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SYNTHESIS, CHARACTERIZATION AND ANTI-MICROBIAL ACTIVITY OF 2,5DIMETHYL PYRROLE

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Abstract:

Aim: Synthesis of some pyrrole derivatives from condensation of acetonylacetone with ammonium carbonate Yields the 2,5 Dimethyl pyrrole and evaluate the potential antimicrobial activity.

Method: Reflexation of acetonylacetone with ammonium carbonate with the support of oil bath at 100 °Caround 60 minutes on cooling reaction mixture.The yellow layer is separated and extracted with chloroform on evaporation of chloroform we yield product .

Result:This molecules exhibits moderate to good antimicrobial activity .Which are comparable to standards used in this study.

Conclusion:The result of 2,5 Dimethylpyrrole indicates that a number of this molecules exhibits moderate to good antibacterial ,antifungal activities and this class of compounds as potential leads towards antimicrobial agents .

Keywords: *Dimethylpyrrole,Reflux,Antimicrobial.*

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INTRODUCTION:

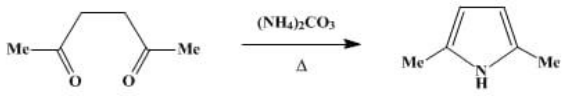
2,5 di-methylpyrrole is a heterocyclic organic compound with the chemical formula C6H9N.It consists of a five-membered ring containing one nitrogen atom and two methyl groups attached at the 2 and 5 positions. This compound is a derivative of pyrrole, a well-known aromatic compound. Pyrrole is a natural product found in Coffea arabica, Nicotiana tabacum and other organisms . It is present in the amino acids proline and hydroxyproline and in coloured products, such as chlorophyll , heme (a part of hemoglobin) and the bile pigments. Pyrrole compounds also are found in alkaloids, a large class of alkaline organic nitrogen compounds produced by plants.2,5-dimethylpyrrole is often used in organic synthesis and pharmaceutical research due to its structural versatility and biological activity.2,5-dimethyl pyrrole exhibits aromatic character due to the delocalization of pi electrons within the ring. It finds application in material science ,including development of dyes, polymers ,electronic materials.The discovery of pyrrole ,the parent compound of 2,5 dimethyl pyrrole , dates back to the 19th century. Pyrrole it self as a long history and occurs naturally in certain biological systems.It was first isolated by Scottish chemist Thomas Anderson in 1834 from crude pyrolysis oil,derived from bone oil .

It can be synthesized through various methods ,including condensation of 1,4-diaminobutane with α-keto acids or via the Paal-Knorr synthesis from 1,4-diketones and ammonia or primary compounds were confirmed by IR, H-NMR and elemental analysis.It is commonly used as a building block in the synthesis of various organic compounds including pharmaceuticals ,agrochemicals and specialty chemicals.It hassome pharmacological properties such as antimicrobial, antimalarial, antiviral, antiinflammatory, antidiabetic, antituberculosis, anticancer.

Some derivatives of 2,5-dimethylpyrrole exhibit biological The reaction pathway of many Paal-Knorr reactions for pyrrolic compounds hasn't been thoroughly studied and remains controversial. In this work, the synthesis of an important anti-ultraviolet agent N-butoxycarbonyl-2,5-dimethylpyrrole based on the Paal-Knorr reaction was studied via in-situ Fourier transform infrared (FTIR) analysis combined with density functional theory (DFT) calculation. The online spectral data were analyzed using K-means clustering in order to find the characteristic wavenumbers of intermediates. It was found that the reaction with 2,5-hexadione and butyl carbamate are more favorable to form the imine and enamine intermediates by nucleophilic addition, which is different from another Paal-Knorr reaction with 2, 5-hexadione and ethanolamine. In addition, the reaction kinetic model was established through chemometric methods, with parameters of two rate-limiting reaction steps calculated. This approach of FTIR analysis is proven to be an effective tool for mechanism study of organic synthesis. development.It can undergo various chemical reactions such as electrophilic aromatic substitution,nucleophilic addition and oxidation reactions,leading to the formation of different derivatives and products.Like many organic compounds ,proper handling and safety precautions are necessary due to its potential hazards,including flammability and toxicity.

EXPERIMENTAL WORK:

1. In a 500 ml round bottom Flask ,fitted with an water-cooled condenser of large bore are placed 10 g of acetonylacetone and 20 g ammonium carbonate in lumps.
2. The mixture is heated in an oil bath at room temp until effervescence stops; this requires 1 hour .
3. The mixture is cooled and the upper yellow layer of pyrrole is separated and lower layer is extracted with 15ml of chloroform ,which is added to the crude drug pyrrole.
4. The whole is dried over anhydrous calcium chloride 2,5 dimethyl pyrrole is collected .



Acetonylacetone 2,5dimethylpyrrol

ANTIMICROBIAL ACTIVITY:

In vitro antimicrobial activities of the pyrrole derivatives were determined against different microorganism. The microbial strains Escherichia coli ,Pseudomonas aeruginosa ,Salmonella typhi, Rhizopus stolonifera, Bacillus subtilis, Aspergillus flavus ,Bacillus cereus ,Aspergillus niger were obtained from spoiled food then cultured it.

* The bacteria and fungal strains were maintained on nutrient agar at 37°C.

How we developed culture media:

The materials required :

Agar
Water
Cotton swabs
Petri dish plates

METHOD:

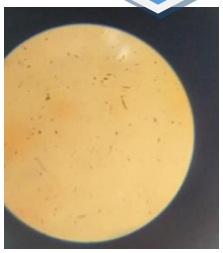
- Pour 10 g of agar into 330 ml of water
- Stir the solution until it is completely dissolved
- Put the solution into microwave
- Set the timer for 4 mins
- Take the solution out and let it cool down for 3 mins
- Now pour the solution into petridishesh. After 1 hour ,the solution is solidify
- Use a cotton swab to collect to microbes .Gently rub the surface of petridish in zig zag pattern turning the dish 2-4 times for maximum coverage.
- And put it in warm dark place at room tempareature .In 3-7 days small bacterial colonies were grown with different colours and texture .

Preparation of inoculums:

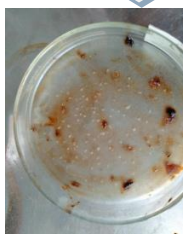
For bacteria:

The bacterial strains are collected from spoiled rice which are grown at 37°C for 5 days and transferred into petridish.By adding 2-3 drops of drug into the dishes under the laminar air flow .Leave it for 2 days.We noticed that the inhibition of bacteria under the microscope .

Bacterial growth



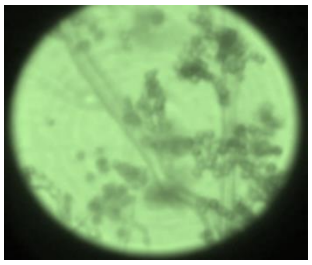
Bacteria under microscope



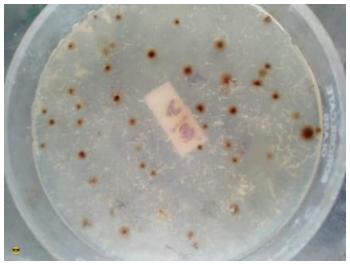
Inhibition of bacteria

For fungus: The fungal inoculums were prepared from 5 days old culture grown on bread mould .We noticed a furry growth appearing on the bread then we transferred into petridish. .By adding 2-3 drops of drug into the dishes under the laminar air flow. Leave it for 2 days.We noticed that the inhibition of fungus under the microscope.

Fungus growth



Fungus under microscope



Inhibition of fungus

MICROBROTH DILUTION ASSAY:

Minimum Inhibitory Concentration (MIC) determination was carried out using micro broth dilution method as per NCCLS guidelines. The test was performed in 96-well culture plates (Hi-media). The compounds were dissolved in DMSO to make eight different concentrations viz. 25, 12.5, 6.25, 3.125, 1.56, 0.78, 0.39, 0.195 mg/ml in the wells by twofold dilution method. Additional dilutions 1, 0.5, 0.25, 0.125, 0.0625, 0.03125, 0.0156, 0.0078 mg/ml were prepared for the compounds 7f, 7j & 7k for A. Fumigates, since these compounds did not show MIC in the concentration range 25–0.195 mg/ml. Negative

Compound	p.aeruginosa	E.coli	K.pneumoniae	S.typhi	B.subtilis	A.niger	A.fumigatus	A.flavu
7a	1.56	1.56	6.25	1.56	3.125	1.56	0.78	0.78
7b	6.25	12.50	12.50	0.78	6.25	0.39	25	6.25
7c	12.50	12.50	6.25	3.125	6.25	0.39	6.25	6.25
7d	0.39	25	0.39	0.195	6.25	6.25	0.78	3.125
7e	12.50	12.50	3.125	12.50	12.50	6.25	0.78	3.125
7f	6.25	6.25	6.25	6.25	6.25	1.56	0.125	1.56
7g	12.50	12.50	12.50	3.125	6.25	0.39	3.125	1.56
7h	12.50	6.25	3.125	12.50	12.50	6.25	0.78	3.125
7i	12.50	6.25	12.50	12.50	12.50	6.25	1.56	6.25
7j	6.25	12.50	6.25	6.25	6.25	6.25	0.125	3.125
7k	1.56	1.56	1.56	1.56	6.25	6.25	0.125	6.25
7l	6.25	12.50	6.25	1.56	6.25	25	6.25	6.25
Tetracycline	0.00125	0.01	0.000312	0.01	0.00125	-	-	-
Amphotericin -n B	-	-	-	-	-	0.00125	0.000156	0.0001

control was prepared using Dimethyl sulphoxide (DMSO) and same concentrations, up to 0.000156 mg/ml, of Tetracycline and Amphotericin B were prepared and used as positive control for bacteria and fungi respectively. The 96 well plates were incubated for 24 h and 48 h at 37 °C for bacteria and fungi correspondingly. All such experiments were repeated thrice. The lowest concentration of each compound which inhibited any visual growth was considered to be the MIC of that respective compound.Results activities are summarized in table.

Antimicrobial activities [MIC mg/ml] of compounds

Aim and objective:

Aim: synthesis, characterization, and biological activity of 2,5 dimethyl pyrrole .

Objective: The objective of the present study was to synthesis a 2,5 dimethyl pyrrole and to evaluate its invitro antimicrobial activities.

CONCLUSION:

The outcome indicates that there is a good scope of evaluation of these class of compounds as potential leads towards antimicrobial activity. The results revealed significant inhibitory effects of 2,5 dimethyl pyrrole against several bacterial strains ,including gram +ve and gram -ve Bacteria and as well as fungal .

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