International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 22 No. 1(s) (2026)



www.ijerst.com
© 2026 IJERST. All Rights Reserved
Peer Reviewed, Referred & Indexed Journal

Research Paper

Synthesis, Characterization & Applications of Chalcone and Chromone Derivative.

Gaikwad V.S.[a], Walunjkar G.K[a],Bidave S.D.[a] ,Misal D.B [b]. Borawake G.A.[b],Ghare P.D [b].

[a] Department of chemistry Jijamata College of Science and Arts Bhende PG analytical Chemistry Student

[b] Department of chemistry Jijamata College of Science and Arts Bhende

Abstract

Medicinal chemists continue to be fascinated by chalcone derivatives because of their simple chemistry, ease of hydrogen atom manipulation, straightforward synthesis, and a variety of promising biological activities. However, chalcones have still not garnered deserved attention, especially considering their high potential as chemical sources for designing and developing new effective drugs. In this review, we summarize current methodological developments towards the design and synthesis of new chalcone derivatives and state-of-the-art medicinal chemistry strategies

This work describes the physiochemical, optical and biological activity of chromone derivative. The chromone derivative gels were prepared by reacting chitosan with chromone-3-carbaldehyde, followed by solvent exchange, filtration and drying by evaporation. The identity of Schiff base was confirmed by UV-Vis absorption spectroscopy and Fourier-transform infrared (FTIR) spectroscopy.

Introduction

The chemistry of chalcone has been an interesting field of study for long time due to growing importance of halogenated compound in biological compound in biological system, there is an existing and increasing demand for organic compound containing one or two halogen atoms. The damage of bacterial and fungal infections has increased hugely in recent years [1]. Infectious diseases caused by bacterial pathogens have become a main public

health problem due to the extensive occurrence of drug resistance. Resistance to antimicrobial agents has increased health concerns and resulted in mortality and morbidity from treatment failures [2-3].

Chalcones containing plants such as Angelica, Glycyrrhiza piper and ruscus species have been used as medicine in Asia, Africa, and South America[4].Natural Chalcones were not isolated until 1910[5]**.** Several pure Chalcones were approved for chemical use since then. The Chalcones class of compounds is known for their anti-infective especially antifungal, antibacterial, anti-inflammatory, antioxidant, cytotoxic, antitumor, anticancer activities since a long time[6].

Chalcones are natural compounds belonging to the flavanoid family. Chalcones are versatile synthons. They undergo variety of reactions. The presence of α, β unsaturated keto functional group in Chalcones responsible for their biological activity.

Chromones are a group of naturally occurring compounds that are ubiquitous in nature, especially in plants. The word chromone is derived from the Greek word chroma, meaning “color”, which point out that many chromone derivatives can exhibit a diversity of colors [7].

Chromones are heterocyclic compounds with the benzo-γ-pyrone framework. Chromones and their structural analogs are of great interest because of their usefulness as biologically active agents. They have been shown to be tyrosine and protein kinase inhibitors, as well as anticancer [8], neuroprotective [9], anti-AIDS antimicrobial [10], antifungal [11], antioxidant activity [12], interleukin-5 inhibitory activity [13], and antiproliferative agents [14].

General Procedure

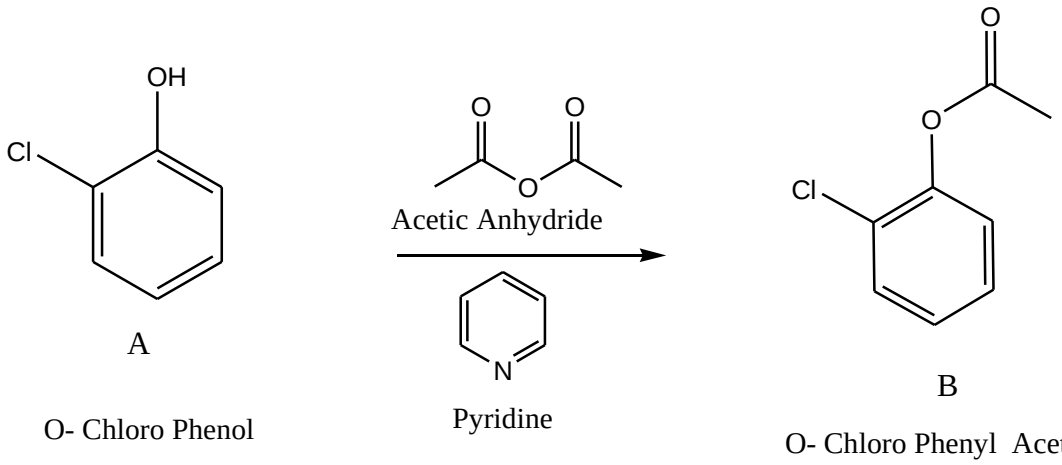
Scheme -1

Step-1. Preparation of o-chloro phenyl acetate from o-chloro phenol

Take a 1 mole of phenol in 100ml conical flask, add 1.2 mole of acetic anhydride and 5ml of pyridine mix the above mixture thoroughly and place overnight at room temperature.

Then poured these solution in crushed ice, add 5-10 drop of conc. HCl. The two layers are separated. Separate organic layer with the help of separating funnel. Wash the

organic layer with cold 1%NaOH. Again wash organic layer with cold water 2-3 times. Then separate organic layer by separating funnel. The liquid product obtained

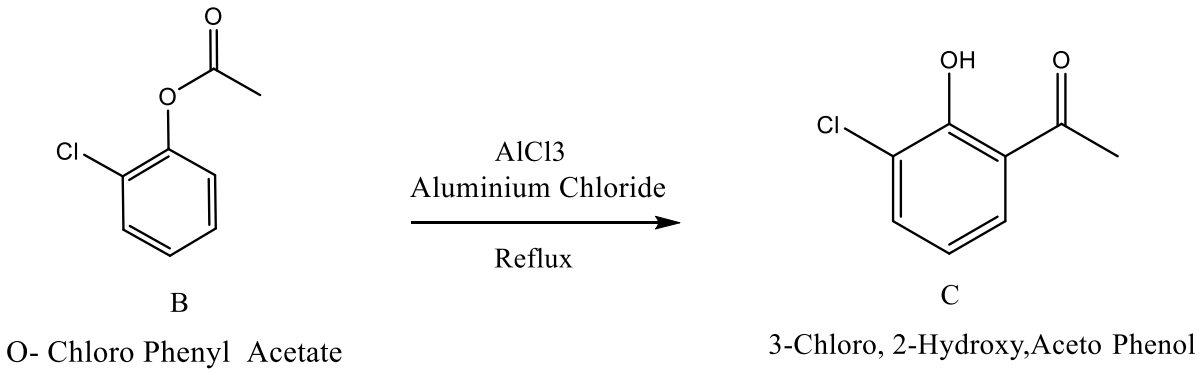


Step -2. Preparation of 3-chloro 2-Hydroxy acetophenone from o-chloro phenyl acetate

Take 1.25 mole of AlCl3 in R.B. add 1 mole of ester dropwise with constant staring. Attach air condenser and then heat these mixture in oil bath (130 -150^{o} C) for about two hour.

Keep the R.B. in ice bath for a two hour then solid product obtained and separate these by simple filtration method and wash with cold water.

Crude product recrystallized in 50% alcohol.

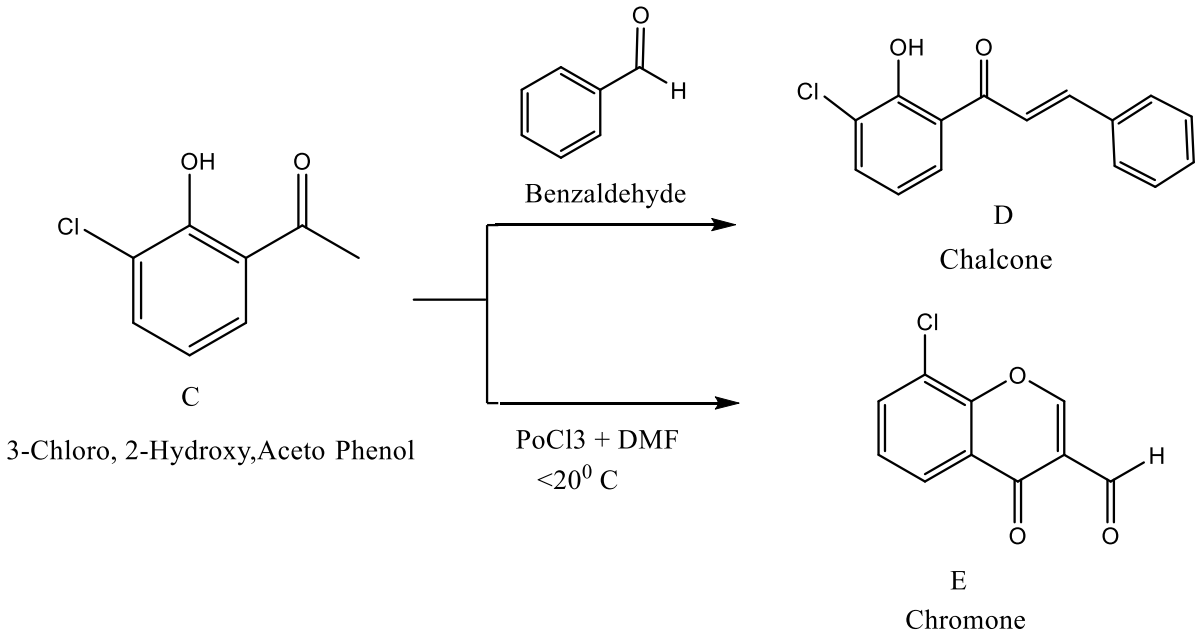


Step -3. Preparation of Chalcone and Chromone from 3-chloro 2-Hydroxy acetophenone

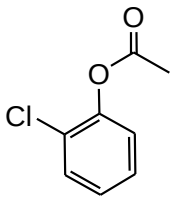
Equimolar amount of Acetone & Benzaldehyde taken in R.B. flask add 25ml EtOH and 2 gm of KOH. Stirr this mixture at room temperature for about 24 Hr.The progress of reaction is monitored by TLC.

After completion of reaction the mixtures was poured in crushed ice and then acidify by con. HCl.

The ppt. is obtained and filter it the solid product is obtained.

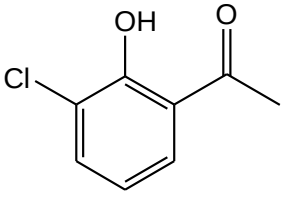


Characterization Table Scheme -1



O- Chloro Phenyl Acetate

B



3- Chloro 2 Hydroxy Acetophenone

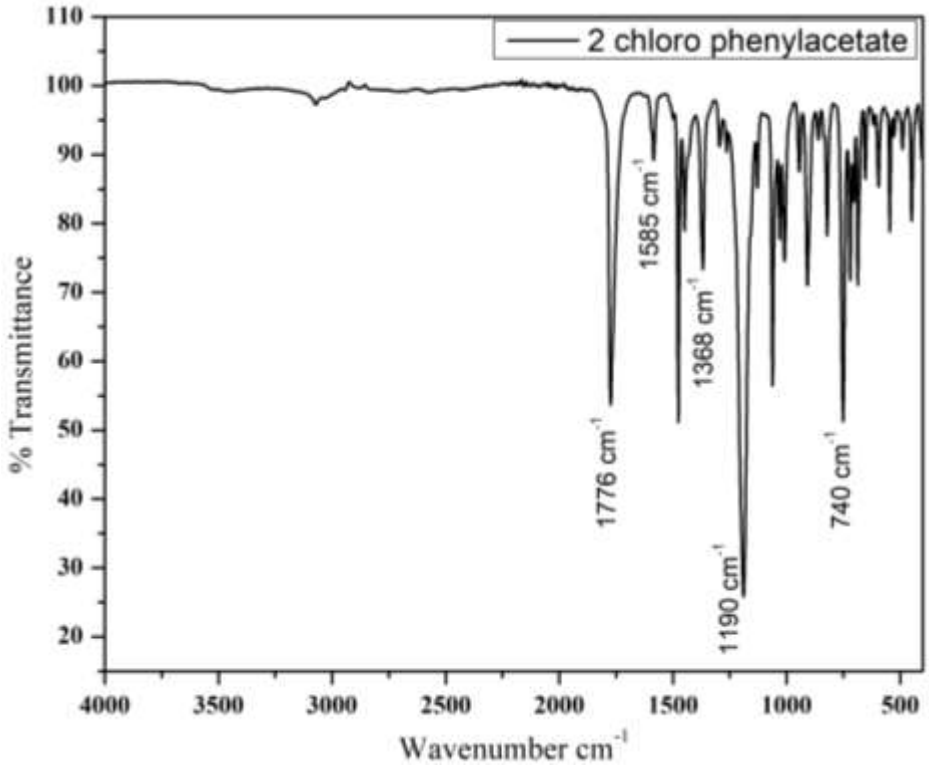
C

Physical constant BP: 218 ^{o}C.

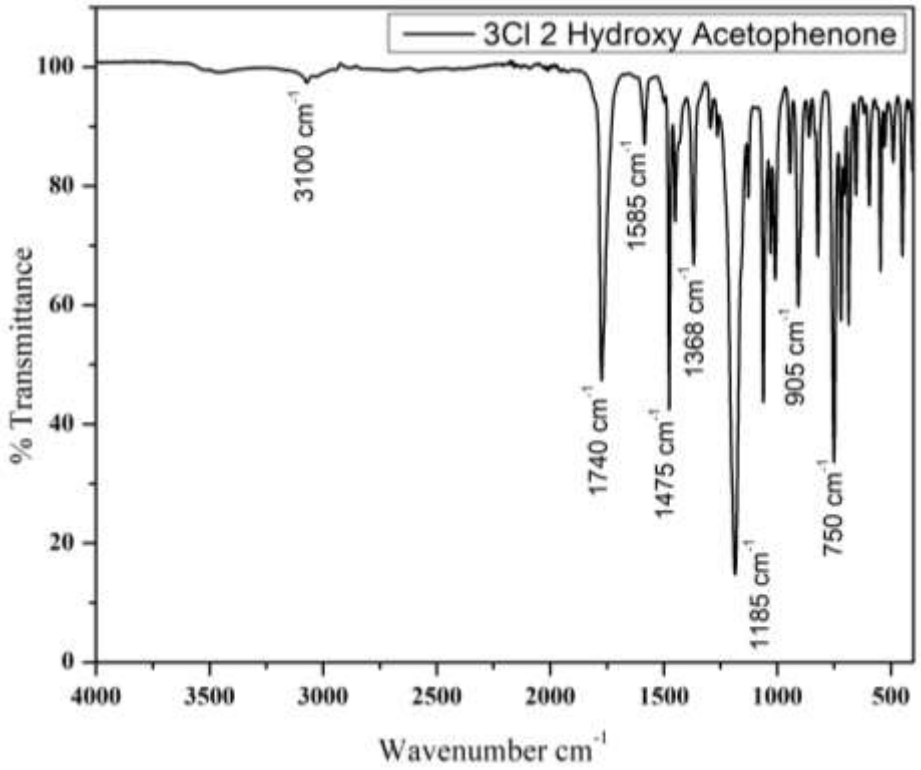
Physical Constant MP: 48 ^{o}C

TLC:	TLC
1. Reactant: O-chloro Phenol 2. Product : O-chlor ophenyl Acetate 3. Solvent system: n hexane	1. Reactant : O-chloro phenyl Acetate 2. Product : 3-Chloro 2Hydroxy Acetophenone 3. Solvent System: alcohol + n hexane
	

IR Spectra:



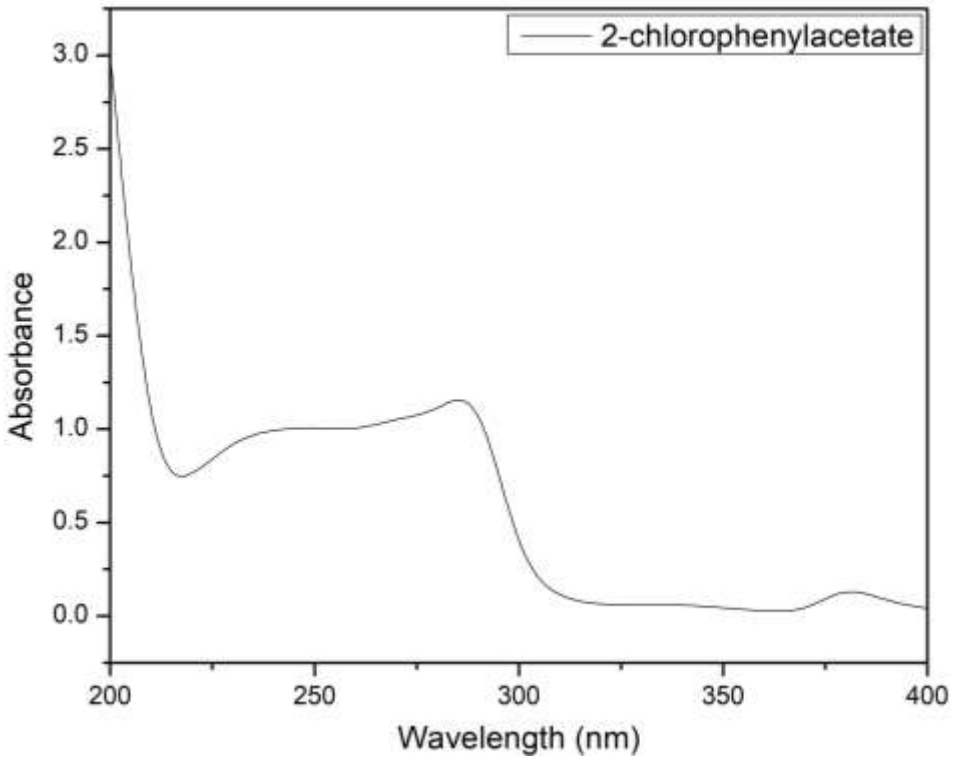
Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
1	1776	1730-1750	RCOOR
2	1585	1480-1600	Benzene
3	1368	1300-1450	C-O Ether
4	1190	1000-1300	Phenolic OH
5	740	735-770	Ortho substitution
6			

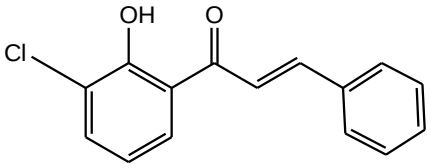


Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
	3100	3000-3400	-OH
	1740	1705-1720	RCOR
	1585	1480-1600	Benzene
	1368	1300-1450	C-O Ether
	1185	1000-1300	Phenolic OH

	905	800-890	Meta substitution
	750	735-770	Ortho substitution

UV Spectra

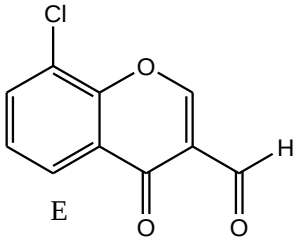




D

(*E*)-1-(3-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one

Chalcone



E

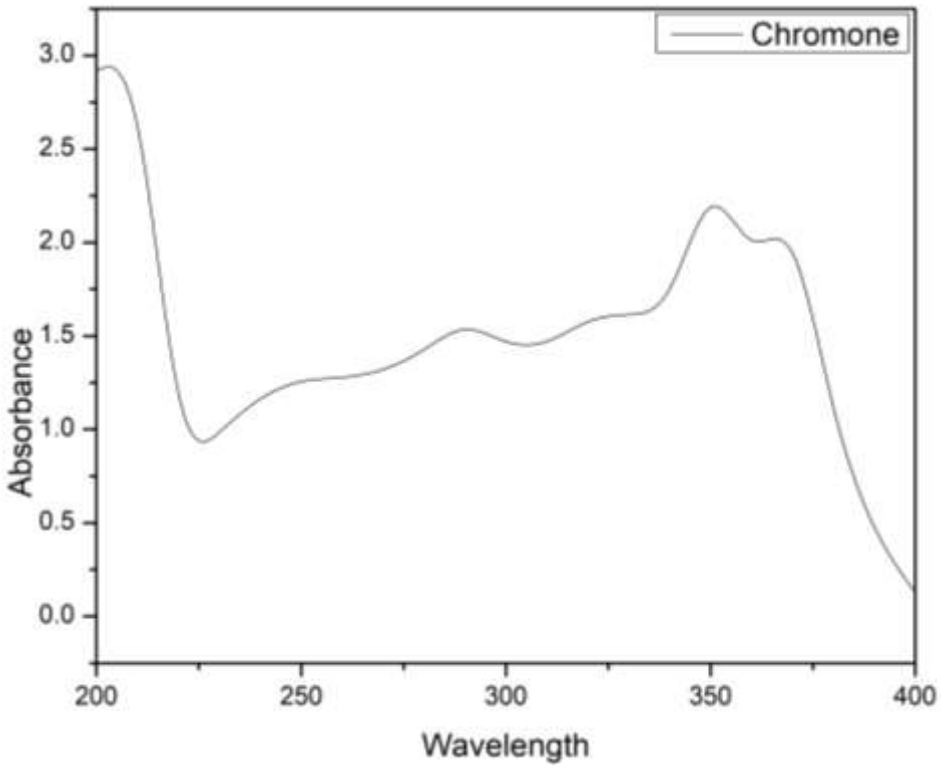
8-chloro-4-oxo-4*H*-chromene-3-carbaldehyde

Chromone

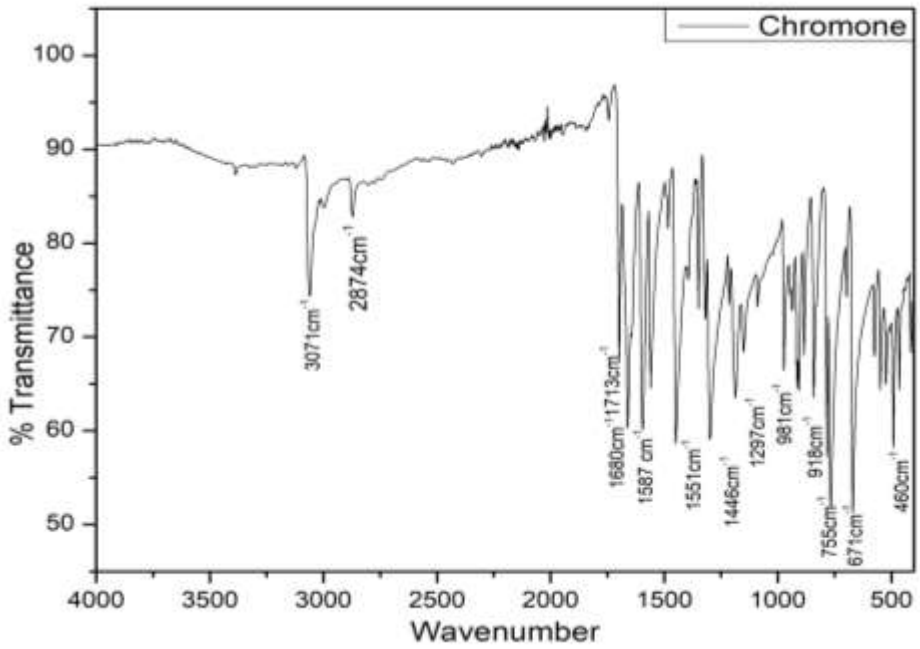
TLC:	TLC

1. Reactant: 3-Chloro 2Hydroxy Acetophenone 2. Product : Chalcone 3. Solvent system: n Hexane	1. Reactant : 3-Chloro 2Hydroxy Acetophenone 2. Product : Chromon 3. Solvent System: Alcohol + n Hexane

UV Spectra:



IR Spectra



Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
1	3071	3000-3400	-OH
2	2874	2800-2900	RCOH stretching
3	1713	1715-1725	RCOH
4	1680	1705-1715	RCOR
5	1587	1480-1600	Benzene
6	1297,1446	1300-1450	C-O Ether
7	1185	1000-1300	Phenolic OH
8	981,918	800-890	Para substitution
9	755,771	735-770	Ortho meta substitution

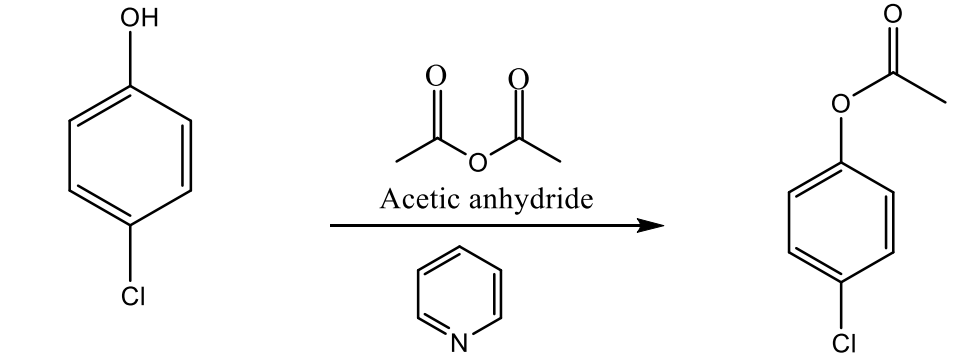
General Procedure

Scheme -2

Step-1. Preparation of p-chloro phenyl acetate from p-chloro phenol

Take a 1 mole of phenol in 100ml conical flask, add 1.2 mole of acetic anhydride and 5ml of pyridine.mix the above mixture thoroughly and place overnight at room temperature.

Then poured these solution in crushed ice, add 5-10 drop of conc.HCl. The two layers are separated. Separate organic layer with the help of separating funnel. Wash the organic layer with cold 1%NaOH. Again wash organic layer with cold water 2-3 times. Then separate organic layer by separating funnel. The liquid product obtained



A
P-Chloro Phenol

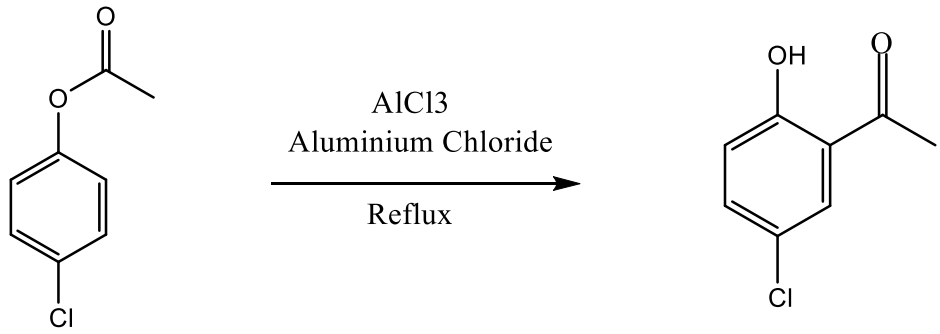
B
P-Chloro-Phenyl Acetate

Step -2. Preparation of 5-chloro 2-Hydroxy acetophenone from p-chloro phenyl acetate

Take 1.25 mole of AlCl3 in R.B. add 1 mole of ester dropwise with constant staring. Attach air condenser and then heat these mixture in oil bath (130 -150^{o} C) for about two hour.

Keep the R.B. in ice bath for a two hour then solid product obtained and separate these by simple filtration method and wash with cold water.

Crude product recrystalised in alcohol.



B
P-Chloro-Phenyl Acetate

C
5-Chloro, 2-Hydroxy Acetophenon

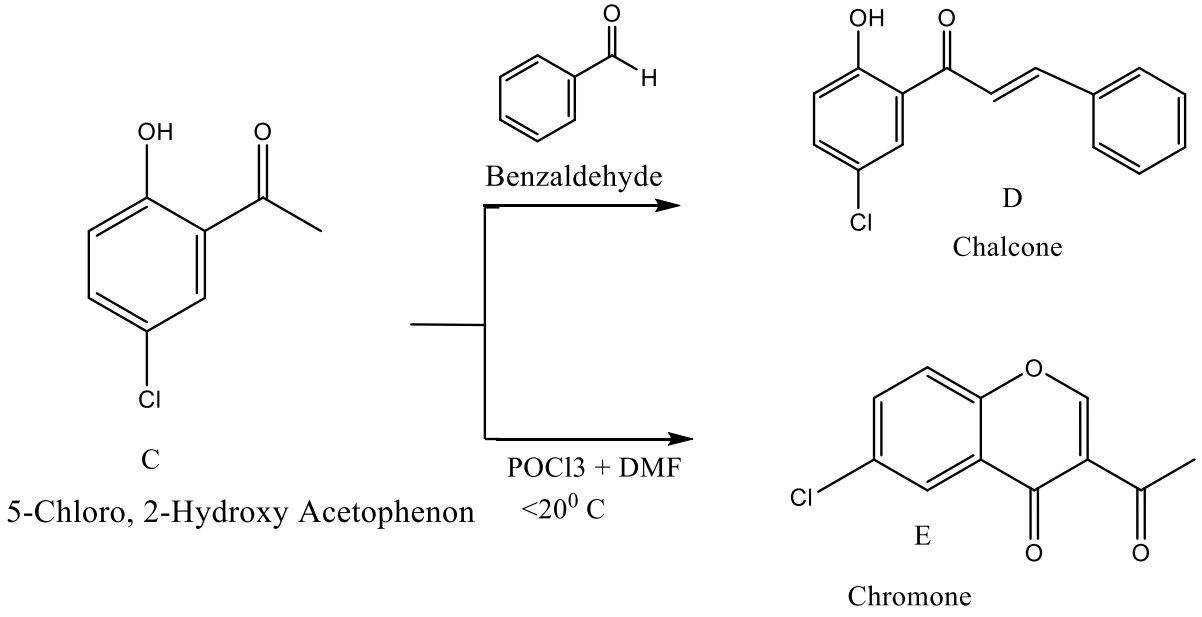
Step-3. Preparation of Chalcone And Chromone from 5-chloro 2-Hydroxy acetophenone

For Chalcone:

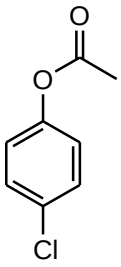
Equimolar amount of Acetone & Benzaldehyde taken in R.B. flask add 25ml EtOH and 2 gm of KOH. Stirr this mixture at room temperature for about 24 Hr.The progress of reaction is monitored by TLC. After completion of reaction the mixtures was poured in crushed ice and then acidify by con. HCl. The ppt. is obtained and filter it the solid product is obtained.

For Chromone:

Equimolar amount of POCl3 (Potassium oxychloride) and DMF (Dimethyl formide) Was added drop wise by maintaining <20^{0}C temp. yellow brown clour crystals was filter. Product wash with ice cold water and recrystallized using ethanol.



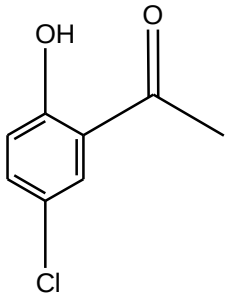
Characterization Table Scheme -2



B

P-Chloro-Phenyl Acetate

Physical constant MP: 232 °C



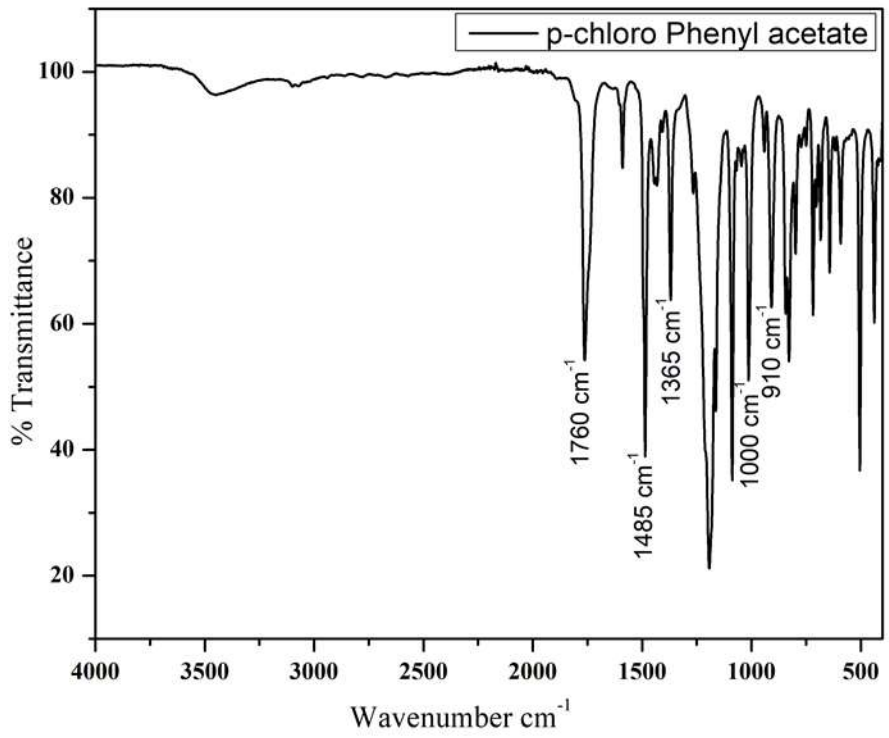
A

3-Chloro5 hydroxy Acetophone

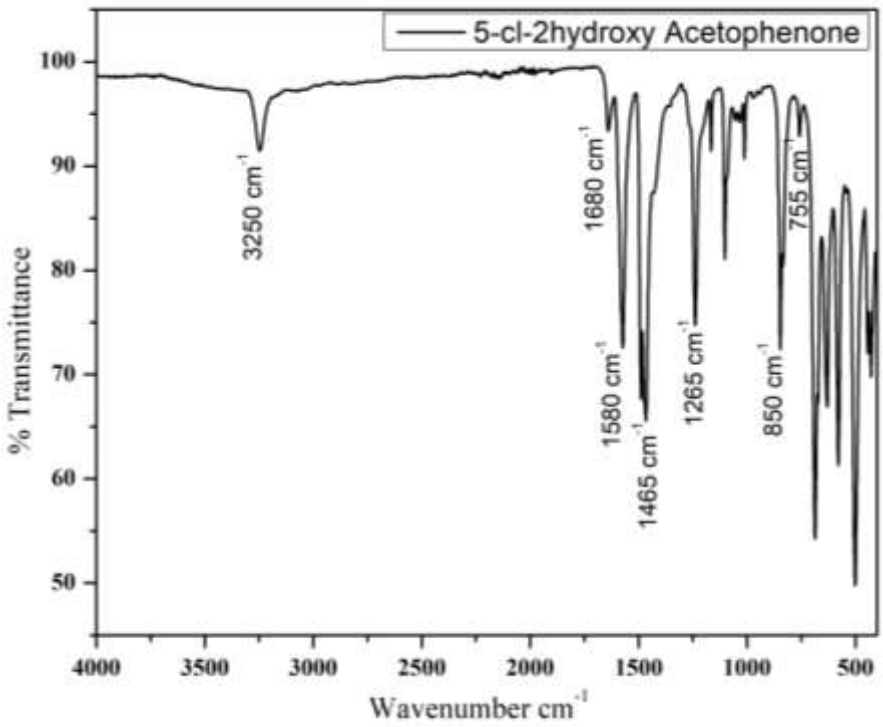
Physical Constant MP: 54 °C

TLC:	TLC
1. Reactant: P-chloro Phenol 2. Product : P-chlor ophenyl Acetate 3. Solvent system:	1. Reactant : P-chloro phenyl Acetate 2. Product :3-Chloro 5Hydroxy Acetophenone 3. Solvent System:
	

IR Spectra:

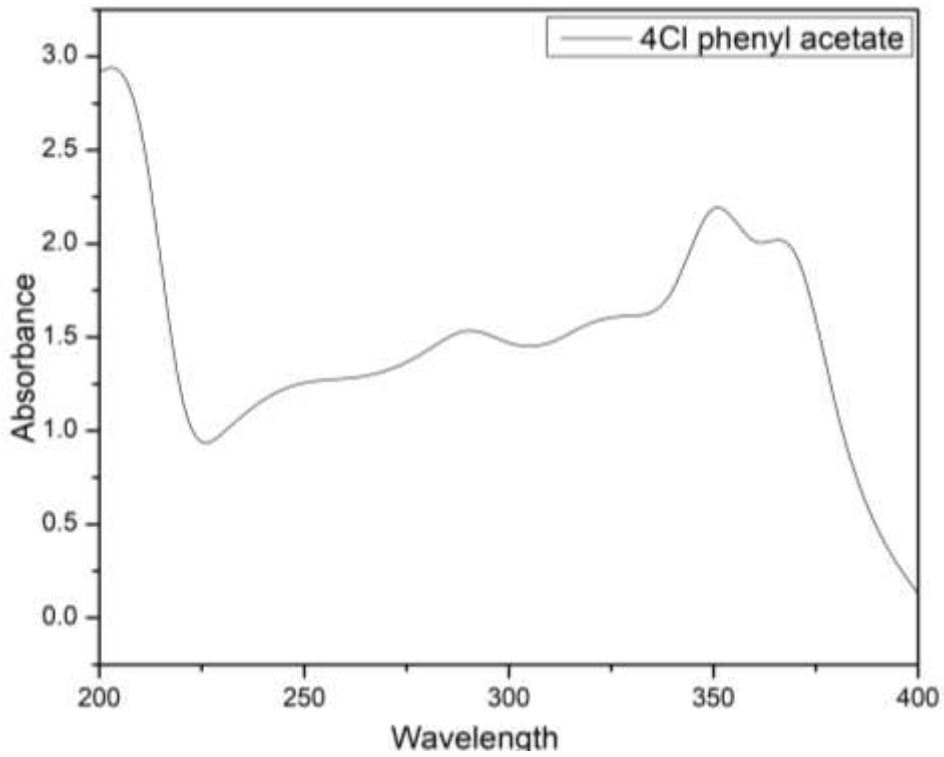


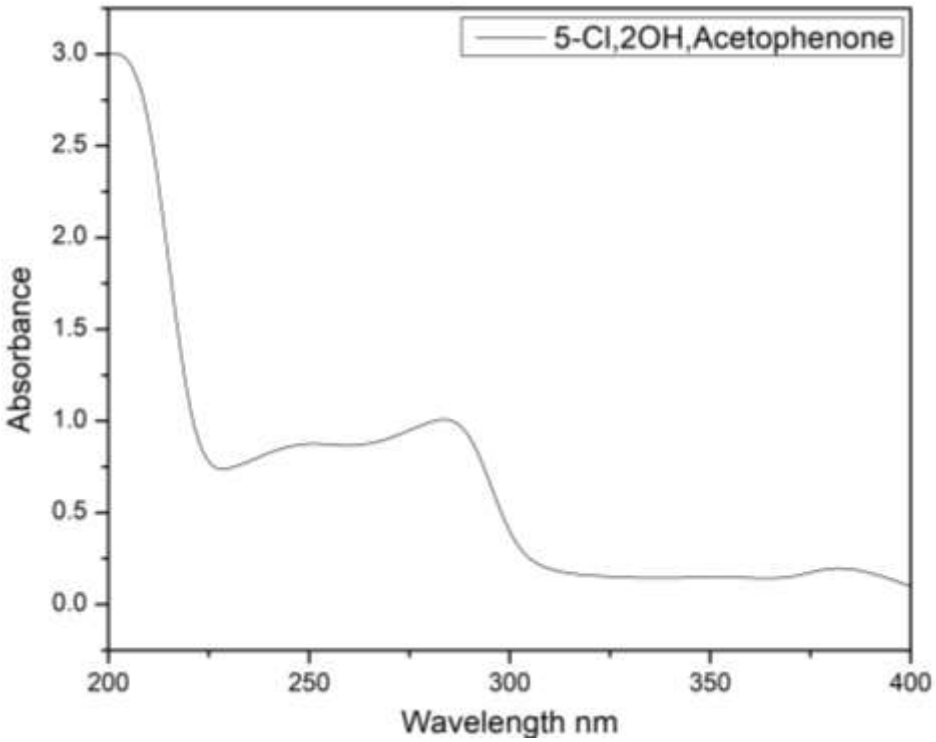
Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
1	1760	1730-1750	RCOOR
2	1585	1480-1600	Benzene
3	1365,1485	1300-1450	C-O Ether
4	1190	1000-1300	Phenolic OH
5	740	735-770	Ortho substitution



Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
	3250	3000-3400	-OH
	1680	1705-1720	RCOR
	1580	1480-1600	Benzene
	1465,1265	1300-1450	C-O Ether
	1185	1000-1300	Phenolic OH
	850	800-890	Meta substitution
	755	735-770	Ortho substitution

UV Spectra:


4Cl phenyl acetate
Absorbance
Wavelength
3.0
2.5
2.0
1.5
1.0
0.5
0.0
200
250
300
350
400


5-Cl,2OH,Acetophenone
Absorbance
Wavelength nm
3.0
2.5
2.0
1.5
1.0
0.5
0.0
200
250
300
350
400

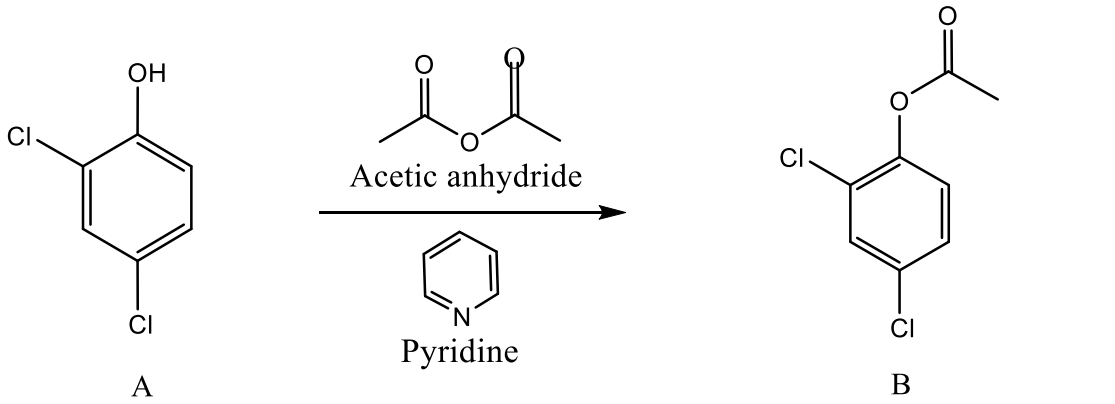
General Procedure

Scheme -3

Step-1. Preparation of 2,4 di-chloro phenyl acetate from 2,4 di-chloro phenol

Take a 1 mole of phenol in 100ml conical flask, add 1.2 mole of acetic anhydride and 5ml of pyridine.mix the above mixture thoroughly and place overnight at room temperature.

Then poured these solution in crushed ice, add 5-10 drop of conc.HCl. The two layers are separated. Separate organic layer with the help of separating funnel. Wash the organic layer with cold 1%NaOH. Again wash organic layer with cold water 2-3 times. Then separate organic layer by separating funnel. The liquid product obtained



A
2,4-di-chlorophenol

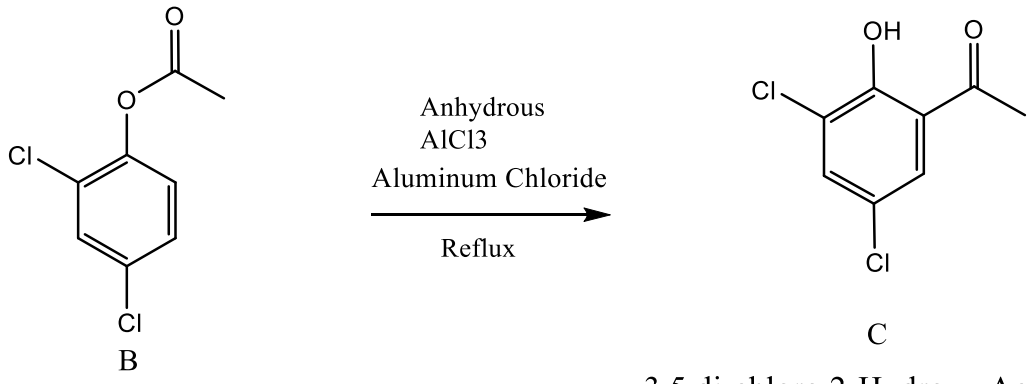
B
2,4-di-chlorophenyl acetate

Step -2. Preparation of 3,5-di-chloro 2-Hydroxy acetophenone from 2,4 di-chloro phenyl acetate

Take 1.25 mole of AlCl3 in R.B. add 1 mole of ester dropwise with constant staring. Attach air condenser and then heat these mixture in oil bath (130 -150^{o} C) for about two hour.

Keep the R.B. in ice bath for a two hour then solid product obtained and separate these by simple filtration method and wash with cold water.

Crude product recrystalised in alcohol.



B

2,4-di-chlorophenyl acetate

C

3,5 di-chloro 2-Hydroxy Acetophenon

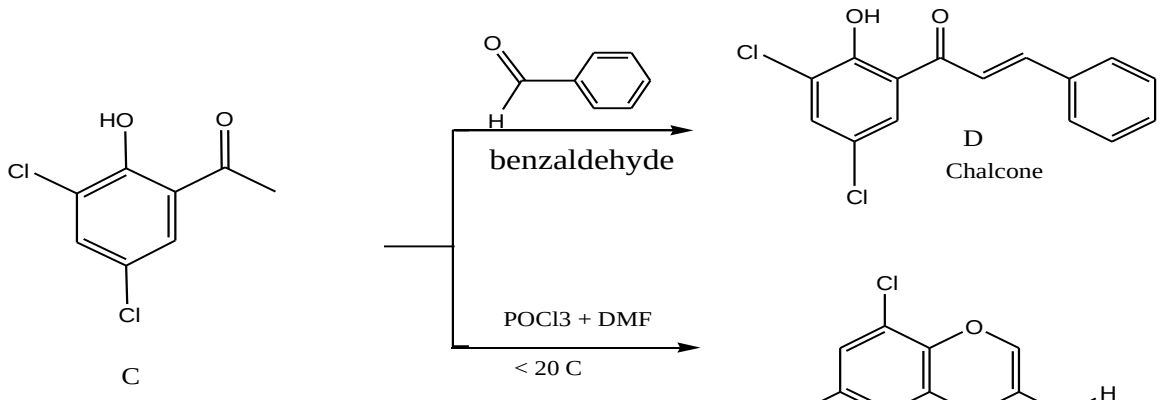
Step-3. (A) Preparation of Chalcone and Chromone from 3,5-di-chloro 2-Hydroxy acetophenone

For Chalcone

Equimolar amount of Acetone & Benzaldehyde taken in R.B. flask add 25ml EtOH and 2 gm of KOH. Stirr this mixture at room temperature for about 24 Hr.The progress of reaction is monitored by TLC. After completion of reaction the mixtures was poured in crushed ice and then acidify by con. HCl. The ppt. is obtained and filter it the solid product is obtained.

For Chromone

Equimolar amount of POCl3 (Potassium oxychloride) and DMF (Dimethyl formide) Was added drop wise by maintaining <20^{0}C temp. yellow brown color crystals was filter. Product wash with ice cold water and recrystallized using ethanol.



C

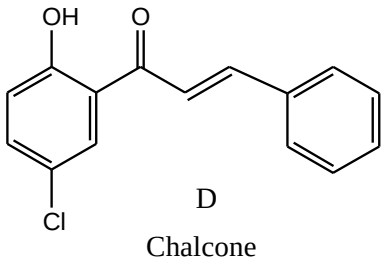
3 ,5, di-chloro 2-Hydroxy Acetophenon

D

Chalcone

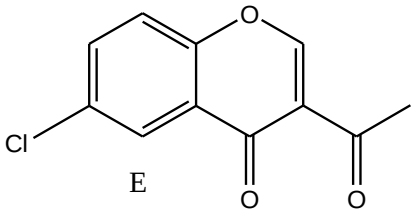
E

Chromone



D

Chalcone



E

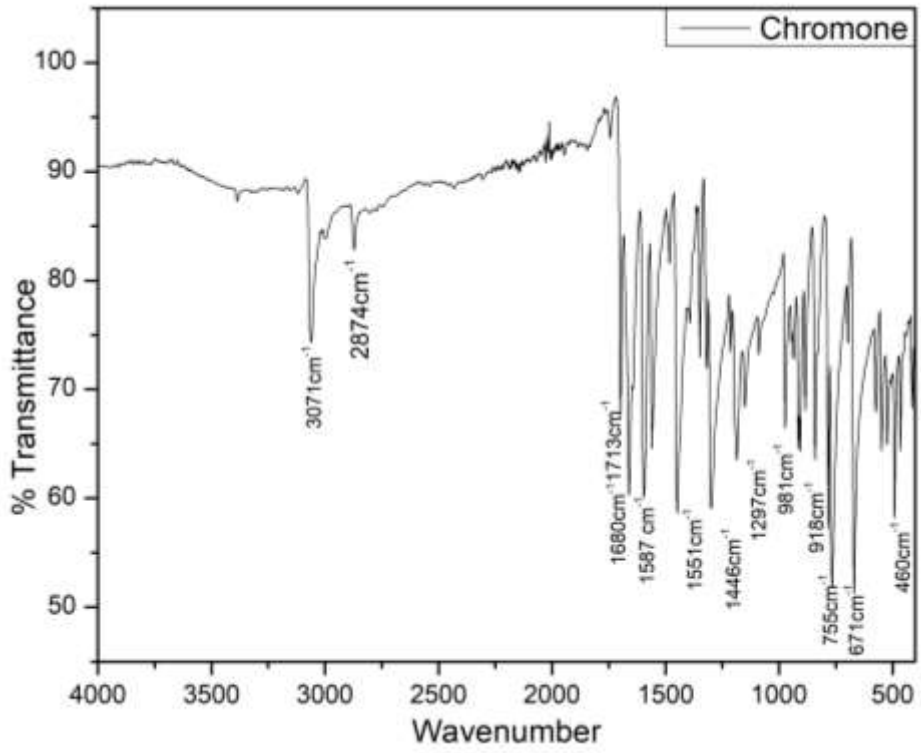
Chromone

Physical constant MP:

Physical Constant MP:

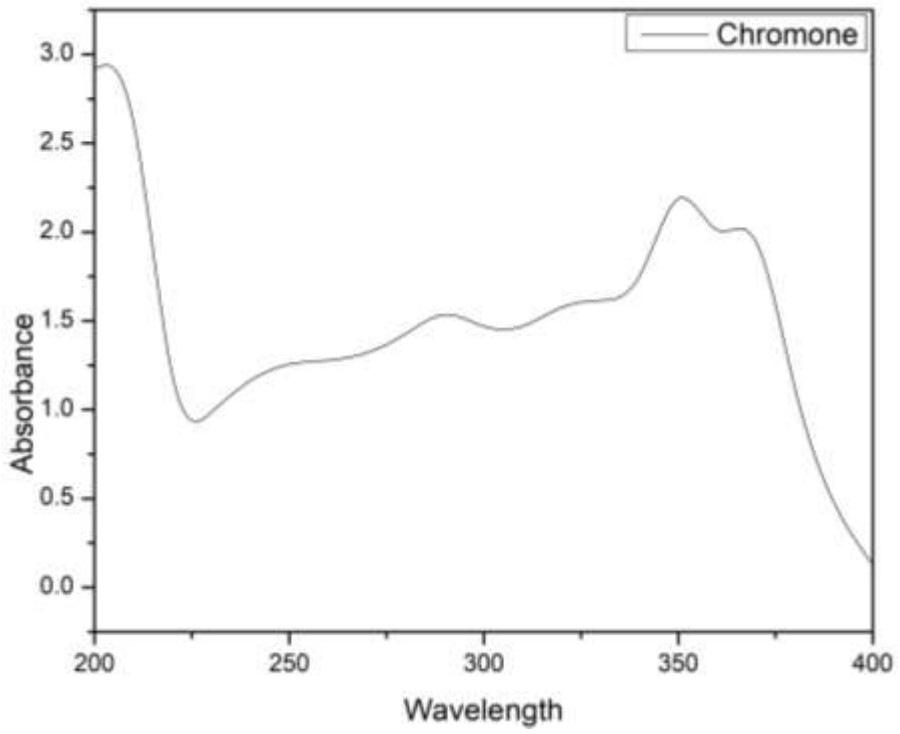
TLC:	TLC
1. Reactant: P-chloro Phenol 2. Product : P-chlor ophenyl Acetate 3. Solvent system:	1. Reactant : P-chloro phenyl Acetate 2. Product :3-Chloro 5Hydroxy Acetophenone 3. Solvent System:
	

IR Spectra:



Sr. No.	IR (in cm^{-1})	IR frequency	Functional group
	3071	3000-3400	-OH
	2874	2800-2900	RCOH stretching
	1713	1715-1725	RCOH
	1680	1705-1715	RCOR
	1587	1480-1600	Benzene
	1297,1446	1300-1450	C-O Ether
	1185	1000-1300	Phenolic OH
	981,918	800-890	Para substitution
	755,771	735-770	Ortho meta substitution

UV Spectra:



References

1. *K. Bush, P. Courvalin, G. Dantas, J. Davies, B. Eisenstein, P. Huovinen, G.A. Jacoby, R. Kishony, B.N. Kreiswirth, E. Kutter, S.A. Lerner, S. Levy, K. Lewis, O. Lomovskaya, J.H. Miller, S. Mobashery, L.J. Piddock, S. Projan, C.M. Thomas, A. Tomasz, P.M. Tulkens, T.R. Walsh, J.D. Watson, J. Witkowski, W. Witte, G. Wright, P. Yeh, H.I. Zgurskaya, Tackling antibiotic resistance, Nat. Rev. Microbiol. 9 (2011) 894-896.*
2. *S.B. Levy, B. Marshall, Antibacterial resistance worldwide: causes, challenges and responses, Nat. Med. 10 (2004) S122-S129.*
3. *C. Ghosh, J. Haldar, Membrane-active small molecules: designs inspired by antimicrobial peptides, Chem. Med. Chem. 10 (2015) 1606-1624.*
4. *Bown D; "Encyclopedia of Herbs and Their Uses", **1995**, Dorling Kindersley Publishing, Inc., New York.*
5. *Shimokoriyama M; "Flavonnes, Chalcones and Aurones" **1992,** the Mac Millan Company, New York.*

6. *Vibhute Y.B. and Basser M.A., **2003**, Synthesis and activity of a new series of Chalcones as antibacterial agents, Indian J. Chem.,*
7. *Sons, Inc.: New York, 1977; Vol. 31, pp 1-10. (b) Edwards, A. M.; Howell, J. B. L. Clin. Exp. Allergy 2000, 30, 756*
8. Nam, D.H.; Lee, K.Y.; Moon, C.S.; Lee, Y.S. Synthesis and anticancer activity of chromone-based analogs of lavendustin A. *Eur. J. Med. Chem.* **2010**, *45*, 4288–4292.
9. *Groweiss, A.; Cardellins, J.H.; Boyd, M.R. HIV-inhibitory prenylated xanthones and flavones from Maclura tinctoria. J. Nat. Prod. 2000, 63, 1537–1539.*
10. *Deng, Y.; Lee, J.P.; Ramamonjy, M.T.; Synder, J.K.; Des Etages, S.A.; Kanada, D.; Synder, M.P.; Turner, C.J. New antimicrobial flavones from Physen madagascariensis. J. Nat. Prod. 2000, 63, 1082–1089.*
11. *Ma, W.G.; Fuzzati, N.; Shao Long, L.; de Shun, G.; Hostettmann, K. Further chromones from Eriosema tuberosum. Phytochemistry 1996, 43, 1339–1343.*
12. *Pietta, P.J. Flavonoids as antioxidants. J. Nat. Prod. 2000, 63, 1035–1042.*
13. *39. Thanigaimalai, P.; Lee, K.C.; Sharma, V.K.; Yun, J.H.; Kim, Y.; Jung, S.H. Design and synthesis of novel hydroxyalkylaminomethylchromones for their IL-5 inhibitory activity. Bioorg. Med.Chem. 2010, 18, 4625–4629.*
14. *Shaw, A.Y.; Chang, C.Y.; Liau, H.H.; Lu, P.J.; Chen, H.L.; Yang, C.N.; Li, H.Y. Synthesis of 2-styrylchromones as a novel class of antiproliferative agents targeting carcinoma cells.Eur. J. Med. Chem. 2009, 44, 2552–2562.*