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Short Note

5,5-Dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine

Ahmad. Abu-Obaid ¹, Ahmad I. Asadi ¹, Afaf. Alruwaili ², Heba. Atieh ¹, Shoqour Khlaif ¹, Taibi Ben Hadda ³, Smaail Radi ³, Belkheir Hammouti ⁴ and Ismail Warad ^{1,*}

¹ Department of Chemistry, AN-Najah National University P.O. Box 7, Nablus, Palestine

² Department of Chemistry, College of Science, University of Hail, P.O. Box 2440, Hail, Saudi Arabia

³ Laboratoire LCM, Faculty of Science, University Mohammed Premier, Oujda-60000, Morocco

⁴ LCAE-URAC18, Faculty of Science, University Mohammed Premier, Oujda-60000, Morocco

* Author to whom correspondence should be addressed; E-Mail: warad@najah.edu; Tel./Fax: +970-9234-5982.

Academic Editor: Norbert Haider

Received: 24 September 2014 / Accepted: 19 December 2014 / Published: 24 December 2014

Abstract: Novel 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine was synthesized in good yield by a one-pot condensation reaction of 2,2-dimethylpropane-1,3-diamine with di(pyridin-2-yl)methanone using dichloromethane as solvent at room temperature. The structure of the synthesized compound was assigned on the basis of its elemental analysis, UV-visible, ¹H-NMR, ¹³C-NMR, IR, and mass spectral data.

Keywords: hexahydropyrimidine; 2,2-dimethylpropane-1,3-diamine; di(pyridin-2-yl)methanone

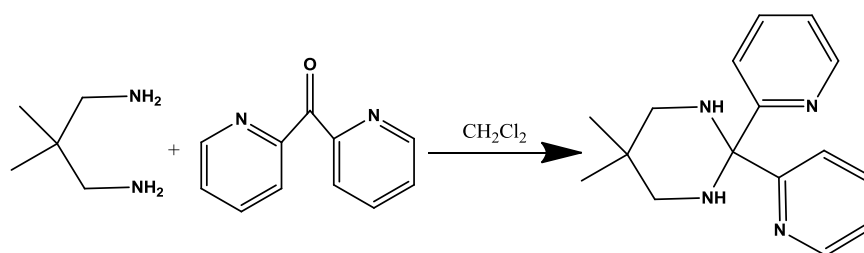
Introduction

The six-membered heterocyclic hexahydropyrimidine unit is present in several natural products and pharmaceutical agents of various pharmacological activities [1]. Hexahydropyrimidines are also found in many bioactive compounds, like antiinflammatory and analgesic agents, fungicides, antibacterials, parasiticides, and antivirals [2]. They also behave as prodrugs of pharmacologically active di- and polyamines [3,4]. Several derivatives of hexahydropyrimidines are used as polymers stabilizers [5]. Due to their facile cleavage under mild acidic conditions, hexahydropyrimidines have been employed in organic synthesis as protective groups in the selective acylation by addition of 1,3-diamines [6]. Furthermore, hexahydropyrimidines and some of their derivatives form good polydentate nitrogen donor complexes, they coordinate the transition metal ions in mono-, di-, or poly-coordination mode [7–9].

The classic synthetic route leading to hexahydropyrimidine heterocyclic compounds involves the condensation of substituted propane-1,3-diamines with aldehydes and ketones [2–4]. In this work, we prepared and characterized 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine, the X-ray structures of this compound and other derivatives which were previously published by our group [9–11].

Result and Discussion

The title compound was synthesized by mixing equimolar amounts of 2,2-dimethylpropane-1,3-diamine and di(pyridin-2-yl)methanone in dichloromethane as shown in Scheme 1. The product is colorless and soluble in CH_2Cl_2 , partially in ROH, insoluble in water and non-polar solvents like *n*-hexane.



Scheme 1. Synthesis of 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine.

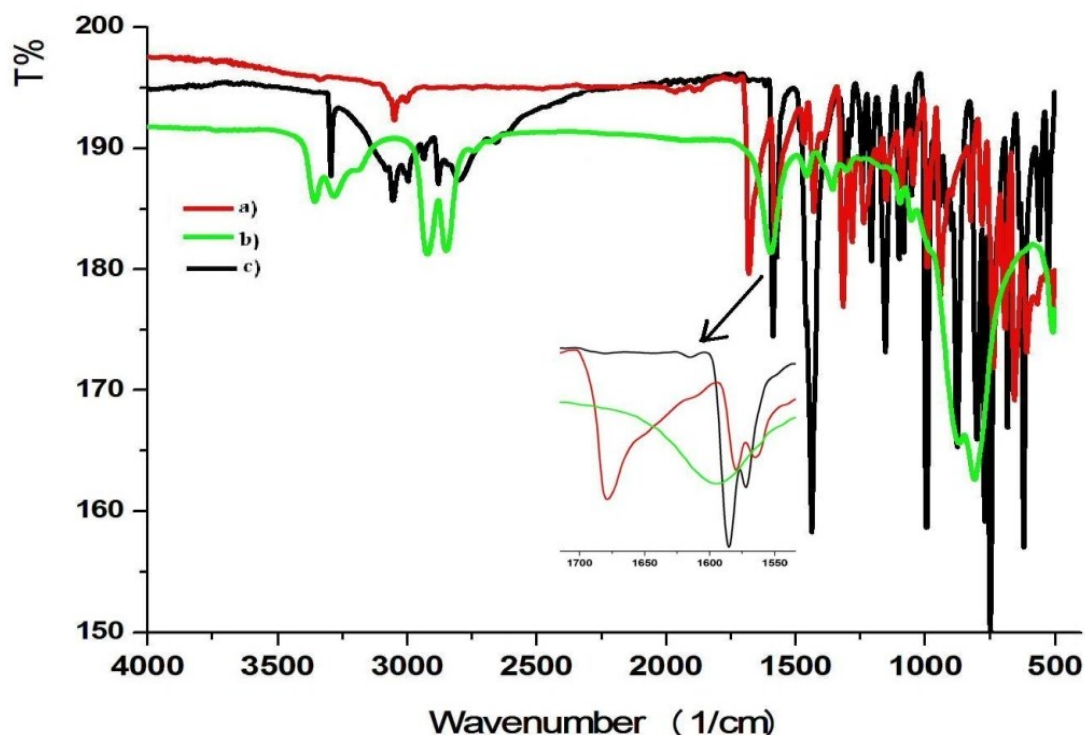


Figure 1. IR spectra of: (a) 2-dipyridylketone (starting material), (b) 2,2-dimethyl-1,3-propanediamine (starting material), and (c) 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine (product).

The IR spectrum of 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine shows the absorption bands of the functional groups present as displayed in Figure 1. The most significant absorption bands in the 3390, 3080, 2980–2700 cm^{-1} region can be assigned to N-H aromatic C-H, aliphatic C-H

stretching vibrations, respectively. Other characteristic bands due to other functional groups are also present in the expected regions, the formation of the product was confirmed by N-H stretching vibration shifts and C=O (of the ketone) disappearance, as seen in Figure 1.

The elemental analysis of the compound is consistent with the proposed molecular formula (Calcd. for $C_{16}H_{20}N_4$: C, 71.61; H, 7.51; N, 20.88. Found: C, 71.25; H, 7.31; N, 20.55). EI-MS spectrum of the compound is in good agreement with the assigned structure and shows the experimental molecular ion $[M^+]$ $m/z = 270$ (269.2 theoretical) as shown in Figure 2.

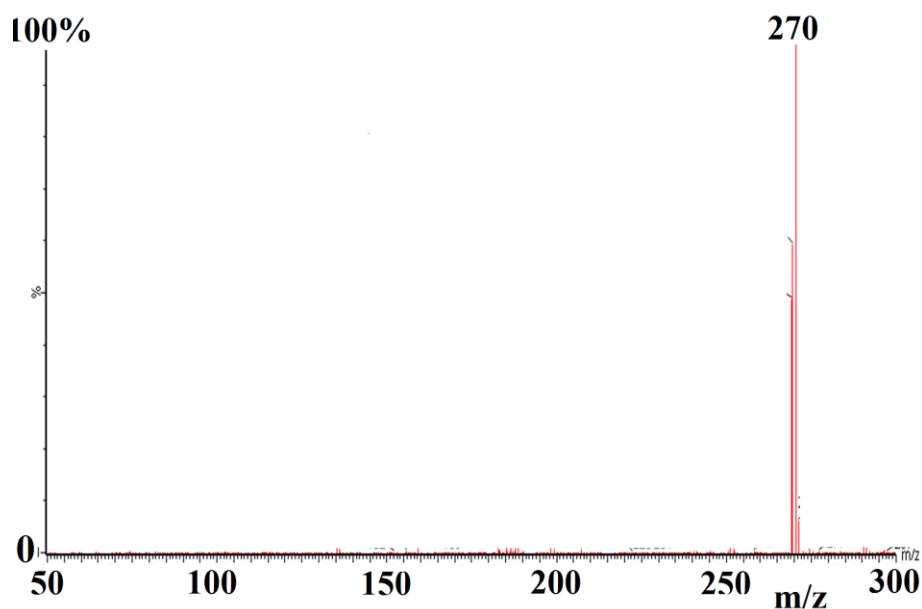


Figure 2. EI-MS spectrum of 5,5-dimethyl-2,2-di(pyridin-2-yl)hexahydropyrimidine.

The electronic absorption spectrum of the compound was acquired in CH_2Cl_2 , Figure 3 shows the electronic absorption as expected (on the UV region only) at $\lambda_{max} = 215$ and 265 nm which assigned to intra-ligand $\pi-\pi^*$ / $n-\pi^*$ transitions.

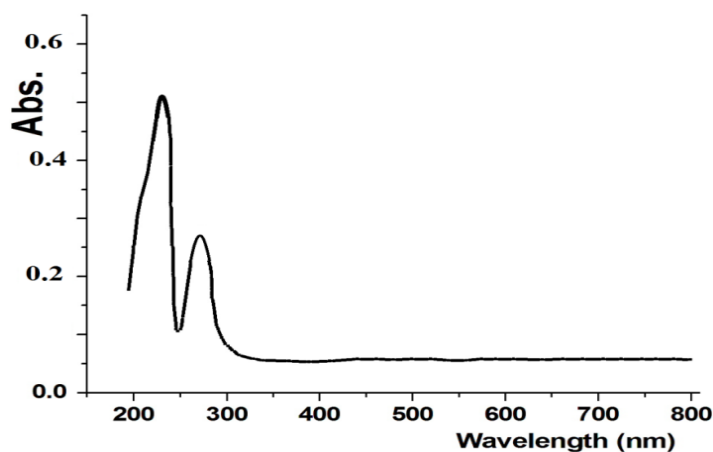


Figure 3. UV-Vis spectrum of 1×10^{-5} M in CH_2Cl_2 at RT.

1H -NMR and the ^{13}C -NMR spectra data are in a good agreement with its assigned structure, signals of aromatic and aliphatic protons and carbon are cited to their positions.

Experimental Section

The IR spectra for samples were recorded using Perkin Elmer Spectrum 1000 FT-IR Spectrometer. The UV-visible spectrum was measured by using a TU-1901 double-beam UV–visible spectrophotometer. High-resolution ^1H , and $^{13}\text{C}\{^1\text{H}\}$ were recorded on Bruker DRX 250 spectrometer (Bruker, Mainz, Germany) (^1H , 250 MHz and ^{13}C , 62.5 MHz frequency) at 298 K. EI-MS data was obtained on a Finnigan 711A (8 kV) (PerkinElmer Inc., Waltham, MA, USA).

A solution of 2-dipyridylketone (0.25 g, 1.45 mmol) in dichloromethane (20 mL) was mixed with 2,2-dimethyl-1,3-propanediamine (0.11 mL, 1.5 mmol) and allowed to stand for 1 h. The resulting mixture was concentrated under reduced pressure and the title compound was precipitated by the addition of 70 mL of *n*-hexane. The precipitates were filtered off, washed three times with 80 mL of distilled water.

Yield 88%, Colorless, Mp: 103 °C; Molecular formula $\text{C}_{16}\text{H}_{20}\text{N}_4$; ^1H -NMR (250 MHz, CDCl_3): (ppm) 0.99 (s, 6H, CH_3), 2.69 (br, 4H, CH_2), 3.24 (br, 2H, NH), 7.10–8.20 (3m, 10H, Py–H), ^{13}C -NMR (62.5 MHz, CDCl_3): (ppm) 24.83 (2 CH_3), 28.29 (C), 53.43 (2 CH_2), 75.82 (CN_2), 122.09, 122.15 (*p*-CH and *m*-CH), 136.70 (*o*-CH), 149.04 (*m*-CHN), 162.23 (*i*-C-Py). Calcd. for $\text{C}_{16}\text{H}_{20}\text{N}_4$: C, 71.61; H, 7.51; N, 20.88. Found: C, 71.25; H, 7.31; N, 20.55). $[\text{M}^+] = 270$ *m/z*. IR: 3390 cm^{-1} _{N-H}, 3080 cm^{-1} _{C-H Py}, 2980–2700 cm^{-1} _{C-H aliphatic}.

Acknowledgments

I. Warad would like to thank AN-Najah National for their research support and Mr. Nafith Dweik for his kind collaboration.

Author Contributions

A. Abu-Obaid and A.I. Asadi analyzed the NMR data; A. Alruwaili, H. Atieh and Sh. Khlaif performed the experiments; T. B. Hadda, S. Radi and B. Hammouti helped in the results and discussion and writing the manuscript; and I. Warad wrote the paper.

Conflicts of Interest

The authors declare no conflict of interest.

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