A substituted imidazole derivative from *Jatropha curcas*†

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4-Butyl-2-chloro-5-formyl-1\(H\)-imidazole, a new minor antibacterial constituent of *Jatropha curcas*, has been characterized by detailed analysis of its spectroscopic (mainly 1D and 2D NMR) data. The molecule is structurally interesting as it contains several functionalities.

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*Jatropha curcas* (Linn) (Euphorbiaceae) grows wild in different parts of India. The plant has been used\(^1\) ethnomedically to treat cancerous growths. An alcoholic extract of the plant has been confirmed\(^2\) to possess significant antileukemic activity. Previously several diterpenoids and coumarin derivatives were reported\(^3-5\) from the plant. During our work on the naturally occurring novel bioactive compounds we have recently isolated a new heterocycle, 4-butyl-2-chloro-5-formyl-1\(H\)-imidazole \(1\) from the CHCl\(_3\)-MeOH (1:1) extract of the roots of the species. Herein we report the isolation, structure elucidation and antibacterial activity of compound \(1\).

**Compound 1** was isolated as a semisolid. Its molecular formula was decided to be C\(_8\)H\(_{11}\)ClN\(_2\)O from its elemental analysis, mass [m/z at 187 and 189 (M\(^+\)+1) in FABMS] and \(^1\)H and \(^13\)C NMR spectra (indicating the presence of 11 hydrogen and 8 carbon atoms respectively). The IR spectrum exhibited the signals for \(-\text{NH-} (3448 \text{ cm}^{-1})\) and \(\text{–CHO groups} (1655 \text{ cm}^{-1})\). The 1D and 2D NMR spectra clearly suggested the compound \(1\) to be an imidazole derivative. The \(^1\)H-\(^1\)H COSY, HMBC and HSQC spectra of the compound were thoroughly studied. The \(^1\)H NMR spectrum revealed the presence of \(\text{–NH-} (\delta 10.98, 1\text{H, brs}), \text{CHO} (\delta 9.64, 1\text{H, s})\) and a butyl group \(\delta 2.82 (2\text{H, t, } J = 7.0 \text{ Hz}), 1.83-1.72 (2\text{H, m}), 1.42-1.38 (2\text{H, m})\) and 0.94 (3\text{H, t, } J =7.0 \text{ Hz})]. The presence of the butyl group was also supported by the \(^1\)H-\(^1\)H COSY and HMBC spectra (Figure 1). The remaining three carbon atoms (corresponding to the values of \(\delta 154.8, 141.9\) and 125.7 (all quaternary in the \(^13\)C NMR spectrum) along with two nitrogen comprised the imidazole core of \(1\) and the three functionalities (\(-\text{CHO, -Cl and –Bu}\)) were attached to these three carbons. The assignment of the \(^13\)C NMR singals were made by DEPT, HSQC and HMBC experiments. The aldehyde proton (\(\delta 9.64\)) showed HMBC correlation with the carbon at \(\delta 125.7\) while the protons of a \(-\text{CH}_2\) group of the butyl moiety (at C-1; \(\delta 2.82\)) with other carbon at \(\delta 154.8\) (Figures 1 and 2). Thus the formyl and the butyl groups were placed at the adjacent equivalent positions, C-4 and C-5 respectively. Consequently the chlorine atom was kept at C-2. The structure of \(1\) was thus arrived at as 4-butyl-2-chloro-5-formyl-1\(H\)-imidazole.

The molecule \(1\) is structurally interesting as it contains various functionalities such as formyl, chloro, butyl and amino groups. Several imidazole derivatives are known\(^6\) to possess different interesting biological properties. The present isolate \(1\) was tested for its antibacterial activity. The compound showed moderate activity against the gram-positive organisms, *Bacillus subtilis* and *Bacillus sphaericus* and weak activity against the gram-negative organisms, *Chromobacterium violaceum* and *Klebsiella aerogens*\(^7\).

**Experimental Section**

The spectra were recorded with the following instruments: IR: Perkin-Elmer FT-IR spectrophotometer; NMR: Varian Unity INOVA 500 MHz spectrometer and FABMS: Finnigan MAT 1020 instrument. Column chromatography was performed on silica gel (BDH, 100-200 mesh) and TLC with silica gel GF\(_{254}\).
Plant material

The roots of *Jatropha curcas* were collected from Dhanasri, Andhra Pradesh in January 2003 and were botanically identified. The voucher specimen of the sample (No. JC-1051) has been kept in the herbarium of IICT.

Extraction and Isolation

The shade dried and crushed plant material (3 kg) was extracted with hexane (5 litre) for 3 days and then the defatted portion with CHCl₃-MeOH (1:1) (5 litre) for 5 days at room temperature. The second extract was filtered and concentrated to produce a brown gummy mass (40 g). The residue was chromatographed and the column was eluted with solvents of increasing polarity using hexane, EtOAc and MeOH. The eluates were collected in fractions of 100 mL each and the resolution of the components in the mixture was monitored by TLC. The fractions eluted with EtOAc-hexane (4:1) were combined, concentrated and subjected to rechromatography to afford 4-butyl-2-chloro-5-formyl-1H-imidazole 1 (7 mg, 0.00023%).

**4-Butyl-2-chloro-5-formyl-1H-imidazole 1:** Semi-solid, IR (KBr): 3448, 1655, 1461, 1258 cm⁻¹; ¹H NMR: δ 10.98 (1H, brs, -NH-), 9.64 (1H, s, -CHO), 2.82 (2H, t, J = 7.0 Hz, H₂-1'), 1.83-1.72 (2H, m, H₂-2'), 1.42-1.38 (2H, m, H₂-3'), 0.94 (3H, t, J = 7.0 Hz, H₃-4'); ¹³C NMR: δ 178.6 (-CHO), 154.8 (C-5), 141.9(C-2), 125.7 (C-4), 29.7 (C-2'), 28.4 (C-1'), 22.2 (C-3'), 13.4 (C-4'); FABMS: m/z 189 and 187 (M⁺ +1). Anal. Calcd for C₈H₁₁ClN₂O: C, 51.61; H, 0.54; N, 15.05; Cl, 18.82. Found: C, 51.42; H, 0.51; N, 15.16; Cl, 18.67%.

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References

7 The detailed biological data will be published elsewhere.