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# **Synthesis of Bis (Indolyl ) Methane from some aromatic aldehydes using natural acid catalysts**

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**ABSTRACT:** The current study deals with synthesis of bis indoles from some aromatic aldehydes and 2-phenyl indole. Bis phenyl indoles and their derivatives are the important organic compounds. This study synthesized bis indoles using natural acid catalysts viz, Sweet lemon, Citrus limmeta, Tamarind, Amla, Butter milk and pineapple juices.

**KEYWORDS:** Natural acid catalysts, 2-phenyl indole, Aromatic aldehydes.

## **I. INTRODUCTION**

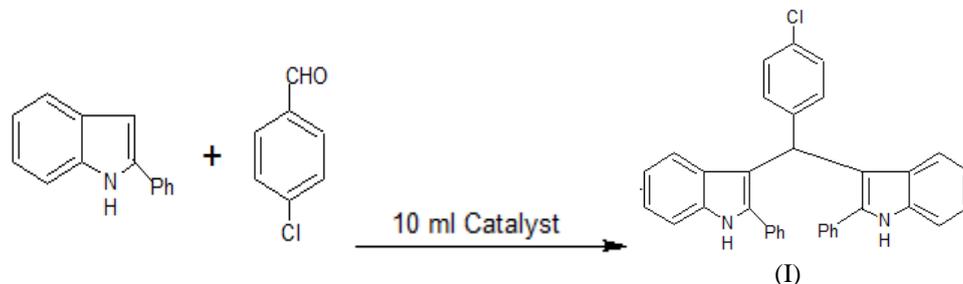
The electrophilic substitution reaction of indoles with carbonyl compounds like aldehydes and ketones to produce bis(indolyl) alkane is an acid catalyzed reaction and both protic as well as Lewis acids<sup>1</sup>. Bis (2-Phenyl indolyl) methanes which contain two substituted indole units in a molecule are an important group of bioactive metabolites of terrestrial and marine origin<sup>2</sup>. Indoles and their derivatives are used as neuroprotective agent affecting oxidative stress, neurotransmitter serotonin involved in various physiological functions<sup>3</sup>. Indoles prevents the breast cancer and also promotes the metabolism of estrogen both in men & women<sup>4</sup>. Organic synthesis using water as a solvent have been attracted much attention because water is considerably safe, non-toxic, environmentally-friendly and cheap compared to other harmful organic solvents<sup>5,6</sup>. Ionic liquids have attracted extensive research interest in recent years as properties like non-inflammability, negligible vapor pressure, reusability and high thermal stability<sup>7</sup>. Transition metal Lewis acids are promising and interesting precursor for the synthesis of bis (Indolyl ) methanes<sup>8</sup>.

The present work based on the synthesis of 4-Chloro phenyl bis (2-phenylindolyl) methane (I), 3-Nitro phenyl bis(2-phenylindolyl) methane(II) and 2-hydroxyphenyl bis(2-phenylindolyl) methane(III) from p-chlorobenzaldehyde, m-nitrobenzaldehyde and salicylaldehyde respectively using some natural acid catalysts.

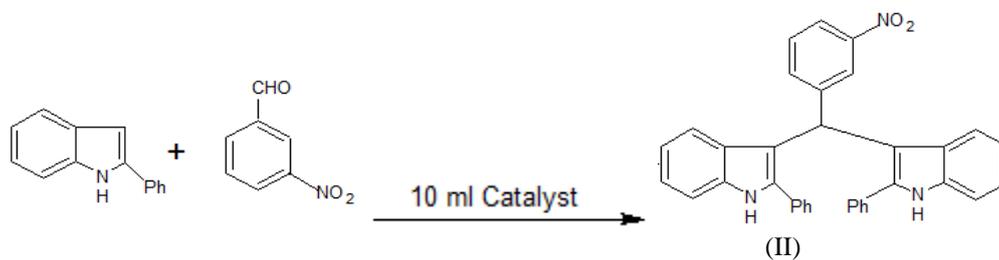
## **II. METHODS AND MATERIALS**

2-phenyl indole was prepared by using commercial method. To the mixture of 2-phenyl indole (4mmol) and aromatic aldehyde (m mol), water (20ml) and catalyst juice (10ml) were added and refluxed at 80°C for 2 hrs. On the other hand the same mixture was heated in microwave for 5 minutes at 70 watt. The obtained crude products 4-Chloro phenyl bis (2-phenylindolyl) methane (I), 3-Nitro phenyl bis (2-phenylindolyl) methane (II) and 2-hydroxyphenyl bis(2-phenylindolyl) methane(III) were filtered separately and re-crystallized with ethanol, dried and weighed.

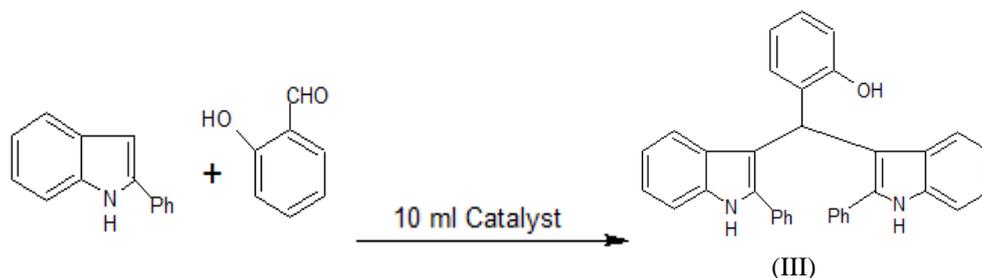
## Scheme-I



## Scheme-II



## Scheme-III



## III. RESULT AND DISCUSSION

In the last decades many synthetic schemes have been developed for the synthesis of bis indolyl methanes. However all the methods reported so far have many limitations such as expensive reagents, reaction conditions, toxic and flammable organic solvents, high reaction time and complicated procedures etc. We synthesized some substituted bis (indolyl) methanes in the absence of hazardous solvents using convenient and environmentally green methodology. The melting points of all three substituted indoles were sharp and yield of the products were satisfactory for the reflux method as compare to microwave heating. The result and catalyst used for synthesis were shown in table no-1. The synthesized compounds were confirmed by melting points and IR spectral analysis.

## A. 3,3'-bis(2-phenylindolyl)-4-chlorophenyl methane (I)

**IR (KBr) :** Shows the presence of a peak at  $3438$  and  $3387\text{cm}^{-1}$  for cyclic  $\text{-NH}$  stretching,  $3053\text{cm}^{-1}$  for aliphatic  $\text{-CH}$  stretching,  $1680$  and  $1598\text{cm}^{-1}$  for aromatic  $\text{C=C}$  group,  $1350$ ,  $1358$  and  $1248\text{cm}^{-1}$  for  $\text{-C-N}$  stretching and some peaks at  $748$  and  $694\text{cm}^{-1}$  for substituted aromatic hydrogens. The peaks at  $505$  and  $430\text{cm}^{-1}$  indicates the presence of aromatic  $\text{-C-Cl}$  stretching.

### B. 3,3'-bis(2-phenylindolyl)-3-nitrophenyl methane (II)

**IR (KBr) :** Shows the presence of a peak at 3442 and 3330 $\text{cm}^{-1}$  for cyclic –NH stretching, 3084  $\text{cm}^{-1}$  for aliphatic –CH stretching, 1565 and 1527 for aromatic –NO<sub>2</sub> group, 1640  $\text{cm}^{-1}$  for aromatic C=C group, 1444, 1348, 1257 and 1151 $\text{cm}^{-1}$  for –C-N stretching and some peaks at 810 and 694  $\text{cm}^{-1}$  for substituted aromatic hydrogens. The peaks at 748  $\text{cm}^{-1}$  indicates the presence of aromatic –C-Cl stretching.

### C. 3,3'-bis(2-phenylindolyl)-2-hydroxyphenyl methane (III)

**IR (KBr) :** Shows the presence of a peak at 3387 $\text{cm}^{-1}$  for aromatic –OH stretching, 3057  $\text{cm}^{-1}$  for aliphatic –CH stretching, 1598  $\text{cm}^{-1}$  for aromatic C=C group, 1307, 1263  $\text{cm}^{-1}$  for –C-N stretching and some peaks at 920, 833, 817, 752, 698, 617  $\text{cm}^{-1}$  for substituted aromatic hydrogen.

**Table no-1: Result and catalysts used for synthesis.**

Sr. No	Catalyst (Juice)	p <sup>H</sup>	Reflux 80 <sup>o</sup> C 2Hr			MW 5min 70Watt			M.P. of Product (°C)		
			I	II	III	I	II	III	I	II	III
			<b>1</b>	Amla	4.9	85.14	85.76	68.36	58.49	66.35	66.30
<b>2</b>	Pineapple	3.36	61.38	86.53	78.00	47.52	48.07	59.00	122	140	136
<b>3</b>	Tamarind	1.73	87.21	91.44	83.97	51.48	40.86	51.10	122	140	140
<b>4</b>	Sweet lemon	2.72	48.51	61.73	70.70	38.61	36.53	53.06	128	139	138
<b>5</b>	Butter milk	2.86	49.50	81.34	91.80	35.64	54.23	51.02	130	145	139
<b>6</b>	Citrus limetta	2.38	70.29	61.73	81.00	54.45	53.94	65.80	126	144	132

## IV. CONCLUSION

The present study reveals that the synthesis of bis (2-phenyl indonyl) methanes from some aromatic aldehydes using various natural acid catalyst was efficient with refluxing the mixture compared to the microwave assisted synthesis.

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