Süleyman Demirel Üniversitesi
Fen Bilimleri Enstitüsü Dergisi
Cilt 23, Özel Sayı, 67-70, 2019

Süleyman Demirel University
Journal of Natural and Applied Sciences
Volume 23, Special Issue, 67-70, 2019

DOI: 10.19113/sdufenbed.432261

Synthesis of Some New Isatin Derivatives and Identification of Their Structures

İnci Selin DOĞAN*[1], Gökçe Gül BÖLEK[2], Bahittin KAHVECI[3]

[1] Karadeniz Technical University, Faculty of Pharmacy, Department of Pharmaceutical Chemistry, 61100, Trabzon, Turkey
[1](ORCID: https://orcid.org/0000-0003-4949-1747)
[2](ORCID: https://orcid.org/0000-0003-0914-9824)
[2] Karadeniz Technical University, Faculty of Health Sciences, Department of Nutrition and Dietetics, 61100, Trabzon, Turkey
[3](ORCID: https://orcid.org/0000-0001-7394-0552)

(Alınış / Received: 08.06.2018, Kabul / Accepted: 03.03.2019, Online Yayınlanma / Published Online: 11.03.2019)

Keywords
Indole,
Isatin,
Schiff base,
Heterocyclic chemistry,
Synthesis

Abstract: Indole, which has an important role in heterocyclic ring systems, exhibits significant biological effects. Isatin (1*H*-indole-2,3-dione) has been used as a reagent in a large number of synthesis due to its biological properties. In addition, it is a heterocyclic ring system used for obtaining and other reactions of indole and quinoline derivatives. In this study, two new Schiff base compounds were synthesized by the reaction of 2-aminoantracene with an isatin/5-nitro-isatin. The structure of the synthesized compounds, were elucidated by spectroscopic methods using IR, ^{1}H-NMR, ^{13}C-NMR spectra and Mass analysis.

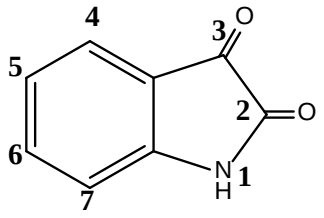
Bazı Yeni İsatin Türevlerinin Sentezi ve Yapılarının Aydınlatılması

Anahtar Kelimeler
İndol,
İsatin,
Schiff bazı,
Heterosiklik kimya,
Sentez

Özet: Heterosiklik halka sistemlerinde önemli bir rolü olan indol, önemli biyolojik etkiler göstermektedir. Isatin (1*H*-indol-2,3-dion), biyolojik özellikleri nedeniyle çok sayıda sentezde bir reaktif olarak kullanılmıştır. Ayrıca, isatin, indol ve kinolin türevlerinin eldesinde ve reaksiyonlarında kullanılan, bir heterosiklik halka sistemidir. Bu çalışmada, iki yeni Schiff bazı bileşikleri, 2-aminoantrasen ile isatin/5-nitro-isatinin reaksiyonuyla sentezlendi. Sentezlenen bileşiklerin yapısı, IR, ^{1}H-NMR, ^{13}C-NMR spektrumları ve Kütle analizi kullanılarak spektroskopik yöntemlerle aydınlatıldı.

1. Introduction

Isatin (1*H*-indole-2,3-dione) is an important starting material in synthetic studies.

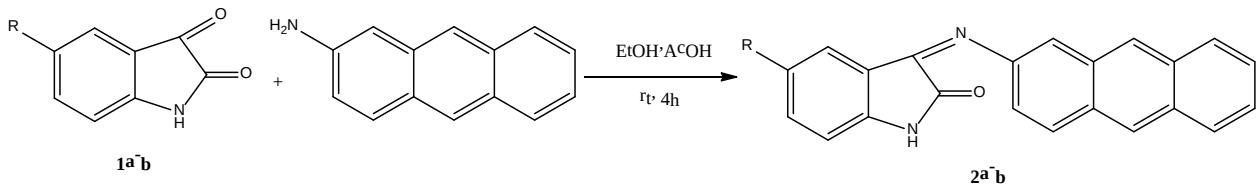


Isatin

A large number of heterocyclic compounds can be synthesized using isatin. These heterocyclic compounds are also suitable for use in drug synthesis and design [1-4]. Isatin has recently been used as a reagent due to its various biological (anxiogenic, sedative, anticonvulsant, endogenous MAO inhibitor and potent antagonist on atrial natriuretic peptide receptor) and structural functional properties [1, 5-8]. One of the most frequently used reactions in this context is the Schiff base reaction [9, 10]. Schiff bases are used as a substrat in different cyclization or replacement reactions were synthesized using different aldehyde and amine derivatives (11,12). Schiff bases possess antimicrobial (12-16) and antifungal (17,18) activities. Some synthesized heterocyclic amine compounds by starting isatin used in hair dyes [19-37], plastic materials [38], synthetic dyes and chemicals used for natural fibers [39,40].

Due to all these properties, in this study, two new derivatives of the isatin have been obtained by reaction of isatin/5-nitroisatin with 2-aminoanthracene for the potential dye property. The reaction equation for work is given in Scheme 1.

*Corresponding author: selinci@gmail.com



Scheme 1. Synthesis of new isatin derivatives (Compounds **2a,b**) **R**; a:H, b:NO_2

2. Material and Method

The general synthesis of Compounds **2a,b** is summarized in Scheme 1. All reagents and solvents were obtained from commercial suppliers. All reactions were monitored by thin-layer chromatography on silica gel pre-coated F254 Merck plates and the plates were examined under 254 nm UV light. The mobile phase for the TLC was chloroform:methanol (90:10). Melting points (mp) were recorded by Electrothermal Digital Melting Point Apparatus without correction. ^{1}H- and ^{13}C-NMR spectrum was recorded on Varian Mercury 400, 400MHz Digital FT-NMR instrument with tetramethylsilane as internal standard. Chemical shifts (δ) were expressed in parts per million (ppm). Significant ^{1}H-NMR data are reported in the following order: multiplicity (s, singlet; d, doublet; dd, doublet of doublet; t, triplet; m, multiplet) and number of protons. IR spectra were recorded on Perkin Elmer Spectrum FT-IR spectrophotometer using attenuated total reflectance (ATR) FT-IR method. Mass spectrometry was conducted using Micromass ZQ LC-MS spectrometer (ESI+ mode).

Preparation of the Compounds 2a, b (12)

Isatin/5-nitro-isatin (1a,b) derivative (0.01 mol), 2-aminoanthracene compound (0.01 mol) and 3-4 dropwise acetic acid were stirred in 40 mL ethanol for 4 hours at room temperature. The reaction progress was monitored by TLC. The crude product was filtered and crystallized from the mixture of ethanol/water (3:1). The compounds (2a,b) obtained were identified as isatin derivative Schiff base; 3-(Anthracen-2-ylimino)-indolin-/5-nitroindolin-2-one (Scheme 1).

The structure of the synthesized compounds, were elucidated by spectroscopic methods as IR, ^{1}H-NMR, ^{13}C-NMR spectra and Mass analysis.

3. Results

3-(Anthracen-2-ylimino)-indolin-/-5-nitroindolin-2-one (Compounds 2a, b) general procedure was followed using isatin and 2-aminoanthracene to give **2a** as a yellow solid (yield 92%; mp 254-5°C). IR (ATR): ν̃ = 3149, 3046 (N-H and aromatic C-H), 1715 (C=O, ketone), 1607 (C=N) cm^{-1}. ^{1}H-NMR (600MHz, DMSO-d_6) δ 6.45 (1H, s, isatin Ar C_5-H), 6.95-7.58 (4H, m, isatin Ar C_6-H and anthracene Ar $C_{2'}$, $C_{6'}$,$C_{7'}$-H), 7.98-8.06 (4H,m, isatin Ar C_4, C_7-H and anthracene Ar $C_{5'}$, $C_{8'}$-H), 8.18-8.58 (4H,m, anthracene Ar $C_{3'}$, $C_{4'}$, $C_{9'}$, $C_{10'}$-H), 11.02 (1H,s,N-H) ppm. ^{13}C-NMR (150 MHz, DMSO-d_6) δ 111.6, 112.2, 113.9, 116.2, 118.6, 119.9, 120.8, 122.1, 126.2, 126.4, 126.5, 127.1, 128.2, 128.6, 130.6, 131.6, 132.3, 141.9, 146.7 (Ar C), 153.6 (C=N), 164.3 (C=O). LC-MS (ESI+) ($C_{22}H_{14}N_2O$, Ma=322) m/z: 322.70(M+, base peak, 100%).

General procedure was followed using 5-nitro-isatin and 2-aminoanthracene to give **2b** as a yellow solid (yield 88%; mp 270-1°C). IR (ATR): ν̃ = 3117 (N-H), 1741 (C=O, ketone), 1619 (C=N), 1529, 1336 (NO2) cm^{-1}. ^{1}H-NMR (600MHz, DMSO-d_6) δ 7.07-7.48 (3H, m, anthracene Ar $C_{2'}$, $C_{6'}$, $C_{7'}$-H), 7.50 (2H, m, anthracene Ar $C_{5'}$, $C_{8'}$-H), 7.52-7.70 (4H,m, anthracene Ar $C_{3'}$, $C_{4'}$, $C_{9'}$, $C_{10'}$-H), 7.72(1H,m, isatin Ar C_7-H), 8.54 (1H,m, isatin Ar C_6-H), 8.66 (1H,m, isatin Ar C_4-H), 11.73(1H,s,N-H) ppm. ^{13}C-NMR (150 MHz, DMSO-d_6) δ 111.3, 112.9, 114.9, 116.3, 120.2, 122.8, 125.8, 125.9, 126.1, 126.9, 128.1, 128.5, 130.5, 131.9, 132.2, 134.9, 138.7, 146.9, 147.5 (Ar C), 155.4 (C=N), 164.0 (C=O). LC-MS (ESI+) ($C_{22}H_{13}N_3O_3$, Ma=367) m/z: 367.90 (M+, base peak, 100%).

Spectral (IR, ^{1}H-NMR, ^{13}C-NMR) data of the synthesized compounds (**2a,b**) were consistent with the literature [41-43]. In the IR spectrum, the vibration bands of the C=O group found at 1715 and 1741; the N-H group was found at 3149 and 3117 cm^{-1}. In the ^{1}H-NMR spectral data of Compounds **2a,b** showed aromatic protons at 6.45-8.58 and 7.07-8.66 ppm and N-H proton at 11.02 and 11.73 ppm, respectively. And also, peaks has been found to comply with the literature data as ^{13}C peaks in aromatic field were observed 111.60-164.30 ppm. The findings obtained from the mass spectra of compounds which we have synthesized confirm the structures of the compounds.

4. Discussion and Conclusion

In this study, synthesis of 2 new Schiff base isatin compounds; 3-(anthracen-2-ylimino)-indol-/5-nitroindol-2-one derivatives (Compounds **2a,b**) were realized. Here, we synthesized some Schiff base compounds by the reaction of isatin and anthracene derivatives. Schiff bases are synthesized by various methods; in this study we have completed the reaction with high yield and purity by an effectively

used method. It is expected that the conjugation properties of the products obtained from the reaction will increase. This situation is observed in the dark color of the products obtained. Because of the increased electronic conjugation of the resulting derivative compounds, the potential dye properties of these compounds are possible. Different isatin derivatives will be synthesized and their antimicrobial activities are planned to be examined.

Acknowledgment

This project was supported by TÜBİTAK (Tübitak 2209A- 1919B011502586).

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