*Original Article*

ISSN Print 2231 – 3648
Online 2231 – 3656

# Synthesis, Characterization and Antibacterial Activity Using Mannich Base, N-[(1-Morpholinobenzyl)] Benzamide: A Structure and Reactivity Study

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**Abstract**

The substituted Mannich base is prepared by condensation of substituted benzaldehyde with benzamide and secondary amine. Like morpholine. The synthesized morpholinobenzyl benzamide undergoes NMR and IR spectral studies. The anti microbial activity of various substituted N-[(1-Morpholinobenzyl)] benzamide compounds studied against various organisms such as *staphylococcus aureus*, *bacillus subtilis*, *Escherichia coli* and *pseudomonas aeruginosa* by well diffusion method using DMSO as solvent. The values of zone of inhibition were found out at 370c for a period of 24 h. It has been found that all the inhibitory action gets enhanced with the introduction of electron withdrawing groups in the phenyl ring.

**Key words:** Mannich base, N-[(1-Morpholinobenzyl)] benzamide, Antibacterial activity, Hammet effect.

## Introduction

In the field of Synthetic pharmaceutical organic chemistry is one of the main streams of development and expanding in diverse branches of science. During the preceding years, synthetic pharmaceutical organic chemistry has seen massive growth, not only in terms of development of novel methodologies for construction of carbon-carbon and carbon hetero atom bonds but also in terms of development of new strategies, reagents, catalysts, transformations and technologies. From the survey of presented literature, it appears that Mannich bases have played a vital role in the development of synthetic pharmaceutical organic chemistry. It is renowned from the literature survey that the compounds containing amide moiety as a functional group have been found to acquire donor properties and exhibit a wide range of biological activities Literature study also reveals that a broad spectrum of biological activity is reported to be associated with a number of heterocyclic compounds.

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Keeping the above facts in mind and as part of continuing efforts on Mannich bases, in the present work the synthesis and characterization of various substituted N-[(1-Morpholinobenzyl)] benzamide compounds and studied the antimicrobial activity to find out the subsistent effect on MBB.

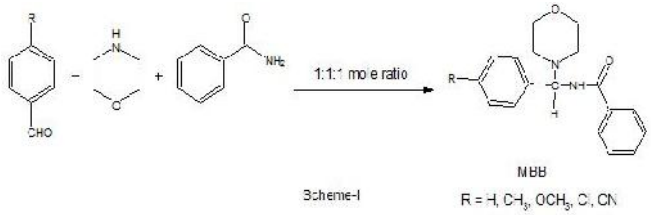
## Material and Methods

Melting points were determined in an open capillary tube with a Thiele tube melting point apparatus. Elemental analyses were carried out using Perkin-Elmer 24°C CHN-analyzer. IR spectra were recorded on a Perkin Elmer IR spectrophotometer. $^1$H- NMR spectra was run in (CDCl3) solvent at 200 MHz on a NMR spectrophotometer (chemical shifts in $\delta$ ppm).

### Synthesis of Mannich base, MBB

The Mannich base, was synthesized by the condensation of an ethanolic solution of benzaldehyde, morpholine and benzamide were taken in 1:1:1 molar ratio. The mixture was stirred and immersed in cool condition at first, a yellow sticky mass appeared. It was kept aside with the mother liquor open to atmosphere for *ca.* 4-6 days. The yellow solid formed was separated by filtration, the supernated liquid was

washed with distilled water, carbon tetrachloride and recrystallised from ethanol. Yield: 82 %; M.P: 172°C. Benzaldehyde (1mL, 0.01mol) was then added in small quantities to the mixture and stirred under ice-bath condition.




Scheme-I

**Table 1: Analytical data of the Mannich bases**

| Compound with mol. formula | Evaluating observations | | | Melting point (0C) | Yield (%) |
|---|---|---|---|---|---|
| | C% | H% | N % | | |
| H-MBB<br>$C_{18}H_{20}N_2O_2$ | 76.75<br>(77.52) | 7.25<br>(7.53) | 8.62<br>(9.52) | 170 | 80 |
| 4-CH3- MBB<br>$C_{19}H_{22}N_2O_2$ | 65.80<br>77.92 | 7.16<br>(7.79) | 11.34<br>(9.09) | 178 | 82 |
| 4-OCH3- MBB<br>$C_{19}H_{22}N_2O_3$ | 76.75<br>(74.07) | 7.25<br>(7.40) | 8.62<br>(8.64) | 182 | 81 |
| 4-Cl-MBB<br>$C_{18}H_{19}N_2ClO_2$ | 76.75<br>(69.51) | 7.25<br>(6.40) | 8.62<br>(8.53) | 184 | 75 |
| 4-CN-MBB<br>$C_{19}H_{19}N_3O_2$ | 71.72<br>(75.23) | 6.84<br>(6.58) | 9.18<br>(13.16) | 181 | 78 |

**Table 2: IR spectral data of the Mannich bases (cm-1)**

| Compound | (NH2) | (C=O) | (C-N-C) | (C=N) |
|---|---|---|---|---|
| H-MBB | 3320 | 1645 | 1160 | -- |
| 4-CH3- MBB | 3312 | 1642 | 1164 | -- |
| 4-OCH3- MBB | 3361 | 1635 | 1140 | -- |
| 4-Cl- MBB | 3364 | 1630 | 1155 | -- |
| 4-CN- MBB | 3310 | 1648 | 1168 | 2204 |

**Table 3: $^1$H NMR spectral data of the Mannich bases**

| Compound | ($^1$H-Aro) | ($^1$H-NH) | (mor N-CH2) | (Methyl) | (OCH3) |
|---|---|---|---|---|---|
| H- MBB | 7.2 -7.7 | 5.5 | 2.5 | -- | -- |
| 4-CH3- MBB | 7.3 -7.8 | 5.7 | 2.7 | 2.2 | -- |
| 4-OCH3- MBB | 7.2 -7.9 | 5.9 | 2.6 | -- | 3.6 |

## Results and Discussion

The analytical, IR and $_1$H-NMR data of Mannich bases are given in Table 1, 2 and 3.

### Antibacterial study

The ligand and its complexes were tested for antibacterial activity. Mueller-Hinton agar was used for testing the susceptibility of microorganisms by well diffusion method using DMSO as solvent, at a concentration of 0.01M against Gram positive (*Staphylococcus aureus*, *Bacillus subtilis)* and *(Escherichia coli*, *Pseudomonas auroginosa)* bacteria. The zone of inhibition against the growth of microorganisms was determined at the end of an incubation period of 24 h at 37$^0$ C. The order of activity of MBB compounds towards *Staphylococcus aureus*, *Bacillus subtilis, Escherichia coli* and *Pseudomonas auroginosa)* is: CN > Cl > H > $CH_3$ > $OCH_3$. It has been found that the inhibitory action gets enhanced with the introduction of electron-withdrawing cyano and chloro groups in the phenyl ring. The compounds, however, with electron-releasing methyl and methoxy groups are lesser active compared to unsubstituted phenyl ring. It appears that there is a linear relationship between logarithm of zone of inhibition and Hammet substiuent constant. The substiuent constant (σ) for H, $CH_3$, $OCH_3$, Cl and CN is 0, -0.17, -0.27, 0.23 and 0.66. According to Hammet, substituents that enhance activity relative to unsubstituted benzene ring will have positive σ values (σ>0).

## Conclusion

In this present paper, we have successfully synthesized various substituted N-[(1-morpholinobenzyl)] benzamide] and characterized by IR and 1H-NMR spectral analysis. The antimicrobial activity of the various substituted N-[(1-morpholinobenzyl)] benzamide compounds has been extensively studied on microorganisms such as *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa* by well-diffusion technique. It has been found that all the inhibitory action gets enhanced with the introduction of electron-withdrawing groups in the phenyl ring.

## Acknowledgements

The author grateful to the Chairman Dr. Guathama Sigamani, Secretary Dr. Ashok sigamani and Director and Dean of Surya Group of Institution, Vikravandi, Villupuram for their constant support and encouragement for carrying out this research work.

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