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Synthesis and photochemical study of 1- (3-methyl -6- hydroxy benzofuran-2-yl)-carbohydrazide-3- chloro -4- phenylazetid-2-one

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New benzofuran derivative 1- (3-methyl -6- hydroxy benzofuran-2-yl)-carbohydrazide-3- chloro -4- phenylazetid-2-one was synthesized and after photochemical reaction 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one was obtained in the present work. The structure of the product was characterized by spectral data.

Keyword: Synthesis, Photochemical reaction, Benzofuran derivative.

1. Introduction

The benzofuran ring system itself is a common structure element that appears in a large number of medicinally important compounds ^[1]. The benzofuran nucleus is widely distributed in natural products particularly among plant kingdom. In the chemistry of benzofurans in a large number of natural products has attracted due to their biological activities and their potential application as pharmacological agents ^[2]. Various benzofuran derivatives possess different pharmacological and biological activities of which the most potent is Anti-Bacterial and Anti-Fungal activity ^[3], Anti-inflammatory Activity ^[4], Anti-HIV activity ^[5], Antitubercular activity ^[6], Antidiabetic activity ^[7], Antidepressant Activity ^[8], Anti-Oxidant Activity ^[9], Anticonvulsant activity ^[10], Analgesic activity ^[11], Inhibitory Activity on Acetylcholinesterase ^[12]. Benzofuran compounds are associated with various physiological and biological properties and thus find important use in various therapeutic areas in medicine. In nature's collection of biologically active heterocycles, benzo[b]furan derivatives constitutes a major group. They are usually important constituents of plant extracts used in traditional medicine ^[14].

2. Material and Methods

2.1 Sample collection

All the melting points were determined in open capillaries. Thin layer chromatography was performed on microscopic slides (2x7.5 cm) coated with silica-Gel-G and spots were visualized under resembling iodine. IR spectra of all compounds were recorded in KBr on FT-IR spectrophotometer using KBr. The ¹H-NMR was recorded on Bruker advanced NMR 400 MHz instruments using CDCl₃ as solvent. Mass spectra were obtained using mass spectrometer.

2.1. Preparation of 3-methyl-6-hydroxy-2-ethoxy carbonyl benzofuran: 2, 4 dihydroxy acetophenone (3 ml) was taken in a round bottom flask and 10 ml of acetone and K₂CO₃ (3 gm) crystals were added to it, the reaction mixture was stirred for 5 minutes in ice-bath. To this reaction mixture ethyl bromo acetate (2.8 ml) was added drop by drop from dropping funnel about 10 minutes. Further whole reaction mixture was allowed to stir for 20 minutes with catalytic amount of potassium iodide. The resultant solution was poured in crushed ice, the solid obtained was filtered and recrystallized from

ethanol to produced 3-methyl-6-hydroxy-2-ethoxy

carbonyl benzofuran.

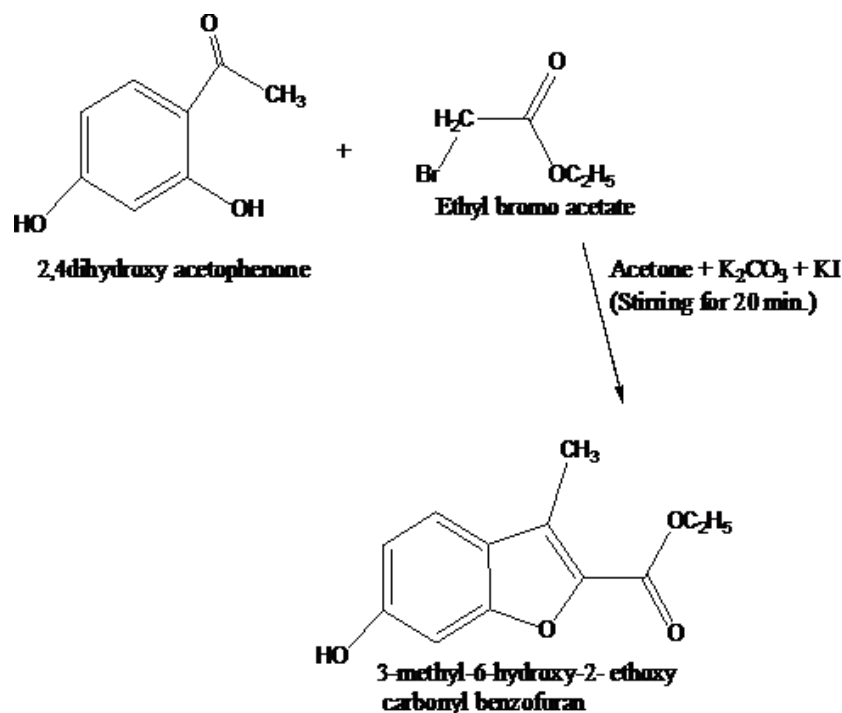


Fig 1: Reaction of reparation of 3-methyl-6-hydroxy-2-ethoxy carbonyl benzofuran

2.2. Preparation of 3-methyl-6-hydroxy-2-benzofurancarbohydrazide:

3-methyl-6-hydroxy-2-ethoxy carbonyl benzofuran (3gm) was taken in a round bottom flask dissolved in 25ml ethanol and catalytic amount of acetic acid was added. To the above solution, hydrazine hydrate (1ml) was added drop wise. The mixture

was stirred at room temperature for about 2 hours. After completion of the reaction as indicated by thin layer chromatography (1:1:: Benzene: Hexane solvent system), the 3-methyl-6-hydroxy-2-benzofurancarbohydrazide formed was recrystallized from ethanol.

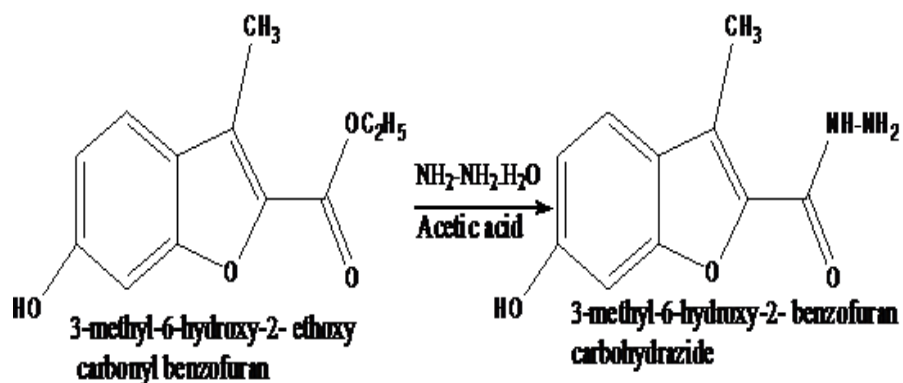


Fig 2: Reaction of preparation of 3-methyl-6-hydroxy-2-benzofurancarbohydrazide

2.3. Preparation of 3-methyl-6-hydroxy -N'-(phenylmethylene) benzofuran-2-carbohydrazide:

3-methyl-6-hydroxy-2-benzofurancarbohydrazide (1.9 gm) was treated with benzaldehyde (1 ml) in

ethanol, in the presence of catalytic amount of acetic acid producing 3-methyl-6-hydroxy -N'-(phenylmethylene) benzofuran-2-carbohydrazide .

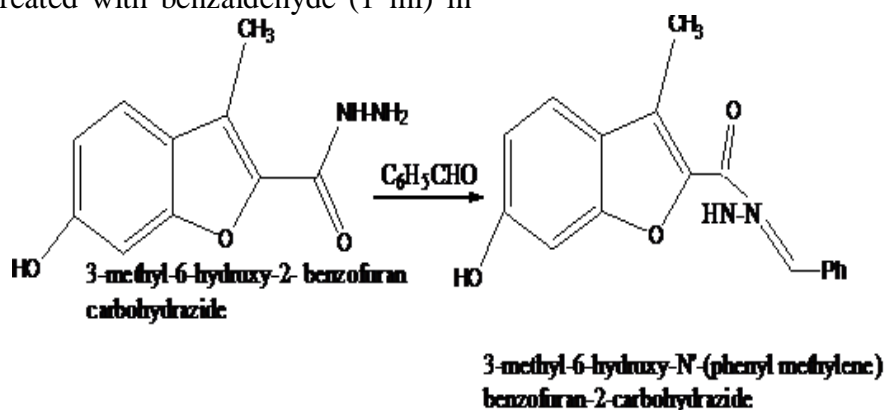


Fig 3: Reaction of Preparation of 3-methyl-6-hydroxy -N'-(phenylmethylene) benzofuran-2-carbohydrazide

2.4. Synthesis of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one:

The 3-methyl-6-hydroxy -N'-(phenylmethylene) benzofuran-2-carbohydrazide (2.5 gm) in Dioxane (25ml) in the presence of triethylamine (0.2 ml) was refluxed with chloroacetyl chloride (2 ml) for 4-5 hours. After the completion of the reaction by

confirmation with thin layer chromatography (1:1:: Benzene: Hexane solvent system), the reaction mixture was cooled ,poured into crushed ice, the solid obtained of 1-(3-methyl-6-hydroxy benzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one was recrystallized from ethanol. Yield: - 3 gms, Melting Point: - 130 $^{\circ}C$ was reported.

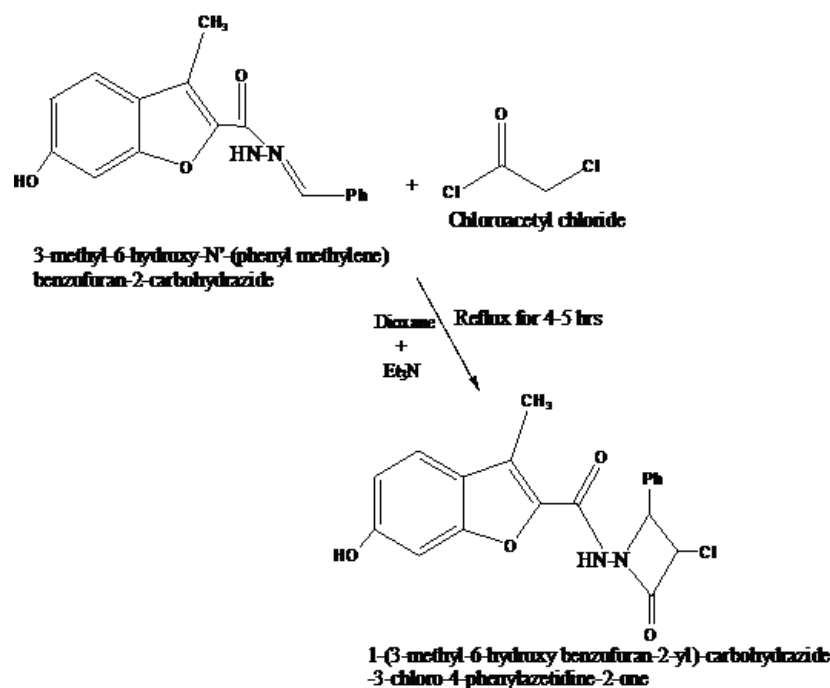


Fig 4: Reaction of Synthesis of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one

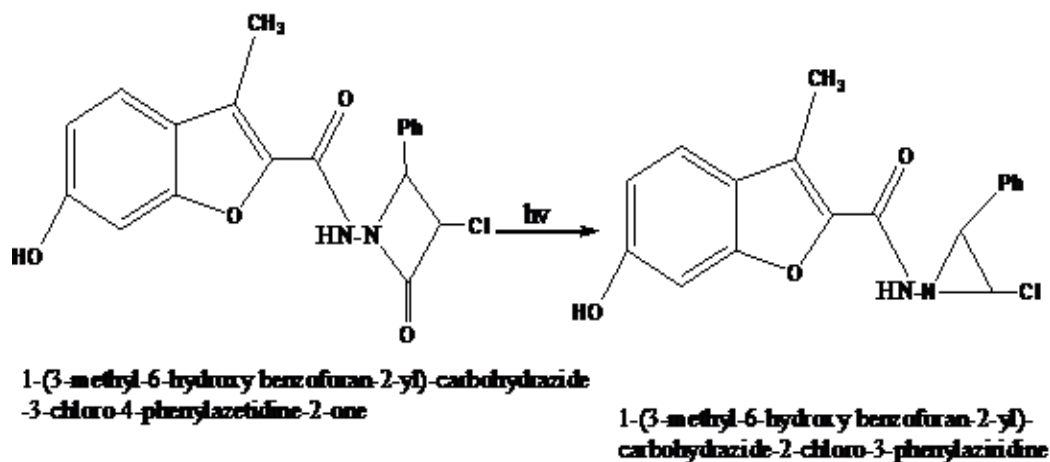


Fig 5: Photochemical reaction of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenylazetidine-2-one

The fragmentation pattern is as follows: - Molecular formula- $C_{18}H_{15}N_2O_3Cl$

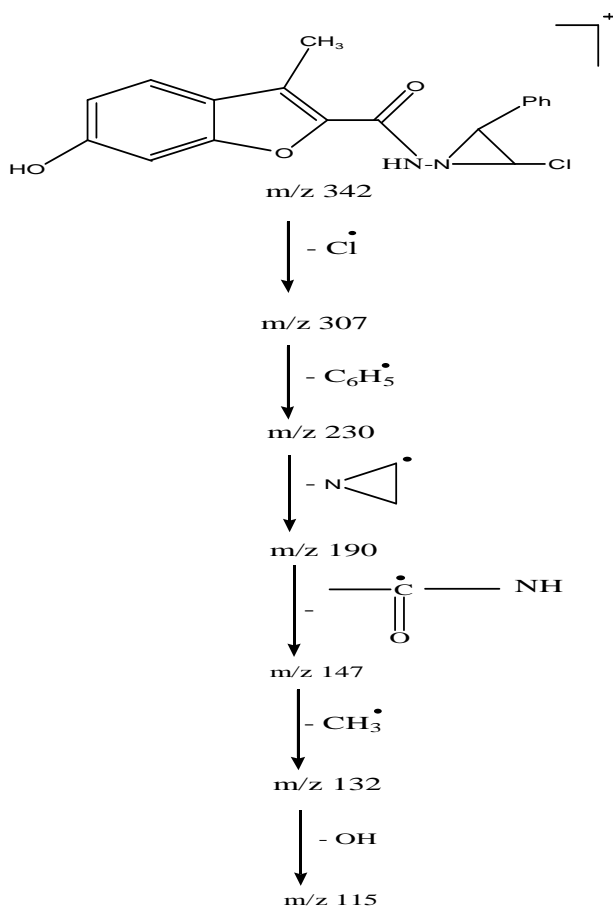


Fig 6: The fragmentation pattern of 1-(3-methyl-6-hydroxybenzofuran-2-yl)carbohydrazide-2-chloro-3-phenylaziridine

2.5. Photochemical reaction of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one with ultraviolet light:

A sample of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidin-2-one (0.5gms) was dissolved in a small volume of dry benzene and then made up to 500 ml of benzene. Benzophenone (0.01 gm) was added to the solution as a sensitizer. The solution was irradiated with a low pressure mercury lamp, which had been placed inside the immersion well. Progress of the reaction was followed by TLC analysis (1:1:: Benzene: Hexane solvent system). Starting material was almost completely consumed in 10 hrs. The solvent was removed under reduced pressure and the residue was chromatographed over silica gel. Elution of the column with a mixture (8:2) of benzene and hexane gave a new product identified as the 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-phenyl-2-chloroaziridine. Yield: - 0.3 gms, Melting Point: - 165-167 °C was reported.

3. Results and Discussion

3.1. Characterization Data of the Synthesized Compound: 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-chloro-4-phenyl azetidine-2-one

The IR spectra (KBr) of the compound shows absorption at 3217.04 cm⁻¹, 3028.03 cm⁻¹, 1076.21 cm⁻¹, 1645.17 cm⁻¹, 594.03 cm⁻¹, 3338.55 cm⁻¹ due to aromatic- OH, aromatic >CH, <C-O-C, >C=O, >C-Cl, -NH stretch respectively.

The ¹H NMR in CDCl₃ shows in the region 5.05 δ (1H) due to aromatic-OH, 7.11 δ (3H) due to aromatic- H, 1.77 δ (3H) due to furan-CH₃, 2.90 δ (1H) due to CH-Cl, 8.29 δ (1H) due to NH and 2.30 δ (5H) due to C₆H₅.

The Mass spectrum shows molecular ion peak at m/z 368 (Molecular formula- C₁₉H₁₃N₂O₄Cl).

3.2. Characterization Data of the Synthesized Compound: 1-(3-methy-6-hydroxy benzofuran-2-yl) carbohydrazide -2- chloro -3- phenyl aziridine.

The IR spectra (KBr) of the compound shows absorption at 3228.62 cm⁻¹, 3039.60 cm⁻¹, 1062.70

cm⁻¹, 584.39 cm⁻¹, 3361.69 cm⁻¹ and 1244.00 cm⁻¹ due to aromatic- OH, aromatic >CH, <C-O-C, >C-Cl, -NH and >C-N stretch respectively.

The ¹H NMR in CDCl₃ shows in the region 5.10 δ (1H) due to aromatic-OH, 7.13 δ (3H) due to aromatic- H, 1.69 δ (3H) due to furan-CH₃, 8.31 δ (1H) due to -NH, 2.33 δ (5H) due to C₆H₅.

The Mass spectrum of 1-(3-methyl-6-hydroxybenzofuran-2-yl)-carbohydrazide-3-phenyl-2-chloro aziridine exhibits the molecular ion peak at m/z 342, which is the molecular weight of the compound and other fragments at m/z 307, 230, 190, 147, 132, 115.

4. Conclusion

The purpose of the present work was to synthesized, characterised and study the Photochemical reaction of benzofuran derivative during this period I was able to successfully synthesized derivative and study its photochemical reaction. The compounds were characterized by melting point, TLC, FT-IR, ¹H NMR and Mass spectral analysis.

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