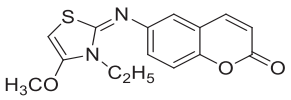
49

Solomon *et al.* [69] reported typically the synthesis 1,3-thiazolidin-4-one nucleus at the terminal chain amino group regarding 4-aminoquinoline **50**. All the particular synthesized compounds were analyzed for their antimalarial activity and some compounds to be able to have shown outstanding activity compared to the reference drugs.

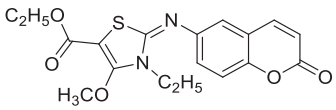


50

Amin *et al.* [70] reported activity of coumarinyl thiazolidin-4-ones **51** and **52** and evaluated their anticonvulsant activity. These derivatives were found to have better activity against PTZ-induced seizures.

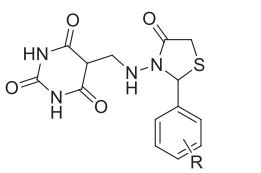


51



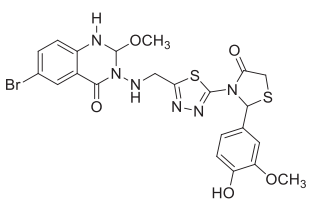
52

Agarwal *et al.* [71] synthesized 5-[(2-phenyl-4-oxo-thiazolidin-3-yl)amino]-2-oxo-thio barbituric acids derivatives **53** and Archana *et al.* [72] synthesized 3-((4-[2-alkylphenyl)-4-oxo-1,3-thiazolidin-3-yl]-1,3,4-thiadiazol-2yl)methylamino)-2-methyl-6-monoquinazolin-4(3H)-one **54** and screened *in vivo* for their anticonvulsant activity.



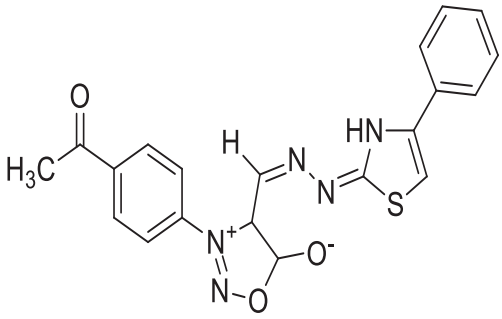
R = p-OCH_3, m-OCH_3, p-OH

53



54

Shih and Ke [73] synthesized sydnonyl moiety substituted thiazolidinone in addition to thiazoline derivatives **55** and evaluated for their antioxidant activity. The antioxidant action of these derivatives has been identified to exhibit a new significant 1,1-diphenyl-2-picrylhydrazyl radical scavenging activity equivalent to that of Vitamin E.



55

Rosy *et al.* [74] synthesized 4-(4-hydrazinylbenzyl) 1, 3-oxazolidin-2-one derivative, and characterized by Fourier-transform infrared (IR) spectroscopy and ^{1}H nuclear magnetic resonance spectral analysis and further studied for their interactions with topoisomerase II DNA gyrase enzymes by molecular docking protocol. 4-(4-hydrazinylbenzyl) 1 and 3-oxazolidin-2-one compound and reported a good glide score value and glide energy.

Naraboli and Biradar [75] synthesized and evaluated antimicrobial and antioxidant activity of *N*-phenylpropyl-3-substituted indoline-2-one derivatives and showed that some of the synthesized compounds exhibited promising results.

Walmik *et al*. [76] studied indole derivatives and evaluated for their antimicrobial activity against bacterial strains such as *Escherichia coli* (MTCC723), *Staphylococcus aureus* (ATCC-29513), *Klebsiella pneumoniae* (NCTC-13368), and *Pseudomonas aeruginosa* (MTCC-1688) and the fungal strains such as *Aspergillus oryzae* (MTCC-3567T), *Aspergillus niger* (MTCC-281), *Aspergillus flavus* (MTCC-1973), and *Aspergillus terreus* (MTCC-1782) and reported most of the compounds showed appreciable antimicrobial activity against the tested bacteria and fungi and emerged as potential molecules for further development.

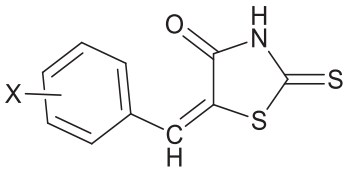
Chaubey [77] reported pyridine is found to have a large number of biological activities those including antiviral, anticancer, antimicrobial, antidiabetic, and antitubercular and its derivatives are very much used as anticancer, antimicrobial, antiviral, antidiabetic, and antithrombotic agents.

DENSITY FUNCTIONAL THEORY (DFT) REVIEW OF THIAZOLIDINONE

Parthiban *et al*. [78] synthesized and study the docking pattern and anti-inflammatory activities of some novel analogs of imidazo [1, 2-a] pyridines by means of the protein sequences for prostaglandin reductase. It was found that all the synthesized derivatives possessed very good binding energy, bringing into concern that the compounds are good inhibitors of prostaglandin reductase and hence are vested with anti-inflammatory properties.

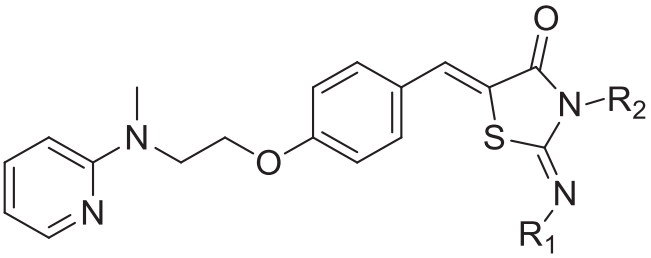
Rosy *et al*. [79] have reported that the metal ion interactions of 2-Thu are consistent with the bonding of ligands through sulfur in all the complexes of Cd (II), Hg (II), Cu (II), and Zn (II) bromides by IR spectroscopy.

Pîrna *et al.* [80] have reported molecular structure and relative energies of the three possible tautomers of thiazolidine by DFT calculations and it was reported that will form the thione **56** tautomer is most stable in gas-phase and also inside water and dimethyl sulfoxide.



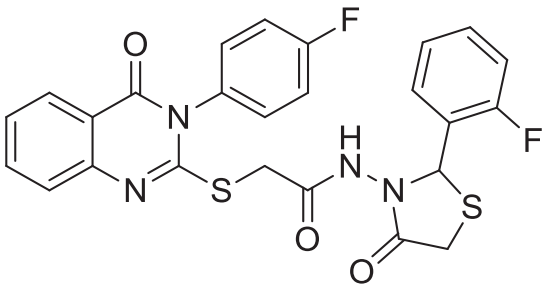
56

Meng *et al.* [81] synthesized 2-substituted imino-3-substituted-5-heteroarylidene-1,3-thiazolidine-4-ones **57** as the potent bidentate PTP1B inhibitor. Biological screening test against PTP1B revealed that most of these compounds have positive inhibitory activity against PTP1B.



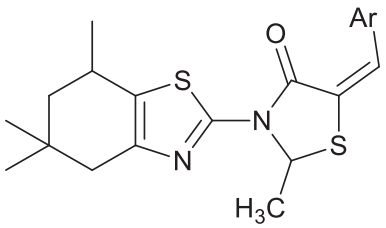
57

Mistry *et al.* [82] synthesized 4-oxo-thiazolidine **58** and their biological activities were evaluated. They will show comparatively excellent antibacterial as well as antifungal and antitubercular activities.



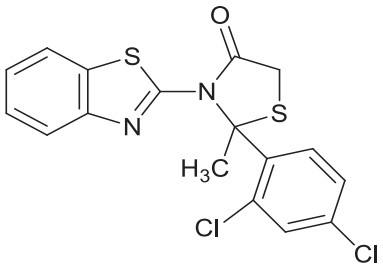
58

Adki *et al.* [83] reported synthesis of 1,3-benzothiazol-2-yl)-1,3-thiazolan-4-one **59** and evaluated their antimicrobial activity. More number of compounds showed a good degree of antimicrobial activity.



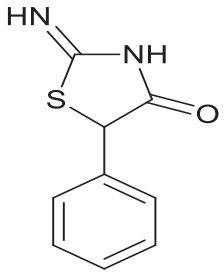
59

Desai and Mistry [84] performed microwave-assisted synthesis of thiazolidinone **60.** They finalized that the percentage yield with microwave-irradiated synthesis was good than the conventional process.



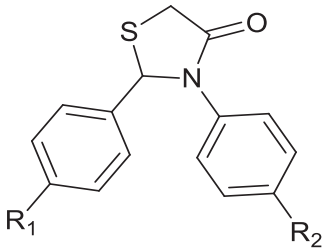
60

Bhosle *et al.* [85] reported one-pot and three-component synthesis of 2-amino-4-thiazolidinone compounds **61**. Numerous iminothiazolidinones have also developed by utilizing distinct reagents together with various reaction conditions under microwave dielectric heating strategies either by one stage three components or a two-step process [86-89]. Microwave strategy is typically the easiest and rapid approach of synthesis with very much better yield than typically the conventional technique.



61

Bolognese *et al.* [90] reported microwave irradiation of a combination of benzylidene anilines and mercaptoacetic acid in benzene produced 1,3-thiazolidin-4-ones **62** together with higher yield (65–90%), whereas the same reaction performed by conventional strategy from reflux temperature, takes a considerable longer time with lower yield (25–69%).



62

Pareek *et al.* [91] reported the synthesis and anti-inflammatory, antiulcer, antitumor, entomological, and antibacterial activities of substitutes-3-(benzothiazolyl)-1,3-thiazolidine-4-ones by means of DMF as a control and streptomycin and ceftazidime used as standard against Gram-positive and Gram-negative bacteria. He reported the consequences of various biological activities that these compounds would be of superior use in drug improvement to struggle bacterial infections and as antifeedant and acaricidal agents in the future.

CONCLUSION

This review shows that microwave irradiation method is fastest synthesis technique for thiazolidine-4-ones. Substitution is probable at 2, 3 and 5 position of thiazolidine-4-ones. The easy synthetic procedures for synthesis have taken attention of the chemists, pharmacologists and researchers. Thiazolidine-4-ones can be synthesized by means of coumarin derivatives, isatin derivatives, primary and secondary amines. Cyclization of compounds can be supported by using thioglycolic acid and chloroacetyl chloride. By heterocyclization of Quinoline-imines with thioglycolic acid using zeolite 5A° under microwaves afforded 2-(2-chloroquinoline-3-yl)-3-substituted phenyl thiazolidin-4-one. Thiazolidin-4-one have a broad band of pharmacological properties i.e., Antifungal, Anti-tubercular, Antimicrobial, Antioxidant, Cytotoxic, Anti-inflammatory, Analgesic, Anti YFV (yellow fever virus) activities. Antimicrobial is the most effective activity of the thiazolidine-4-ones. Anticancer and anti HIV are most promising activities of thiazolidin-4-ones for the researchers for the improvement of novel anticancer and anti HIV agents, which is prerequisite of currently medicinal field.

ACKNOWLEDGMENT

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AUTHORS' CONTRIBUTIONS

Authors K. Santhanthanalakshmi and S. Muthukumar contributed to the design of draft and M. Jebastin Sonia Jas conceived the study and were in charge of analysis of overall references mentioned in the manuscript.

CONFLICTS OF INTEREST

The authors declared that they have no conflicts of interest.

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