International Science and Technology Journal
المجلة الدولية للعلوم والتقنية
Volume 33 العدد
Part 2 المجلد
January 2024 يناير
المجلة الدولية للعلوم والتقنية
ISTJ

تم استلام الورقة بتاريخ: 25/ 12/2023م وتم نشرها على الموقع بتاريخ:31 / 1/2024م

Synthesis of thiosemicarbazide aldehyde derivatives in alcoholic medium

www.doi.org/10.62341/msta2531

Maryam.J.Yaseen
Science Faculty-Tobruk University- Libya.
maryamyasen1212@gmail.com

Abstract

Thiosemicarbazide derivatives (3a-c) were synthesized by reacting Thiosemicarbazide with aromatic aldehydes in an alcoholic medium. The reaction was monitored by TLC, and the structural composition of the derivatives was confirmed by melting point, IR, and ^{1}HNMR spectroscopy. Thiosemicarbazide derivatives are important in the biological field and can form complexes with some transition elements.

Keywords: Thiosemicarbazide , Aldehehydes, Synthesis, Derivatives.

تخليق(توليف) مشتقات الثيوسيمياكاربازيد الالدهيدية في وسط كحولي

مريم جمعة ياسين

كلية العلوم– جامعة طبرق– ليبيا.

maryamyasen1212@gmail.com

الخلاصة:

تم تحضير مشتقات الثيوسيمياكاربازيد (3a–c) من تفاعل تكثيف الثيوسيمياكاربازيد مع الالدهيدات الأروماتية في وسط كحولي من الايثانول وتم تتبع نهاية التفاعل باستخدام TLC ، وتم تأكيد التركيب البنائي للمشتقات الثيوسيمياكاربازيد بواسطة نقطة الانصهار والتحليل الطيفي باستخدام IR, HNMR، تعتبر مشتقات ثيوسيمياكاربازيد مهمة في المجال البيولوجي ويمكن أن تشكل معقدات مع بعض العناصر الانتقالية.

تم استلام الورقة بتاريخ: 25/ 12/ 2023م وتم نشرها على الموقع بتاريخ:31 / 1/ 2024م

الكلمات المفتاحية: ثيوسيمياكاربازيد، الالدهيدات، تخليق، مشتقات.

1-Introduction

Lately, much interest has been focused on the chemistry, and biological activity of the compounds bearing thiosemicarbazide moiety because of their attractive biological activities and consequently, a variety of novel compounds is being add to the science world every year[1,2] Thiosemicarbazones are an important class of organic chemicals which have an –NH-C(=S)NH-N= bond .They are used as versatile intermediates for synthesizing numerou moieties as well .Thiosemicarbazones have shown numerous medicinal properties and biological activities such as anticonvulsant[3].Thiosemicarbazones are compounds obtained by the reaction of thiosemicarbazide with aldehydes and ketones . Due to their biological activities and pharmacological properties, they have been the subject of many studies in recent year. Thiosemicarbazones have important pharmacological properties such as anti –cancer [4,5]. Molecule structure has an important role in the pharmacological activity of thiosemicarbazide derivatives [6]. Thiosemicarbazone (hydrazine carbothioamides) are a family of compounds with high biological activity [7]. A synthesis of thiosemicarbazide derivatives by condensation of aldehydes with thiosemicarbazide their characterization is done by different analytical techniques, such as FT-IR, ^{1}HNMR. .

.

2-Materilas and Methods

Materials

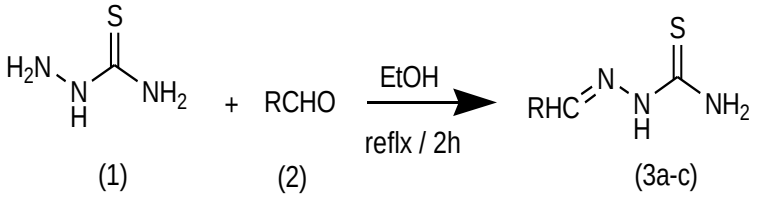
IR spectra were recorded on KBr discs, using a shimadzu IR Affinity-1 FT-IR instrument. ^{1}HNMR (500MHz) spectra were recorded on Varian UNITY INOVA spectrometer in DMSO-d6 solution. chemical shifts(δ) were reported in ppm; coupling constants (J) The reactions were monitored by TLC aluminum plates

تم استلام الورقة بتاريخ: 25/ 12/ 2023م وتم نشرها على الموقع بتاريخ:31 / 1/ 2024م

with silica gel Kieselgel 60 F254 thickness 0.25mm (Merk), using UV light as a visualizing agent.

General method

Place a mixture of thiosemicarbazide (1) (1.82g, 0.02mol) and aromatic aldehydes (2) (0.02mol) in 50ml ethanol in a round-bottomed flask, stir at room temperature for 5 minutes and heat to reflux Two hours. The reaction was monitored for completion by TLC, cooled to room temperature, filtered, washed with water and recrystallized in ethanol to obtain compounds.



Scheme 1: preparation of thosemicarbazide

2-1- Synthesis of (Z)1-benzylidene thiosemicarbazide (3a):

Amixture thiosemicarbazide (1) (1.82gm, 0.02mol), benzaldehyde (2.12gm, 0.02mol) in 50ml ethanol. Filtered, washed with water and recrystallized ethanol.

Mp 137.2 Cº, yield: 56.88%. C8H9N3S(M.W.179).IR νmax(KBr, cm^{-1}): 3416-3121(N-H stretching), 1680(N=C stretching), 1249(C-N stretching), 1172 (C=S stretching), 2018 (-N-C=S stretching), 1543-1607 (NH starching),1447-1463(Aromatic C=C starching) HNMR (500MHz) (DMSO-d6/TMS) δ(ppm): 2 (s, H,NH), 8.1 (s, 1H, CH), 7.6 (s, 2H, ar), 7.3(s, 3H, ar), 2(s, 2H, NH).

تم استلام الورقة بتاريخ: 25/ 12/ 2023م وتم نشرها على الموقع بتاريخ:31 / 1/ 2024م

2-2-Synthesis of (E)-1-((Z)-3-phenylallyidene) thiosemicarbazide (3b):

A mixture thiosemicarbazide(1) (1.82gm,0.02mol), cinamaldehyde (2.64gm, 0.02mol) in 50ml ethanol, filtered, washed with water and recrystallized ethanol to give the compound(3b).

Mp 111.1 Cº, yield: 63.44%. C10H11N3S (M.W.206).IR νmax(KBr, cm^{-1}): 3416-3356(N-H stretching), 1690(N=C stretching), 1224(C-N stretching), 1172 (C=S stretching), 2022 (-N-C=S stretching), 1524(NH starching),1447-1488(Aromatic C=C starching) 1690-1624(C=C). ^{1}HNMR (500MHz) (DMSO-d6/TMS) δ(ppm): 7(s, H,NH), 6.6 (s, 1H, CH), 5.2(s, H, CH), 7.5(s, H, CH), 7.3 (s, 2H, ar), 7.21(s, 2H, ar), 2(s, 2H, NH).

2-3-Synthesis of (Z)-1-(2-hydroxybenzylidene) thiosemicarbazide (3c):

A mixture thiosemicarbazide (1.82gm,0.02mol), salicylaldehyde (2.44gm,0.02mol) in 50ml ethanol, , filtered, washed with water and recrystallized ethanol to give the compound (3c).

Mp 211.9 Cº, yield: 56.69%. C8H9N3SO (M.W.195).IR νmax (KBr, cm^{-1}): 3416-3356(N-H stretching), 1690 (N=C stretching), 1225-1200 (C-N stretching), 1172 (C=S stretching), 2056 (-N-C=S stretching), 1536 (NH stretching),1488-1409(Aromatic C=C starching) 1690-1630(alkene C=C), 3400 (OH stretching), 1264 (C-O stretching). ^{1}HNMR (500MHz) (DMSO-d6/TMS) δ(ppm): 2 (s, H,NH), 8.1(s, 1H, CH), 7.4 (s, H,ar), 7.1(s, H,ar), 6.8 (s, 2H, ar) 2(s, 2H, NH), 5 (s, H, OH).

3-Results and Discussion

Thiomacarbazine and aromatic aldehydes were reacted in ethanol medium (see scheme1) in a condenser for 2 hours to synthesize the

تم استلام الورقة بتاريخ: 25/ 12/2023م وتم نشرها على الموقع بتاريخ:31 / 1/2024م

target compounds (3a-c). The reaction was monitored by TLC, then filtered and recrystallized from organic solvent.

The resulting product is in good proportions and the physical data are shown in Table1. The data obtained from the spectral analysis of the thiosemicarbazone compounds correspond to the proposed product structure. Therefore, the infrared spectrum of thiosemicarbazone shows the band of the 2NH product in the range of 3440-3314 cm-1. The area of NC=S is in the range of 2018-2056, the area of C=N is in the range of 1663-1690, the absorption range of NH is in the range of 1524-1543, the absorption range of OH in compound (3c) is in the range of 3400, the absorption range at 1264 for the C-O of compound(3c) because it contains a hydroxyl group and when a catalyst is added it is possible to extract the water component through the hydroxyl and amine groups when adding a catalyst or polarization within the compound to form a cyclic compound. In nuclear magnetic resonance, the proton shows a single-single absorbance in the range of 6.6-8.1 for CH, a single-single absorbance in the range of 7.5-7.6 for NH, and single-single absorbance in the range of 7.6-6.8 for the CH ring.

Table1: Synthesis of thiosemicarbazide derivatives

Entry	RCHO	Yelid%	COLOR	Melting point	Product
1	C6H5	56.88	white	137.2	3a
2	C6H5CH=CH	63.44	yellow	111.1	3b
3	2-OH-C6H5	56.89	yellow	211.9	3c

4- Conclusion

In this paper, an efficient and mild protocol for the synthesis of thiosemacarbazide derivatives using ethanol as an inexpensive alcohol is presented. Short reaction times, high throughput, ease of

تم استلام الورقة بتاريخ: 25/ 12/ 2023م وتم نشرها على الموقع بتاريخ:31 / 1/ 2024م

work, low cost and easy availability of catalyst are the key advantages of this method.

5- References:

[1] Singhal S, Arora S, Agarwal S, et al. A rview on potential biological activities of thosemicarbazides. World J Pharm Sci. 2013;2:466-81.

[2] Narang R, Narasimahan B, Sharma S. A review on biological activities and chemical synthesis of hydrazide derivatives. Curr Med Chem. 2012;19:569-612.

[3] Aly MM Mohamed YA El-Bayouki KA Basyouni WM Abbas SY Synthesis of some new 4(3H)-quinazolinone-2-carboxaldehyde thiosemicarbazones and their metal complexes and a study on their anticonvulsant, analgesic, cytotoxic and antimicrobial activities-Part-1. European Journal of Medicinal Chemistry.2010;45:3365-3373.[PubMed][Google Scolar]

[4] Sroor FM, Khatab TK, Basyouni WM and El-Bayouki KAM(2019) Synthesis and molecular docking studies of some new thiosemicarazone derivatives as HCV polymeraseinhibitors. Synthetic Communications 49:1444-1445.doi:10.1080/00397911.2019.1605443.

[5] El-Sharief MAMS, Abbas SY, El-Bayouki KAM and El-Gammal EW (2013) Synthesis of thiosemicarbazones derived from N-(4-hippuric acid) thiosemicarbazide and different carbonyl compounds as antimicrobial agents. European Journal of Medicinal Chemistry 67:263-268.doi:10.1016/j.ejmech.2013.06.031.

[6] Popovici, C,.Pavel,C.M., Sunel, V., Cheptea,C., Dimitriu, D.G., Dorohoi, D.O., Davide, D., et al.(2021)Optimized Synthesis of New Thiosemicarbazide Derivatives with Tuberculostatic Activity. International Journal of Molecular

تم استلام الورقة بتاريخ: 25/ 12/ 2023م وتم نشرها على الموقع بتاريخ: 31 / 1/ 2024م

Sciences, 22, Article ID: 12139.https://doi.org/10.3390/ijms222212139.

[7] Alomar K, Khan MA, Allain M and Bouet G: Synthesis, crystal structure and characterization of 3-thiophene aldehyde thiosemicarbazone and its complexes with cobalt(II), nickel(II) and copper(II). Polyhedron28:1273-1280, 2009.