



Novel Synthetic Derivatives of Sydnones and Elucidation of Biological Applications

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The heterocyclic compounds have been effectively utilised as clinical agents among the various synthesised chemotherapeutic medicines. In synthetic chemistry, several of these are also useful intermediates. Because of their structure, chemical behaviour, and diverse pharmacological characteristics, the "Mesoionic" chemicals have garnered interest among the enormous number of non-benzenoid heterocycles known. The "Sydnones," which are being explored for their pharmacological characteristics and have lately been widely employed as synthons, are the most thoroughly studied class of mesoionic chemicals. Sydnones are one of the most well investigated mesoionic chemicals for cycloaddition processes. Despite their chemical stability and adaptability, only a few research groups have studied their chemistry and applications in organic synthesis. The research was carried out on a variety of sydnones. The analytical laboratory results have revealed on the synthesis and biological characteristics of a vast number of sydnone derivatives combined with physiologically active heterocycles; however none of them has progressed to the clinical stage. As a result, we attempted to construct various heterocycles on the sydnone ring in order to conducting structure-activity relationship (SAR) research.

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Keywords: Heterocyclic compounds; cycloaddition processes; chemical stability; mesoionic compounds; heterocyclic complex; chloroacetic acid.

1. INTRODUCTION

The sydnone are mesoionic compounds; right off the bat depicted by Earl and Mackney in 1935. The enthusiasm for this class of compounds was created by their incentive as synthons in building heterocyclic complex molecules, just as their pharmaceutical applications [1-3]. Sydnone are the most contemplated compounds among the mesoionic family because of their fascinating structures,

concoction properties, synthetic utility and biological activities [4-9]. They proposed the development of intertwined 3 and 4-frameworks ring. Item (I) from the activity of acidic anhydride on N-nitrosophenylglycine which was later viewed as off-base by scientists [10-14]. Hence, Baker and his associate excluded the scaffold bond and suggested an in part fragrant five-membered cyclic (II to V) which was a cross breed of numerous zwitterionic structures [15-19].

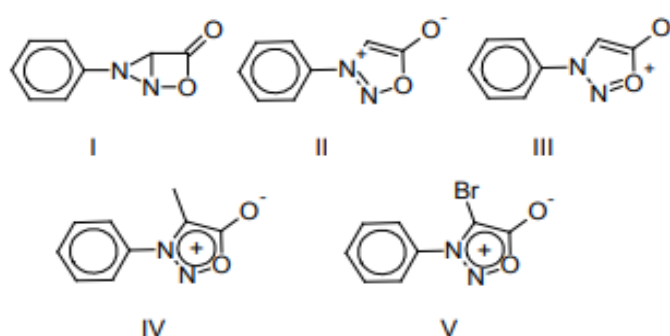


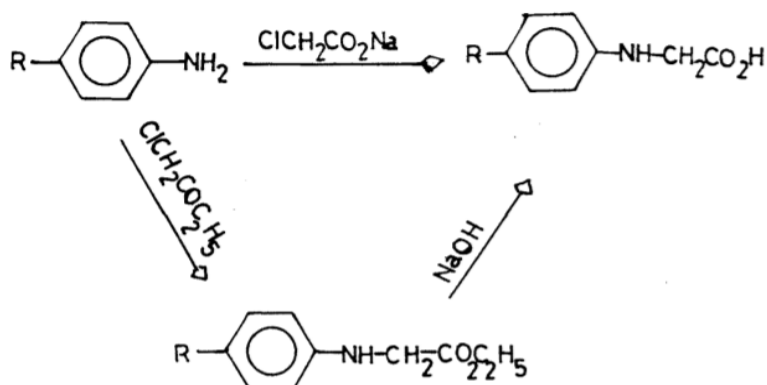
Fig. 1. Sydnone structure

2. METHODS AND MATERIALS

The 3-arylsydnone were synthesized according to the simple procedure which involves the below steps:

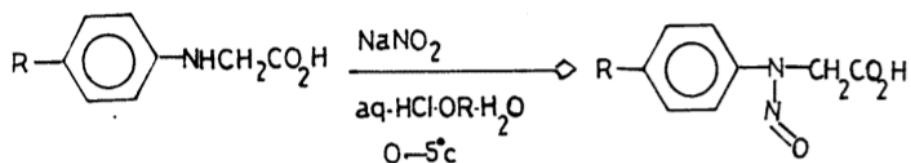
2.1 Preparation of N-substituted Glycines

Condensation of $C_6H_5NH_2$ with neutralised chloroacetic acid and interaction of anilines with ethylchloroacetate followed by hydrolysis were used to make the aryl glycines.



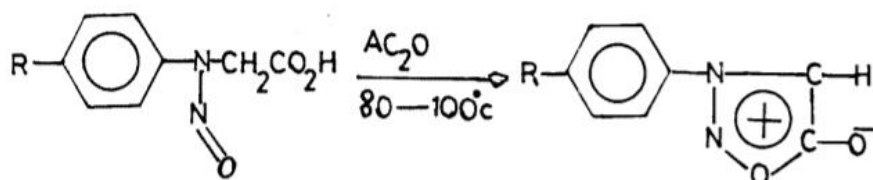
2.2 Nitrosation of Arylglycines to N-nitroso-N-arylglycines

The addition of sodium nitrite to water or aqueous HCl is used to nitrate the solution.

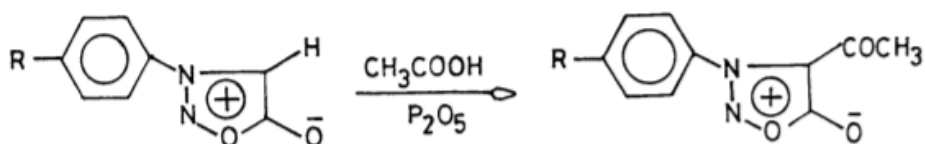


2.3 Cyclisation of N-nitroso-N-arylglycines to N-arylsydones

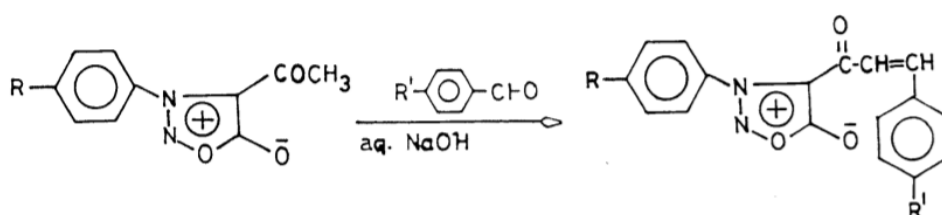
Now N-nitrosoglycines are cyclised to the corresponding sydones by boiling with acetic anhydride.



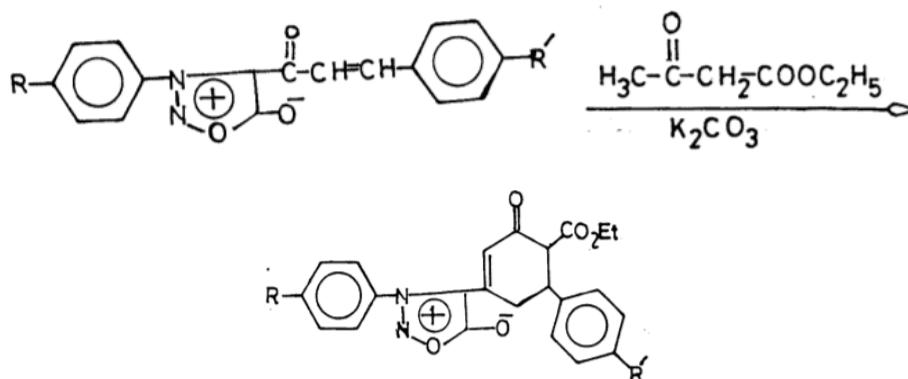
4-acetyl-3-arylsydones are the initial materials for the synthesis of these intermediates, which are made via acetylation of 3-arylsydones with CH_3COOH and P_2O_5 .



The Claisen-Schmidt reaction converts 4-acetyl-3-arylsydones to 4-cinnamoyl derivatives. In the presence of an aqueous alkali, the acetyl molecule is condensed with substituted aromatic $\text{R}'\text{CHO}$ to produce unsaturated ketones (chalcones).



To make the title compounds, the 3-aryl-4-cinnamoyl sydones undergo Michael A addition with ethylacetoacetate in the catalyst of a base, followed by internal Claisen condensation.



2.4 Evaluation of Antibacterial Activity

2.4.1 Preparation of culture

a) Preparation of nutrient broth:

Peptone	0.5%
Yeast extract	0.15%
Beef extract	0.15%
NaCl	0.35%
Potassium dihydrogen phosphate	0.13%
Potassium monohydrogen phosphate	0.13%

In dist. H₂O, pH = 7.2, using NaOH solution, sterilised at 15 psi (120°C) for 20 min.

b) Preparation of inoculums:

The above-stated O2 cultures were injected with 20 ml of nutrient broth the day before testing and incubated overnight at 37°C.

2.4.2 Preparation of nutrient agar:

Bacteriological peptone	0.6%
Yeast extract	0.3%
Beef extract	0.13%
Agar	2.5%

In distilled water, pH = 7.2 and autoclaved at 16 psi (119°C) for 19 minutes.

a) Preparation of Drug Solution: The specific material (10 mg) was dissolved in 5 ml dimethyl formamide, and 1 ml of this resultant was diluted to 200 mg/ml. Antimicrobial activity was tested using 0.1 ml of the solution.

b) Testing Method: Nutrient agar was put into sterile petri dishes (25 ml each) while hot and allowed to cool to r.t. After 24 hours culture, with a sterilised bent glass rod, 4-5 drops of were dispersed over the surface of the set agar. After that, the cups were produced by punching a sterilised cork orer into the set agar and scooping out the punched area. Each cup had a diameter of 10 mm. aseptically; 0.1 ml (20 ug) of the test chemical solution in dimethyl formamide was applied to these cups.

To aid dispersion, these plates were allowed to cool for hour, and incubated for 24 hours at 37°C. In millimetres, the ZOI was calculated. Two standards were used to compare the results. Norfloxacin and tetracyclic hydrochloride

for the aforesaid species, the 'antibacterial activity of the solvent (DMF) was examined by putting aseptically (0.1 ml) into the relevant cup of the agar plates'.

2.5 Antifungal Activity Evaluation

2.5.1 Preparation of culture

a) Preparation of fungal broth:

Peptone	1%
Yeast extract	0.6%
Sodium chloride	0.5%
Potassium hydrogen phosphate	0.3%
Glucose	1%

In distilled water, pH = 6.0, sterilised at 15 p.s.i. (120°C) for 20 minutes.

b) Preparation of inoculum

The above-mentioned fungi were introduced into the fungal broth the day before testing and cultured at 37°C for 48 hours.

2.5.2 Preparation of nutrient agar:

Peptone	4%
Yeast extract	0.6%
Sodium chloride	0.5%
Potassium hydrogen phosphate	0.3%
Glucose	1%
Agar	2.5%

In distilled water and pH = 6. The solution was sterilised at 15 psi (120°C) for 20 min.

a) Preparation of Drug Solution: In 5 ml of dimethyl formamide, the test substance (10 mg) was dissolved. To get a concentration of 200 mg/ml, 1 ml of this solution was diluted to 10 ml with dimethyl formamide, and 0.1 ml of this solution was used for the test.

b) Method of Testing: Nutrient agar was placed into disinfected petriplates (20 ml each) and kept to cool to room temperature while still hot. 48-hour culture, with a sterile bent glass rod, 4-5 droplets were dispersed over the crust of the set agar. After that, the cups were produced by punching a sterile cork borer into the set agar and scooping out the punctured section. Each cup had a diameter of 10 mm. Aseptically, 0.1 ml (120 mg) of the sample chemical solution in dimethyl formamide was added to these cups.

To aid dispersion, these plates were allowed to normal for sometime then they were incubated for 24 hours at 38°C. In millimetres, the inhibitory zone was checked. Griseofulvin, a standard medication, was used to compare the values (antifungal agent). As a solvent control, dimethyl formamide was employed.

3. SYNTHESIS OF SYDNONES DERIVATIVES

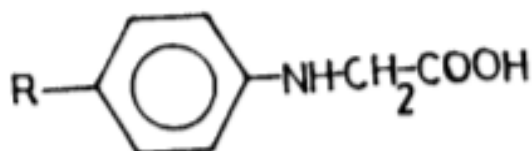
3.1 Preparation of Glycines

- ✓ **Condensation of Amines with Monochloroacetic Acid:** In cool, 100 ml of 2N sodium hydroxide solution was used to neutralise chloroacetic acid 18.9 (0.2 mol). The reaction mixture was refluxed with shaking till the aniline had reacted, which took 18.6 g (0.2 mol) (appro. for one hr). Cooling separated N-phenylglycine, which was gathered and rinsed with icy water. It was then refined further by dissipating it in a small amount of 10% NaOH solution and extracting it with ether to eliminate any unreacted reactant. To get

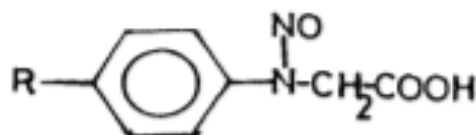
pure N-phenylglycine, the aqueous stage was treated with norit and acidified with strong HCl.

- ✓ Reaction of amines with ethylchloroacetate to produce N-p-chloro phenylglycineethyl ester.
 - ✓ The aforementioned ester is hydrolyzed to provide the equivalent glycine.
1. In an oil-bath at 125°C, a combination of ethylchloroacetate (31.0 g), p-chloroaniline (32.0 g), C₂H₅OH (25 ml), and hydrated sodium acetate (30 g) was refluxed for 5 hours. After that, 100 mL of water was added, and the solid ester precipitated was collected, cleaned it.
 2. N-p-Chlorophenylglycine ethyl ester (26.5 g), ethanol (10 ml), and a NaOH solution (14.5 g) in water (100 ml) were refluxed for 0.5 hrs. The glycine was then collected, filtered & neutralised with strong HCl (23.5 ml).

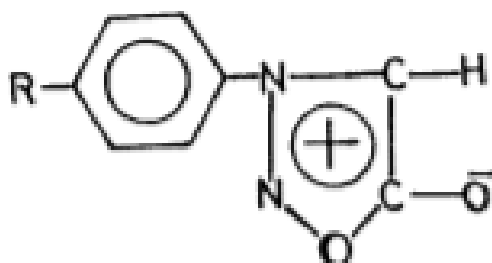
These procedures yielded a variety of N-phenylglycines, which were crystallised from hot water:



N-Substituted Glycine



N-Nitroso-N-substituted glycine



3-Arylsydnone

3.2 Nitrosation of H-substituted Glycines

- A. **Nitrosation in Water:** Sodium nitrite 6.9 g (0.1 mol) in water 24 ml was applied dropwise over 30 minutes to a stirred suspension of N-phenylglycine 15.1 g (0.1 mol) in water 120 ml at 0°C. After 2 hours, the reaction blend was almost clear, and it was treated with norit to the cold. Using strong HCl, it was filtered and acidified. The N-nitroso-N-phenylglycine that had precipitated was filtered, rinsed, air dried.

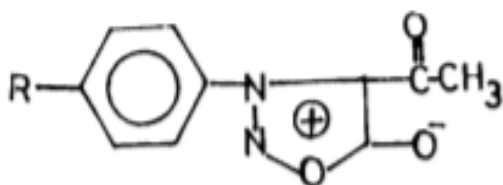
Aqueous Hydrochloric Acid Nitrosation: At 0.5°C, a mixed suspension of N-p-chlorophenylglycine 18.1 g (0.1mol) in 300 ml of 20% aqueous HCl was added to a solution of sodium nitrite 6.0 g (0.1mol) in water 25 ml. The final mixture was stirred at room temperature for 3 hrs. after the addition was completed. The separated nitrosoglycine was filtered, rinsed carefully with tap water to remove any acid, and demoirised in the open air. The nitrosoglycines crystallised from aqueous ethanol using the procedures described above.

3.3 Cyclisation of N-nitroso-N-substituted Glycines to Sydnone

On a water bath, 9.09 g (0.05 mol) of N-Nitroso-N-phenylglycine was cooked for 2 hours with 20 ml of acetic anhydride. In ice cold water, the solution was poured. The solid was filtered before being rinsed with water and 5% NaHCO₃ solution. Dehydrated and crystallized the solid by C₆H₆.

3.4 Preparation of 3-phenyl-4-acetylsydnone

In a 03 necked 250 ml R.B. flask assembled with a reflux condenser and supplied with a CaCl₂ drying tube, 8.1 g (0.05mol) of 3-phenylsydnone was added to a suspension of 21.3 g (0.115mol) of P₂O₅ in 125 ml of Na dried thiophene free benzene. On water bath, the magnetically swirled mixture was boiled to reflux. Each 10-minutes interval, 2.86 ml (0.05mol) of glacial CH₃COOH was added dropwise by help of a dropping funnel. The stirring reaction mixture was heated for 5 hours, resulting in a blackened clear solution. Benzene was decanted after cooling to ambient temperature, and the black residual was extracted twice by 20 ml of benzene. The decanted and combined wash were evaporated to dryness, a pale-yellow solid yielded by using alcohol to crystallise.



3.5 Preparation of 4-cinnamoyl-3-phenylsydnone (Chalcones)

4-Acetyl-3-phenylsydnone (2.0g, 0.01mol) was suspended in NaOH solution (0.5g, 5ml water, 5 ml EtOH) and benzaldehyde (1.0g, 0.01mole)

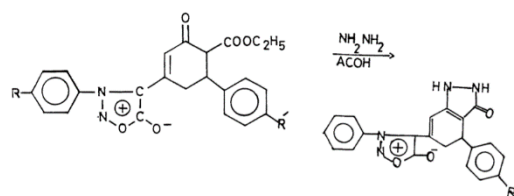
was added. At the room temperature, the mix was agitated for 30 minutes. The precipitate was quickly collected, thoroughly cleaned with water. Table 1 lists various cinnamoyl compounds that were synthesized.

3.6 Preparation of 3-phenyl-4-(6-carbethoxy-5-phenyl-cyclohex-2-en-1-one-3-yl) Sydnone

4-Cinnamoyl-3-phenylsydnone 2.9g (0.01 mole) was dissolved in dry acetone, to which dry K₂CO₃ 5.2 g (0.04 mole) and ethyl acetoacetate 1.3 g (0.02 mole) were added, and the mixture was agitated for 5 hrs at ambient temperature. The reaction mixture was allowed to sit at surrounding temperature overnight. The filtrate evaporated to dryness after being filtered to remove K₂CO₃. Yellow crystals were formed by crystallising the residue in ethanol. Table 2 lists different derivatives that made when using this method.

3.7 Preparation of 3-Aryl-4(4, 5-dihydro-3-oxo-indazolin-6-yl) sydnone

Condensation of 3-aryl-4 (6-carbethoxy-5-aryl-2-en-1-one-3-yl) sydnone with hydrazine hydrate in AcOH yields these chemicals.



On a water bath, the 3-phenyl-4-(6-carbethoxy-5-phenyl-2-en-1-one-3-yl) sydnone 4.0 g (0.01 mole) and hydrazine hydrate 0.5 g (0.01 mole) were refluxed for 4 hours in CH₃COOH 1.3 ml (0.02 mole) and ethyl alcohol (100 ml). After cooling, the residue was filtered and crystallised from ethanol to produce saffron colour crystals. Table 3 lists the several oxoindazole derivatives that have been made.

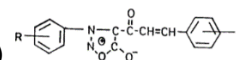


Table 1. 4-Cinnamoyl-3-arylsydnone (chalcones)

R	R ¹	Yield %	M.P. ^o C	Formula	Results				
					Cal/Obs	C%	H%	N%	Ref
H	H	55	145.7	C ₁₇ H ₂₂ N ₂ O ₃	Cal/Obs	50.73 (50.70)	5.52 (5.47)	6.96 (6.93)	3
H	CH ₃	60	124.6	C ₁₈ H ₁₄ N ₂ O ₃		70.58 (70.53)	4.50 (4.29)	9.15 (9.07)	3
H	OCH ₃	65	185.7	C ₁₈ H ₁₄ N ₂ O ₄		67.08 (67.05)	4.34 (4.23)	8.69 (8.61)	3
H	Cl	78	150.2	C ₁₇ H ₁₁ N ₂ O ₃ Cl		62.49 (62.41)	3.36 (3.33)	8.57 (8.52)	3
OCH ₃	H	50	160.2	C ₁₈ H ₁₄ N ₂ O ₄		67.08 (67.03)	4.34 (4.29)	8.69 (8.53)	3
OCH ₃	CH ₃	70	160.2	C ₁₉ H ₁₆ N ₂ O ₄		67.85 (67.83)	4.76 (4.32)	8.33 (8.30)	3
OCH ₃	OCH ₃	70	180.90	C ₁₉ H ₁₆ N ₂ O ₅		64.77 (64.72)	4.54 (4.49)	7.95 (7.90)	3
OCH ₃	Cl	67	185.6	C ₁₈ H ₁₃ N ₂ O ₄ Cl		60.67 (60.62)	3.65 (3.61)	7.86 (7.81)	3
CH ₃	H	60	180.1	C ₁₈ H ₁₄ N ₂ O ₃		70.57 (70.53)	4.61 (4.59)	9.14 (9.12)	3
CH ₃	CH ₃	70	180.1	C ₁₉ H ₁₆ N ₃ O ₂		71.23 (71.21)	6.03 (5.01)	8.74 (8.71)	3
CH ₃	OCH ₃	65	205.6	C ₁₉ H ₁₆ N ₂ O ₄		68.25 (68.21)	4.20 (4.01)	8.38 (8.35)	3
CH ₃	Cl	70	176.7	C ₁₈ H ₁₃ N ₂ O ₃ Cl		63.44 (63.40)	3.84 (3.79)	8.20 (8.02)	3
Cl	H	60	218.2	C ₁₇ H ₁₁ N ₂ O ₃ Cl		62.49 (62.42)	3.36 (3.31)	8.57 (8.53)	3
Cl	CH ₃	80	216.7	C ₁₈ H ₁₃ N ₂ O ₃ Cl		63.44 (63.40)	3.84 (3.80)	8.20 (8.12)	3
Cl	OCH ₃	70	220.1	C ₁₈ H ₁₃ N ₂ O ₄ Cl		60.67 (60.62)	3.65 (3.61)	7.86 (7.81)	3
Cl	Cl	68	219.2	C ₁₇ H ₁₀ N ₂ O ₃ Cl		56.52 (56.49)	2.70 (2.30)	7.75 (7.73)	3

Table 2. 3-Aryl-4-(6-carbethoxy-5-arylcyclohex-2-en-1-one-3-yl) sydnones

R	R ¹	Yield %	M.P.°C	Formula	Analysis			
					Cal/Obs	C%	H%	N%
H	H	75	165.6	C ₂₃ H ₂₀ O ₅ N ₂	Cal/Obs	67.30 (58.30)	4.92 (4.95)	6.77 (6.92)
H	CH ₃	60	178.9	C ₂₄ H ₂₂ O ₅ N ₂		68.90 (68.99)	5.30 (5.20)	6.70 (6.68)
H	OCH ₃	75	168.9	C ₂₄ H ₂₂ O ₆ N ₂		66.36 (66.31)	5.10 (4.87)	6.43 (6.45)
H	Cl	80	168.9	C ₂₃ H ₁₉ O ₅ N ₂ Cl		62.94 (62.90)	4.36 (4.30)	6.38 (6.35)
CH ₃	H	85	145.6	C ₂₄ H ₂₂ O ₅ N ₂		68.87 (68.83)	5.29 (5.17)	6.70 (6.49)
CH ₃	CH ₃	80	160.1	C ₂₅ H ₂₄ O ₅ N ₂		69.42 (69.39)	5.60 (5.00)	6.47 (6.43)
CH ₃	OCH ₃	75	171.2	C ₂₅ H ₂₄ O ₆ N ₂		66.95 (66.91)	5.16 (5.15)	6.24 (6.21)
CH ₃	Cl	8	180.2	C ₂₃ H ₁₉ O ₅ N ₂ Cl		62.94 (62.90)	4.36 (4.32)	6.38 (6.34)
OCH ₃	H	75	163.4	C ₂₄ H ₂₁ O ₆ N ₂		66.34 (66.23)	5.10 (5.02)	6.44 (6.41)
OCH ₃	CH ₃	80	179.0	C ₂₅ H ₂₄ O ₆ N ₂		66.95 (66.97)	5.39(5.29)	6.24 (6.08)
OCH ₃	OCH ₃	80	185.6	C ₂₅ H ₂₄ O ₇ N ₂		64.64 (64.57)	5.20 (5.12)	6.03 (6.01)
OCH ₃	Cl	75	158.9	C ₂₄ H ₂₃ O ₅ N ₂ Cl		61.47 (61.39)	4.51(4.08)	5.03 (5.01)
Cl	H	80	161.2	C ₂₃ H ₁₉ O ₅ N ₂ Cl		62.94 (62.87)	4.36 (4.31)	6.38 (6.34)
Cl	CH ₃	85	168.9	C ₂₄ H ₂₁ O ₅ N ₂ Cl		69.05 (69.02)	4.89 (4.82)	6.71 (6.63)
Cl	OCH ₃	70	172.3	C ₂₄ H ₂₁ O ₆ N ₂ Cl		61.47 (61.43)	4.50 (4.46)	5.97 (5.90)
Cl	Cl	75	195.6	C ₂₃ H ₁₈ O ₅ N ₂ Cl ₂		58.48 (58.41)	3.81 (3.43)	5.93 (5.87)

Table 3. 3-Ary1-4-(4, 5-dihydro-4-ary1-(3H)-3-oxo-indazolin-6-yl) sydnones

R	R ¹	Yield %	M.P. ^o C	Formula	Analysis			
					C%	H%	N%	
H	H	80	290.1	C ₂₁ H ₁₆ N ₄ O ₃	Cal/Obs	67.73 (67.70)	4.33 (4.30)	15.04 (15.01)
H	CH ₃	85	294.5	C ₂₂ H ₁₈ N ₄ O ₃		68.38 (68.33)	4.69 (4.65)	14.50 (14.47)
H	OCH ₃	70	280.1	C ₂₂ H ₁₈ N ₄ O ₄		65.66 (65.61)	4.50 (4.46)	13.92 (13.87)
H	Cl	75	198.2	C ₂₁ H ₁₅ N ₄ O ₃ Cl		61.99 (61.92)	3.71 (3.67)	13.77 (13.73)
CH ₃	H	80	285.6	C ₂₂ H ₁₈ N ₄ O ₃		68.38 (68.38)	4.69 (4.64)	14.49 (14.45)
CH ₃	CH ₃	85	292.3	C ₂₃ H ₂₀ N ₄ O ₃		68.98 (68.93)	5.03 (5.01)	13.92 (13.89)
CH ₃	OCH ₃	70	285.7	C ₂₃ H ₂₀ N ₄ O ₄		66.34 (66.29)	4.84 (4.80)	13.45 (13.41)
OCH ₃	H	80	304.5	C ₂₂ H ₁₈ N ₄ O ₄		65.67 (65.62)	4.50 (4.47)	13.92 (13.89)
OCH ₃	CH ₃	75	285.6	C ₂₃ H ₂₀ N ₄ O ₄		66.33 (66.30)	4.84 (4.80)	13.45 (13.39)
OCH ₃	OCH ₃	85	286.8	C ₂₃ H ₁₇ N ₄ O ₅		63.88 (63.83)	4.66 (4.62)	12.95 (12.91)
CH ₃	Cl	75	290.2	C ₂₂ H ₁₇ N ₄ O ₄ Cl		60.48 (60.42)	3.92 (3.89)	12.82 (12.79)
Cl	H	75	304.5	C ₂₁ H ₁₅ N ₄ O ₃ Cl		61.99 (61.93)	3.71 (3.69)	13.77 (13.75)
Cl	OCH ₃	80	306.7	C ₂₂ H ₂₇ N ₄ O ₄ Cl		60.48 (60.43)	3.92(3.89)	12.82 (12.79)
Cl	CH ₃	75	310.1	C ₂₂ H ₇₇ N ₄ O ₃ Cl		62.78 (62.74)	4.07 (4.03)	13.30 (13.09)
Cl	Cl	70	303.4	C ₂₂ H ₁₄ N ₄ O ₃ Cl ₂		55.88 (55.85)	5.35 (5.31)	12.41(2.39)

4. RESULTS AND DISCUSSION

Table 4. Antibacterial and antifungal activity of 3-Arylsydnonones

Compound no.	R	R ₁	Zone of inhibition (ZOI) in mm			
			Antibacterial		Antifungal	
			<i>B. aureus</i>	<i>E. coli</i>	<i>A. niger</i>	<i>C. albicans</i>
1	H	H	++	++	-	+
2	H	CH ₃	-	-	-	-
3	H	OCH ₃	-	-	-	+
4	H	Cl	++	++	-	+
5	CH ₃	CH ₃	++	++	-	++
6	CH ₃	H	-	-	-	+
7	CH ₃	OCH ₃	-	-	-	+
8	OCH ₃	Cl	++	++	-	+
9	OCH ₃	H	+	++	-	++
10	OCH ₃	OCH ₃	-	-	+	+
11	OCH ₃	CH ₃	++	+	-	+
12	Cl	H	++	++	-	++
13	Cl	CH ₃	++	++	-	++
14	Cl	OCH ₃	++	++	-	-
15	Cl	Cl	-	-	-	+

ZOI in mm: 12-14 (+), 15-17 (++) , 18-21 (+++)

- ✓ **Antibacterial:** With the exception of compounds 2, 3, 6, 7, 10, 15 all of the fifteen derivatives tested for antibacterial function had only little action opposed *E. coli* and *B. aureus*.
- ✓ **Antifungal:** Only entities 5,9,12 and 13 have been found to exhibit anti-*C. albicans* and none of the substances have demonstrated anti-*A. niger* action.

Table 5. Antibacterial and Antifungal Activity of Aryl-4(4,5-Dihydro-4-Aryl 3h)-3-oxo-indazolin-6-yl) Sydnonones

Compound no.	R	R ₁	Z.O.I. in mm			
			Antibacterial		Antifungal	
			<i>B. aureus</i>	<i>E. coli</i>	<i>A. niger</i>	<i>C. albicans</i>
1	H	H	++	++	-	+
2	H	CH ₃	-	++	+	+
3	H	OCH ₃	+	++	-	+
4	H	Cl	+	++	-	++
5	CH ₃	CH ₃	+	++	-	-
6	CH ₃	H	++	++	-	-
7	CH ₃	OCH ₃	-	-	-	+
8	OCH ₃	H	++	++	-	-
9	OCH ₃	CH ₃	+	++	-	++
10	OCH ₃	OCH ₃	+	++	+	+
11	OCH ₃	Cl	++	++	-	++
12	Cl	H	++	++	-	+
13	Cl	CH ₃	++	++	-	-
14	Cl	OCH ₃	++	++	-	++
15	Cl	Cl	++	-	-	+

ZOI in mm.: 12-14 (+), 15-17 (++) , 18-21 (+++)

- ✓ **Antibacterial:** With a few exceptions, all of these chemicals have proven action against *E. coli*. Only a few chemicals have exhibited limited anti-*B. aureus* action.
- ✓ **Antifungal:** Only compounds 4,9,11,14 have been found to exhibit anti-*C. albicans* and nil substances demonstrated anti-*A. niger* action.

5. CONCLUSION

Mesoionic compounds are a form of heterocycle that belongs to the non-benzenoid aromatics category. Due of its peculiar geometry, chemical characteristics, fabrication value, sydnone, the typical mesoionic substance, has been intensively explored. In heterocyclic synthesis, sydnone is a flexible synthon.

Owe to ease of synthesis from basic amines and the fact that it is the single mesoionic ring that witnesses a large variety of reagent reactions of synthetic use, the Sydnone ring is the most intensively researched of complete mesoionic compounds known. This lactone, a 1, 2, 3-oxadiazole-5-one heterocycle, was given the name Sydnone in honour of the (University of Sydney + lactone), where Earl and Mackney originally manufactured it in 1935.

Sydnones are dipolar compounds having delocalized positive and negative charges that belong to the class of mesoionic heterocycles. According to the IUPAC definition, mesoionic compounds are composed of five-member ring heterocyclic i.e. incapable to accurately represent by an equal or only one polar frame, requiring numerous canonical structures to be specified. Planar conjugated entities, known as sydnones, are aromatic. The aromaticity of sydnones is supported by their planar structure, delocalized charges, and high resonance energy.

Sydnones are a new type of meso-ionic molecule having unusual chemical and physical compounds. Sydnone derivatives have been discovered to disclose a wide spectrum of biological features, like antioxidant activity, liquid crystalline qualities. Biological activities have been documented for a variety of meso-ionic compounds. Antibacterial, antifungal, antimalarial, anti-inflammatory, analgesic, anticonvulsant, antihypertensive, antithrombotic, antitumor, and other biological actions have been claimed for sydnones. In vivo, sydnone cephalosporin derivatives show anti-streptococcal and anti-staphylococcal activity. Molsidomine has antianginal and antischemic properties, whereas sydnofen and sydnocarb have depressive properties.

New compounds have been discovered, demonstrating that sydnones may be used to make a wide range of heterocycles. The majority of the novel compounds were discovered to have antibacterial, antifungal, and anti-helmintic

applications, as well as being effective in the treatment of cancer. The mesoionic structures made it possible to use it as a solvent for ionic processes or as a component in electrical devices. Despite the fact that sydnones have been around for a long time, their applications continue curiosity piqued of organic chemists and others.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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