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Synthesis of 1-(5-Chloro-2-Hydroxyphenyl)-3-(2-Chloro Phenyl)-1-Oxo-2, 3-Epoxy Propane Derivatives as Antimicrobial Agents

Awinash S. Chavan[1*] and Seema P. Rathod[2]

[1]*Department of chemistry, Raosaheb Patil Danve College of Pharmacy Badnapur, Dr. Babasaheb Ambedkar Technological University Lonere, Raigad, India*
[2]*School of Pharmacy Nanded, Swami Ramanand Teerth Marathwada University Nanded, India*

***Corresponding author:** Awinash S. Chavan, Department of chemistry, Raosaheb Patil Danve College of Pharmacy Badnapur, Dr. Babasaheb Ambedkar Technological University Lonere, Raigad, India, **E-mail**: avichavan4741@gmail.com*

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ABSTRACT

Epoxides are the natural phytoconstituents with several biological significance such as Anti-inflammatory, Antioxidant, Anticancer and Antimicrobial activity. The Series 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane derivatives was designed and synthesized from 1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl)-prop-2-en-1-one.

Current research work screened forIv-vitroanti-bacterial activity against Escherichia coli, Staphylococcus aureus (Pathogens obtained from animal), Xanthomonas citri and Xanthomonas malvacearum (Pathogens obtained from plant). The compound SAC-3 and SAC-6 shows good antibacterial activity while other shows moderate to good anti-microbial activity.

Keywords: Epoxide; Chalcone; Escherichia coli; Anti-bacterial Activity

INTRODUCTION

Chalcones are the natural phytoconstituents widely distributed in plants originate in fruits, vegetables, grains, bark, roots, stems and flowers. The different derivatives of chalcones were synthesized from chalcones with marked biological significance such as Antibacterial, Antifungal, Antimalaria, Anti-inflammatory, Anticancer and Antitubercular activity. Hence, Chalcones are considered as an indispensable component in a variety of nutraceutical, pharmaceutical, medicinal and cosmetic applications with versatile health benefits [1-3].

In organic chemistry epoxides are valuable building blocks in the synthesis of many important reactions for derivatization. Basically for the preparation of surfactants, corrosion protection agents, additives to laundry detergents, lubricating oils, textiles and cosmetics epoxides are play important role in industry.

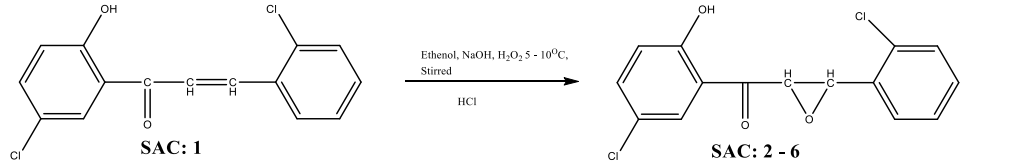
Present research a novel 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane (SAC: 2 to 6) series of synthetic epoxide have been synthesized. Synthesis of novel derivatives is carried out using 1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl) -1-oxo-2-propene as starting material and followed by to evaluate antimicrobial activity [4,5].

MATERIALS AND METHODS

Melting points were determined in an open capillary tube and are uncorrected. IR spectra were recorded in KBr on a Perkin-Elmer spectrometer. ^{1}H NMR spectra were recorded on a Gemini 300-MHz instrument in Dimethyl Sulfoxide (DMSO) as solvent and TMS as an internal standard. The purity of products was checked by Thin Layer Chromatography (TLC) on silica gel [6-10].

EXPERIMENTAL WORK

Synthesis Scheme (Figure 1)



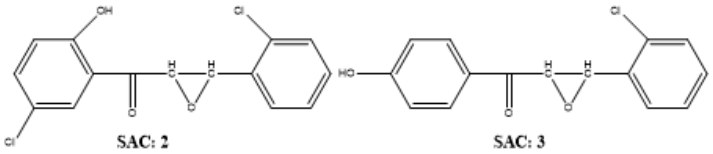
SAC: 1
1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2-propene

SAC: 2 - 6
1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane **Preparation**

Figure 1: Scheme for the synthesis of 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane (SAC: 2 - 6).

Synthesis of 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane (SAC: 2 - 6)

Take 0.01 ml (0.293 g) of 1-(5-chloro-2-hydroxyphenyl)-3-(2-chlorophenyl) -1-oxo-2-propene (SAC:1) and 25 ml of ethanol in a dry conical flask followed by 10 ml of 5% NaOH. Stir reaction mixture until chalcone get completely dissolved. Add 5 ml of 30% hydrogen peroxide in above reaction mixture and stir the reaction mixture for 2 Hrs. Collect the separated solid, filtered, washed with cold water and recrystallized from ethanol. All SAC: 2-6 were synthesized by same reaction mechanism (Figure 2) [11-17].

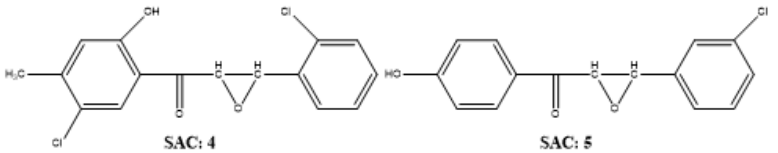


SAC: 2

SAC: 3

SAC-2:1-(5-Chloro-2-hydroxyphenyl)-3-(2-chlorophenyl)-1-oxo-2,3-epoxy propane

SAC-3:1-(4-hydroxyphenyl)-3-(2-chlorophenyl)-1-oxo-2,3-epoxy propane

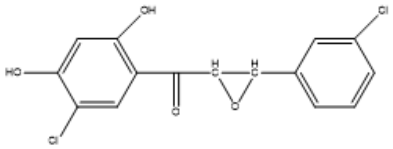


SAC: 4

SAC: 5

SAC-4:1-(5-Chloro-2-hydroxy-4-methylphenyl)-3-(2-chlorophenyl)-1-oxo-2,3-epoxy propane

SAC-5:1-(4-hydroxyphenyl)-3-(3-chlorophenyl)-1-oxo-2,3-epoxy propane



SAC-6:1-(5-Chloro-2,4-dihydroxyphenyl)-3-(3-chlorophenyl)-1-oxo-2,3-epoxy propane

Figure 2: Synthesis of 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane

RESULTS AND DISCUSSION

Spectral Data of 1-(5-Chloro-2-hydroxyphenyl)-3-(2-chlorophenyl)-1-oxo-2,3-epoxy propane **(SAC-2):**
IR: ν max (cm^{-1}): 3120 **(OH)**, 1640 **(C=O)**, 1682, 1585 **(C=C aromatic)**.
^{1}H NMR: δ 4.3 **(d, 2H, CH),** 4.45 **(d, 2H, CH),** 12.3 **(s, 1H, OH),** 7.56 **(m, 3H, ArH),** 7.95 **(m, 4H, ArH).**
Spectral Data of 1-(5-Chloro-2-hydroxy-4-methylphenyl)-3-(2-chlorophenyl)-1-oxo-2,3-epoxy propane **(SAC-4):**
IR: ν max (cm^{-1}): 3125 **(OH),** 1640 **(C=O),** 1680, 1595 **(C=C aromatic).**
^{1}H NMR:δ 4.43 **(d, 2H, CH),** 4.40 **(d, 2H, CH),** 12.35 **(s, 1H, OH),** 2.33 **(s, 3H, CH_3),** 7.61 **(m, 2H, ArH),** 7.20 **(m, 4H, ArH)** (Table 1,2).

Table 1: Physicochemical data of synthesized compounds.

Sr. No.	Code	Molecular Formula	Mol. Weight (g/mol)	Yield %	Melting Point (ºC)	R_f-Value	Appearance
1	SAC-2	$C_{15}H_{10}O_3Cl_2$	308	78	156	0.6	Yellow
2	SAC-3	$C_{15}H_{11}O_3Cl$	274	75	152	0.82	Yellow
3	SAC-4	$C_{16}H_{12}O_3Cl_2$	287	79	155	0.7	Yellow
4	SAC-5	$C_{15}H_{11}O_2Cl$	258	64	180	0.81	Brown
5	SAC-6	$C_{15}H_{10}O_4Cl_2$	324	72	162	0.8	Yellow

Table 2: The representative IR spectra and ^{1}H NMRof synthesized compounds.

Sr. No.	CODE	IR (CM^{-1})	^{1}H NMR
1	**SAC-2**	3120 **(OH)**, 1640 **(C=O)**, 1682, 1585 **(C=C aromatic)**	δ 4.3 **(d, 2H, CH),** 4.45 **(d, 2H, CH),** 12.3 **(s, 1H, OH),** 7.56 **(m, 3H, ArH),** 7.95 **(m, 4H, ArH).**
2	**SAC-4**	3125 **(OH),** 1640 **(C=O),** 1680, 1595 **(C=C aromatic)**	δ 4.43 **(d, 2H, CH),** 4.40 **(d, 2H, CH),** 12.35 **(s, 1H, OH),** 2.33 **(s, 3H, CH_3),** 7.61 **(m, 2H, ArH),** 7.20 **(m, 4H, ArH).**

BIOLOGICAL SCREENING

Antibacterial Activity: The newly synthesized 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane (SAC-2 to SAC-6)were screened for antibacterial activity against Escherichia coli, Staphylococcus aureus (Pathogens obtained from animal), Xanthomonas citri and Xanthomonas malvacearum (Pathogens obtained from plant) using Disc Diffusion Method11. The Filter paper discs were soaked in solution of different compounds at concentration of 100 ppm [18-25]. The solvent aqueous DMF (5% 1ml) used for preparing solution of the compounds. The disc soaked in solution of compound placed at the center of bacteria seeded nutrient agar plates (Petri dishes). The Petri dishes were incubated at 26± 1°C for 24 hrs. The strength is reported by measuring the diameter of zone of inhibition in mm and results were standardized against tetracycline. The zone of inhibition was measured and reported in table 3.

Table 3: Biological Screening of Synthesized compound.

Sr. No.	CODE	Zone Inhibition in mm			
		Escherichia coli	Staphylococcus aureus	Xanthomonas malvacearum	X. Citri.
1	**SAC-2**	14	9	14	16
2	**SAC-3**	12	7	11	12
3	**SAC-4**	18	11	24	26
4	**SAC-5**	15	14	17	21
5	**SAC-6**	21	16	19	22
6	**Standard(Tetracycline)**	22	26	23	24

CONCLUSION

The series of 1-(5-chloro-2-hydroxyphenyl)-3-(2-chloro phenyl)-1-oxo-2,3-epoxy propane (SAC-2 to SAC-6) and derivatives have synthesized by conventional method and further screened for biological activity. All the compounds showed potent antibacterial activity [26-31].

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Conflict of interest statement

The authors report no conflict of interest.

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