# $CeCl_3 \cdot 7H_2O$ as a catalyst for the synthesis of new indoles substituted at C-3

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## INTRODUCTION

Facile access to indole and their derivatives is of general interest since they are widely present in bioactive metabolites of numerous compounds isolated from natural sources.[1] Arylthioindoles are an important class of compounds due to their activity towards the treatment of several diseases.[2]
On the other hand, cerium (III) chloride has emerged as a very useful Lewis acid imparting high regio- and chemoselectivity in various chemical transformations over the past few years. It is an inexpensive, nontoxic and water-tolerant catalyst and has been used in several different forms, alone as heptahydrate, anhydrous, and in combination with NaI.[3]

## RESULTS AND DISCUSSION

In view of our interest in the development of new and efficient methodologies promoted by cerium (III) species,[4] we decided to study the electrophilic substitution reaction of Indoles **1** with *p*-toluenesulfonothioate **2** catalyzed by $CeCl_3 \cdot 7H_2O$.
Indole **1** ($R_1$, $R_2$=H) and **2** were used as starting materials to establish the best conditions, Table 1. Careful analysis revealed that the use of DMF as solvent and $CeCl_3 \cdot 7H_2O$ (1:1 to indole) at 80° allows the synthesis of compounds **3,** scheme 1.

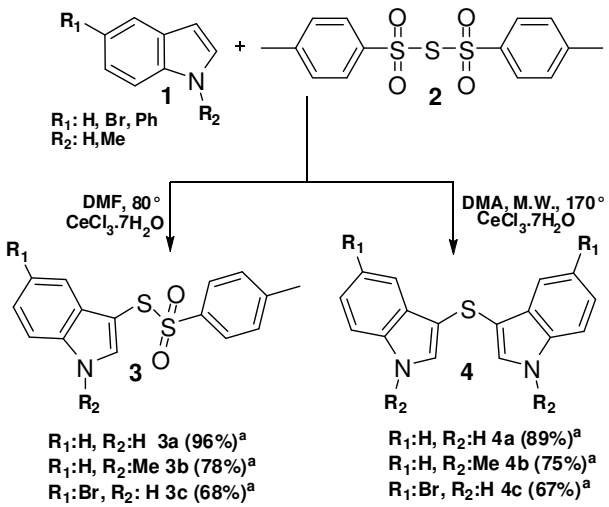
**Table 1.** Optimization of the reaction conditions to synthesis of compounds **3**.

| Entry | Solvent | $CeCl_3.7H_2O$ – Indole | Time (min)[a] | Yield (%)[b] |
|---|---|---|---|---|
| 1 | DMF | 0,5:1 | 20 | 55 |
| 2 | $MeNO_2$ | 0,5:1 | 20 | 35 |
| 3 | MeCN | 0,5:1 | 20 | 25 |
| 4 | Isopropanol | 0,5:1 | 20 | 21 |
| 5 | DMA | 0,5:1 | 20 | 52 |
| 6 | DMF | 1:1 | 20 | 96 |
| 7 | $MeNO_2$ | 1:1 | 20 | 38 |
| 8 | MeCN | 1:1 | 20 | 26 |
| 9 | Isopropanol | 1:1 | 20 | 25 |
| 10 | DMA | 1:1 | 20 | 60 |

[a] Reaction followed by TLC. [b] Isolated yields.

Adequate solvents and amount of catalyst for the synthesis of compounds **4** were also tested. The use of DMA as a solvent, $CeCl_3 \cdot 7H_2O$ (1:1 to indole) at 170°C under M.W., led to good yields of **4**, Scheme 1.

**Scheme 1.**




[a] Isolated yields by column chromatograph.

## CONCLUSION

In conclusion, the method described is very simple and efficient, furnishing good yields of products **3** and **4.** All compounds were isolated and characterized by $^1H$ and $^{13}C$ NMR and GC/MS.

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