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MICROWAVE-ASSISTED RUTHENIUM TRICHLORIDE-CATALYZED SYNTHESIS OF PYRROLE FUSED WITH INDOLE SYSTEM IN WATER[#]

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[#]Dedicated to the memory of Dr. R. R. Gupta

Abstract

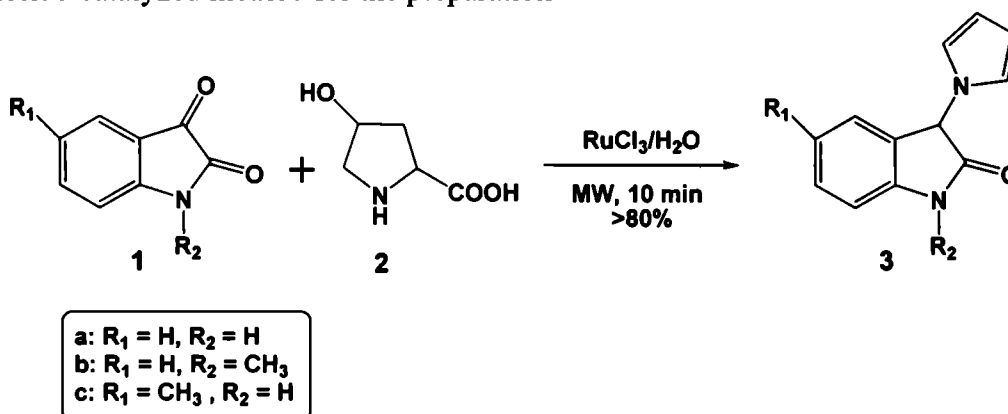
A simple and efficient microwave-induced ruthenium trichloride-catalyzed synthesis of pyrrole fused with indole system in water is developed by reacting commercially available isatin and 4-hydroxyproline.

Introduction

Pyrrroles important classes of compounds with many medicinal activities.¹ Many methods for the synthesis of substituted pyrroles are known in the literature.² However, synthesis of pyrroles fused to indole system has not been explored systematically.³ In a previous paper, we have described the preparation of these types of products using iodine in ethyl alcohol.⁴ We describe herein a new method for the synthesis of substituted pyrroles fused to indole skeleton by microwave-induced ruthenium trichloride-catalyzed reaction in water.

Results and Discussion

We⁵ have demonstrated bismuth nitrate-catalyzed synthesis of pyrroles following Paal-Knorr method. During the course of our investigation, we have identified a ruthenium trichloride-catalyzed method for the preparation



Scheme 1

of pyrrole-substituted with indole using microwave-induced reactions in water (**Scheme 1**). The reaction of isatin (**1**) with 4-hydroxyproline (**2**) in water was irradiated in the presence of ruthenium trichloride (20 mol%) and water. The reaction was completed within 10 minutes. This method is therefore, unique because there are no other methods that describe the preparation of these types of heterocycles in water and within this short time. Other methods needed acidic reagents and were more time consuming.^{3,4}

The reaction did not proceed without ruthenium trichloride. The mechanism of the reaction is not investigated.

Experimental

To isatin (1 mmol), hydroxyproline (1 mmol), ruthenium trichloride (20 mol%) was added water (2 mL) and the reaction mixture was irradiated in a CEM automated microwave oven for 10 min (Power 300 watts and temperature 50°C). The reaction was diluted extracted with dichloromethane and dried (Na₂SO₄). Pure product (approximately, 80%) was isolated through column chromatography (ethyl acetate/hexane=30/70).⁶

Conclusion

In conclusion, we have demonstrated synthesis of pyrrole substituted indoles using ruthenium trichloride-catalyzed microwave-induced reaction under environmentally benign conditions.

Acknowledgment

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References and notes

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