



## Data Article

## Data for the lipase catalyzed synthesis of cyano-containing multi-substituted indoles

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## ABSTRACT

The data presented here are related to the research paper entitled "Efficient Synthesis of Cyano-containing Multi-substituted Indoles Catalyzed by Lipase" [1]. In this data article, the lipase catalyzed synthetic procedures for the preparation of multi-substituted indoles and their derivatives were described. In total, 11 compounds were obtained and the optimum pH, reaction time and substrate ratio were screened through this study.

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## Specifications Table

Subject	Bioorganic chemistry
Specific subject area	Organic chemistry, Enzyme catalysis, Biocatalysis.
Type of data	Figure; Table;
How data were acquired	All the yields in these experiments were obtained by column chromatography. The pH of the solution is measured by a pH meter (HANNA, HI2221-02, Germany).
Data format	Analyzed;
Parameters for data collection	Data were collected for characterization purposes
Experimental features	The experiments were designed for the optimization of synthesis cyano-containing multi-substituted indoles.
Data source location	Key Laboratory of Molecular Enzymology and Engineering of Ministry of Education School of Life Sciences Jilin University Changchun China
Data accessibility	With the article
Related research article	F. Li, Y. Xu, C. Wang, C. Wang, R. Zhao, L. Wang. Efficient Synthesis of Cyano-containing Multi-substituted Indoles Catalyzed by Lipase. <i>Bioorg. Chem.</i> , 107(2021), 104583, <a href="https://doi.org/10.1016/j.bioorg.2020.104583">https://doi.org/10.1016/j.bioorg.2020.104583</a> .

## Value of the Data

- The data contain the lipase catalyzed synthetic procedures for the preparation of cyano-containing multi-substituted indoles, which may serve as valuable guidance for other organic chemists.
- The data provide characterization of physical-chemical properties of original compounds-5-cyclopropyl-2-methyl-1H-indole-4,6,7-tricarbonitrile and 5-(tert-butyl)-2-isobutyl-1H-indole-4,6,7-tricarbonitrile which have not been reported before.
- Moreover, the described synthetic procedures and obtained spectroscopic data will be useful for preparation and structure elucidation of representatives in related heterocycles.
- The data also provide more experiment detail about the lipase catalyzed synthesis of cyano-containing multi-substituted indoles, such as: pH; ratio of substrates.

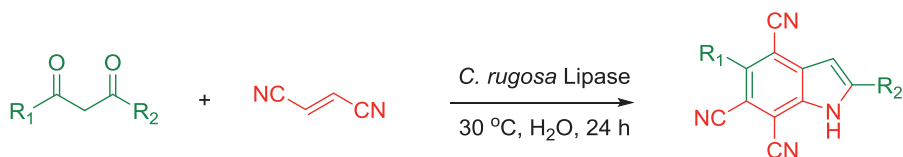
## 1. Data Description

The data set presented in this article focuses on characterization of the multi-substituted indoles described in [1]. The article provides the information on the spectroscopic data of the multi-substituted indoles (1–11) produced by enzymatic method (Fig. 1). Although other methods have been used to synthesize multi-substituted indoles [2,3], using lipase as a catalyst for the synthesis of multi-substituted indoles is more efficient and environmentally friendly. Moreover, the data also present the effect of pH (Fig. 2) and ratio of substrate (Table 1) on the enzymatic synthesis of multi-substituted indoles.

## 2. Experimental Design, Materials and Methods

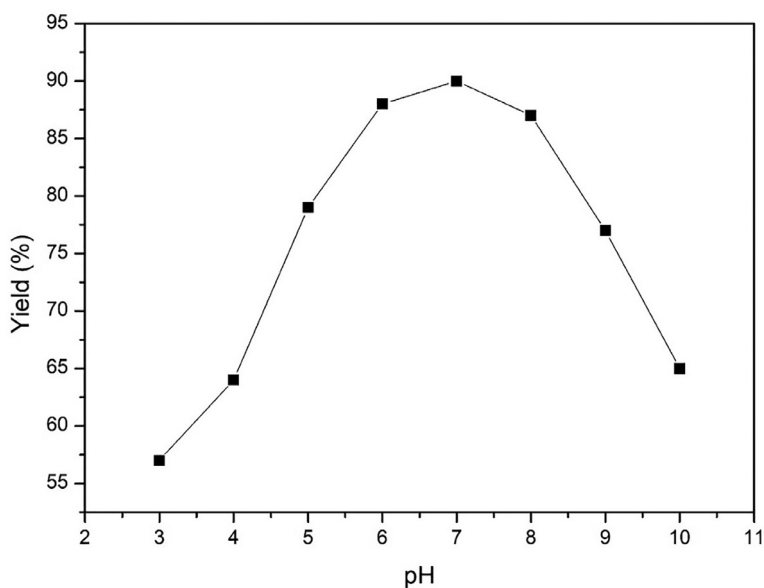
### 2.1. General procedure for synthesis of multi-substituted indoles

CRL (15 mg) was added into a mixture of 1,3-diketones (1, 0.5 mmol) and fumaronitrile (2, 2 equiv) in water and stirred in a pre-heated constant temperature shaker until completion



- 1: R<sub>1</sub> = R<sub>2</sub> = Methyl; 2: R<sub>1</sub> = R<sub>2</sub> = Ethyl;  
 3: R<sub>1</sub> = R<sub>2</sub> = Isopropyl; 4: R<sub>1</sub> = R<sub>2</sub> = Tertiary butyl;  
 5: R<sub>1</sub> = R<sub>2</sub> = Isobutyl;  
 6: R<sub>1</sub> = Methyl; R<sub>2</sub> = Ethyl; 6': R<sub>1</sub> = Ethyl; R<sub>2</sub> = Methyl;  
 7: R<sub>1</sub> = Methyl; R<sub>2</sub> = n-Amyl; 7': R<sub>1</sub> = n-Amyl; R<sub>2</sub> = Methyl;  
 8: R<sub>1</sub> = Methyl; R<sub>2</sub> = cyclopropyl; 8': R<sub>1</sub> = cyclopropyl; R<sub>1</sub> = Methyl;  
 9: R<sub>1</sub> = Methyl; R<sub>2</sub> = Tertiary butyl; 9': R<sub>1</sub> = Tertiary butyl; R<sub>2</sub> = Methyl;  
 10: R<sub>1</sub> = Methyl; R<sub>2</sub> = Isobutyl; 10': R<sub>1</sub> = Isobutyl; R<sub>2</sub> = Methyl;  
 11: R<sub>1</sub> = Isobutyl; R<sub>2</sub> = Tertiary butyl; 11': R<sub>1</sub> = Tertiary butyl; R<sub>2</sub> = Isobutyl.

**Fig. 1.** Structures of multi-substituted indoles 1–11 produced by enzymatic method.



**Fig. 2.** Effect of pH on the enzymatic synthesis of multi-substituted indoles  
 Reaction condition: **1a** (0.5 mmol), **2** (1 mmol), PBS buffer (2 ml, various pH), CRL, 30 °C, 24 h.

of reaction. Then, the reaction mixture was evaporated to dryness. The residue was purified on silica column with ethyl acetate: n-Hexane (1:4) to afford the desired indoles.

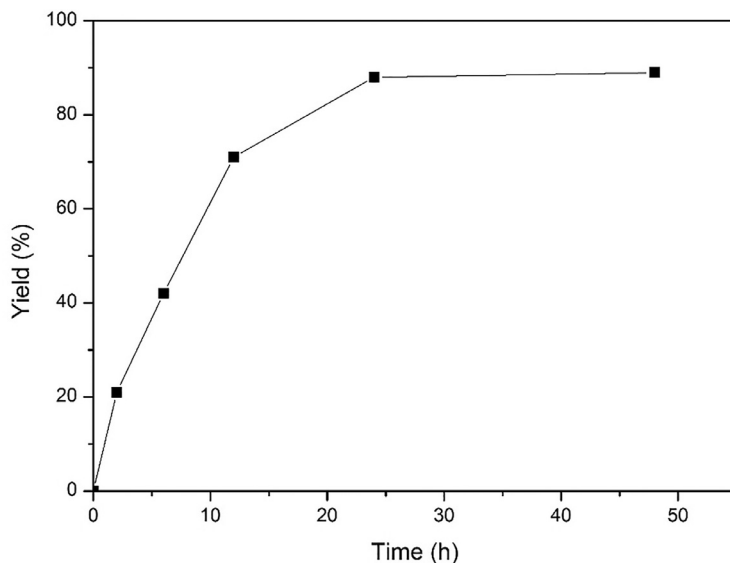
## 2.2. Optimization of the reaction conditions

The effect of reaction pH on this reaction was investigated (pH = 3–10) and the results were shown in Fig. 2. The yield was increased by increasing the pH from 3 to 7. Then, the yield was

**Table 1**  
Effect of Ratio of substrates on the lipase synthesis of multi-substituted indoles<sup>a</sup>.

Entry	Ratio of substrate	
	(Acetylacetone: Fumaronitrile)	Yield (%)
1	1:1	41
2	1:2	88
3	1:3	91
4	1:4	93
5	2:1	43 <sup>b</sup>
6	3:1	47 <sup>b</sup>

<sup>a</sup> Reaction condition: **1a**, **2**, water (2 ml), CRL, 30 °C, 24 h, yield based on the conversion of **1a**; b. yield based on the conversion of **2**.



**Fig. 3.** The time course curve.  
Reaction condition: **1a** (0.5 mmol), **2** (1 mmol), water (2 ml), CRL, 30 °C.

decreased by further increasing pH (7–10). These results indicate that the various pH may affect the enzyme performance. Therefore, we chose pH = 7 as the optimal pH for the study.

Then, we investigated the time course curve on this reaction and showed these results in Fig. 3. The yield was increased by prolonging the time from 0 to 48 h. However, considering the slight increasing of yield from 24–48 h, we chose 24 h as the optimal reaction time.

To investigate the mechanism of the reaction, we chose the various ratio of substrates and the results were shown in Table 1. The yield was increased with the increasing of the amount of fumaronitrile (Entry 1–4). A slight increase of yield was observed by further increasing the amount of fumaronitrile (2–4). Nevertheless, when the amount of acetylacetone was increased, only the slight increase of yields could be obtained (Entry 5,6).

### 2.3. Characterization data

All the NMR data for the target products are supplied in Supplementary information [1].

## CRediT Author Statement

**Fengxi Li:** Conceptualization, Methodology, Software; **Yaning Xu:** Data curation, Writing - Original draft preparation; **Ciduo Wang:** Writing - Reviewing and Editing; **Chunyu Wang:** Visualization, Investigation; **Ruihong Zhao:** Supervision; **Lei Wang:** Supervision.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

## Acknowledgments

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## Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.dib.2021.107045](https://doi.org/10.1016/j.dib.2021.107045).

## References

- [1] F. Li, Y. Xu, C. Wang, C. Wang, R. Zhao, L. Wang, Efficient synthesis of cyano-containing multi-substituted indoles catalyzed by lipase, *Bioorg. Chem.* 107 (2021) 104583.
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