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SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL ACTIVITY OF EPOXIDE DERIVATIVES

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ABSTRACT

Synthesis of epoxide involves two stages first chalcone synthesis followed by epoxide synthesis. The synthesized products were characterized by spectroscopic technique. This study explored the synthesis and antibacterial, antifungal activity of a series of epoxides. The synthesized epoxides were tested on *E. coli*, *P. aeruginosa*, and *S. aureus*, strains for antibacterial activity and against *C. albicans*, for antifungal activity. Compared to standard drugs, some of the synthesized compounds have moderate antibacterial activity.

KEYWORDS- Chalcone, Epoxide, antibacterial, antifungal.

INTRODUCTION

Chalcone possesses a broad spectrum of biological activity, due to the presence of the alpha-beta unsaturated system. Chalcones are acted as a precursor for the synthesis of different intermediates like pyrazoline, isoxazole, pyrimidine, benzodiazepines.[1-4], etc. The development of heterocyclic compounds with epoxide groups has piqued researchers' interest. Epoxide, sometimes known as epoxy, is just a three-membered cyclic ether. Two carbon atoms, one oxygen atom. Epoxide is extensively used as a precursor in the production of a variety of chemicals. The Weitz-Scheffer reaction, which uses hydrogen peroxide under alkaline circumstances to oxidize a chalcone to an epoxychalcone, is a good example of green chemistry.[5-7] Epoxychalcone is an intermediary and a precursor to a wide range of chiral chemicals and natural products.[8-12] and has outstanding biological and pharmacologically active ingredients.[13-18] In addition, life-threatening infections caused by pathogenic bacteria

and fungi, which are becoming more common, as well as ubiquitous epidemics around the world, have prompted many research groups from all over the world to work on novel antibacterial and antifungal agents in order to avoid the risk of various infectious diseases and the rise of multi drug resistance microbial organisms.[19-24]

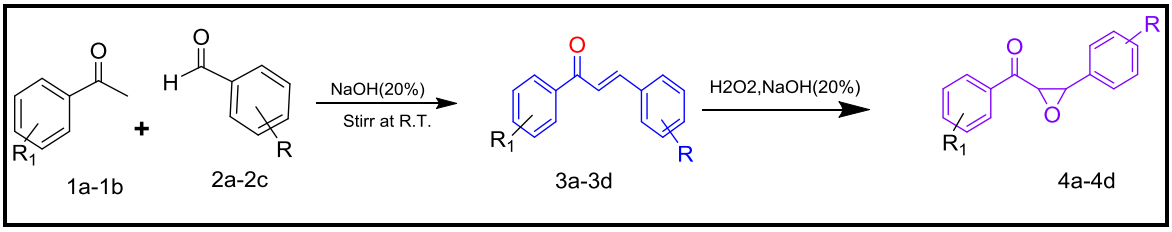
We present the synthesis of epoxide which involves two stages, first one is chalcone synthesis followed by epoxide formation. The synthesized compounds screened for antibacterial and antifungal activity.

1. MATERIAL AND METHODS

The Chemicals used are purchased for synthesis are of analytical grade and were used without further purification. The melting point of the compound was determined in open capillaries and uncorrected. The ^{1}H NMR spectra were recorded on Brucker Avance NEO 500MHZ NMR spectrometer using TMS as an internal standard. Progress of the Reaction is monitored by thin layer chromatography using aluminium sheets precoated with UV fluorescent silica gel Merck 60 F254 and was visualized by UV lamp by using n-hexane and ethyl acetate solvent system.

1.2 Synthesis

In the first step, the Starting Material (0.01mol) Was added to a conical flask containing (10mL) ethanol, the compound gets dissolved. then the mixture was stirred for 15 -20 minutes on a magnetic stirrer at room temperature. After 20 minutes (H_2O_2) Hydrogen Peroxide of about 4ml was added to the reaction mixture drop by drop slowly to get the product. The starting Compounds colour is yellow and changes to white colour after adding H_2O_2 the reaction was complete. The product began to separate from the reaction mixture. The reaction mixture was then stirred for 10 minutes. Then the product was filtered, dried, and monitored the reaction using Thin Layer chromatography After completion of the reaction the reaction mixture was poured into ice cold water and filtered to get the product. The structures of these compounds were confirmed on the basis, ^{1}H NMR and ^{13}C NMR spectral analysis.



Scheme 1 Synthesis of epoxide derivatives.

Table 1: Physicochemical analysis of epoxide derivatives (3a-3d).

Sample code	Name of the compound	Mol. Formula	Yield (%)	M.P (°C)
3a	(4-chlorophenyl)(3-(4-isopropylphenyl) oxiran-2-yl) methanone	$C_{17}H_{17}ClO_2$	88%	120-122˚C
3b	(4-chlorophenyl)(3-(4-chlorophenyl) oxiran-2-yl) methanone	$C_{15}H_{10}Cl_2O_2$	84%	126-128˚C
3c	(4-methoxyphenyl)(3-(4-isopropylphenyl)oxiran-2-yl) methanone	$C_{17}H_{20}O_3$	84%	132-134˚C
3d	(4-methoxyphenyl)(3-(4-2,6-dichloro phenyl)oxiran-2-yl) methanone	$C_{15}H_{12}ClO_3$	72%	118-122˚C

Spectral analysis of synthesized compounds

(4-chlorophenyl)(3-(4-isopropylphenyl)oxiran-2-yl) methanone (3a)

^{1}H NMR (500 MHz, CDCl3) δ 7.97 – 7.93 (m, 2H), 7.47 – 7.41 (m, 2H), 7.32 – 7.22 (m, 4H), 4.24 (d, J = 1.9 Hz, 1H), 4.04 (d, J = 1.9 Hz, 1H), 2.99 – 2.85 (m, 1H), 1.26 (d, J = 6.9 Hz, 6H); ^{13}C NMR δ 190.3, 136.85, 131.2, 128.66, 126.7,124.5,121.54,120.23, 118.62, 62.12, 56.41, 28.22, 18.06.

(4-chlorophenyl)(3-(4-chlorophenyl)oxiran-2-yl) methanone (3b)

^{1}H NMR (500 MHz, CDCl3) δ 7.82 (d, J= 8.2 Hz, 2H), 7.47 (d, J= 8.2 Hz, 2H), 7.36 (d, J = 7.9 Hz, 2H), 7.28 (d, J = 7.9 Hz, 2H) 4.20 (d, J = 1.7 Hz, 1H), 3.96 (d, J = 1.7 Hz, 1H); ^{13}C NMR δ 188.27, 136.88, 134.12, 126.16, 125.07,125.05,120.14,120.13, 116.26, 61.06, 55.41.

(4-methoxyphenyl)-(3-(4-isopropylphenyl)oxiran-2-yl) methanone (3c)

^{1}H NMR (500 MHz, CDCl3) δ 7.52 (d, J= 8.3 Hz, 2H), 7.42 (d, J= 8.3 Hz, 2H), 7.38 (d, J = 7.7 Hz, 2H), 7.21 (d, J = 7.7 Hz, 2H), 4.26 (d, J = 1.9 Hz, 1H), 4.04 (d, J = 1.9 Hz, 1H), 3.92 (s, 3H), 2.99 – 2.85 (m, 1H), 1.26 (d, J = 6.9 Hz, 6H); ^{13}C NMR δ 187.02, 137.15, 131.82, 127.46, 125.55, 124.87, 122.33, 120.13, 119.26, 60.87, 55.45,52.26, 27.76, 18.98.

(4-methoxyphenyl)-(3-(4-2,6 dichloro phenyl) oxiran-2-yl) methanone (3d)

^{1}H NMR (500 MHz, CDCl3) δ 7.86 (d, J= 8.1 Hz, 2H), 7.66 (dd, J= 8.2 Hz, 1H), 7.32 (d, J = 8.4 Hz, 2H), 7.26 (d, J = 8.4 Hz, 2H) 4.20 (d, J = 1.7 Hz, 1H), 3.96 (d, J = 1.7 Hz, 1H), 3.94 (s, 3H); ^{13}C NMR δ 187.02, 137.15, 131.82, 127.46, 125.55, 124.87, 122.33, 120.13, 119.26, 60.87, 55.45, 27.76, 18.98.

Antimicrobial activity

There are different methods used for antibacterial activity, we have used the paper disc method. The procedure involves seeding a lawn of bacteria on the surface of an agar medium, inserting paper discs saturated with antimicrobial agents on top of the lawn, incubating the plate overnight, and evaluating the presence or absence of a zone of inhibition surrounding the discs.

Table 2 Antimicrobial activity of the synthesized compound.

Sample code	*E . Coli* ATCC 25922	*P.aeruginosa* ATCC27853	*S.aureus* ATCC25923	Candida.sp
3a	08 mm	08mm	No zone	07mm
3b	10 mm	08 mm	No zone	07 mm
3c	10 mm	08 mm	No Zone	07 mm
3d	08 mm	08 mm	No zone	07 mm
Gentamicin	23 mm	08 mm	No zone	--
Nystatin	--	--	--	25 mm

CONCLUSION

The epoxide synthesis is more convenient, requires less purification, and is a faster process. The structure of produced compounds was validated using spectroscopic techniques. The synthesized compounds show moderate antibacterial activity compared to standard drugs.

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Conflict of interest

The author declares that they have no conflict of interest.

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