

NUCLEOSIDES FROM THE MARINE SPONGE *Callyspongia* SP.

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UDC 547.963.3

The genus *Callyspongia* (order *Haplosclerida*, family *Callyspongiidae*) is widely distributed and contains various bioactive constituents [1].

The wet marine sponge *Callyspongia* sp. (10 kg) was extracted with ethanol (90%). Ethanol was evaporated *in vacuo* to afford a syrupy residue that was suspended in distilled water and fractionated successively with petroleum ether, ethyl acetate, and *n*-butanol. Rechromatography of the ethyl acetate fraction over columns of silica gel, Sephadex LH-20, and ODS HPLC produced compounds **1–8**. The isolated compounds were identified using spectral analysis (NMR and MS). Compounds **1–8** were identified as spongothymidine (**1**) [2], spongouridine (**2**) [3], 1-(2'-deoxy- $\alpha$ -D-ribofuranosyl)thymine (**3**) [4], 2'-deoxyuridine (**4**) [5], 2'-deoxyinosine (**5**) [5], 2'-deoxyadenosine (**6**) [6], 1-(2'-Deoxy- $\beta$ -D-erythro-pentofuranosyl)-1*H*-1,2,4-triazone (**7**) [7], and 1-( $\beta$ -D-ribofuranosyl)-1*H*-1,2,4-triazone (**8**) [8] by comparison of the results with the literature. Compounds **1–3**, **5–8** were isolated for the first time from *Callyspongia* sp.

**Spongothymidine (1)**. White solid. <sup>1</sup>H NMR (500 MHz, CD<sub>3</sub>OD,  $\delta$ , J/Hz): 7.83 (1H, s, H-4), 6.30 (1H, t, J = 7.0, H-1'), 4.42 (1H, m, H-3'), 4.24 (1H, m, H-4'), 3.93 (1H, m, H-2'), 3.83 (1H, dd, J = 12.0, 3.0, H-5'a), 3.80 (1H, dd, J = 12.0, 3.5, H-5'b), 1.88 (3H, s, 5-CH<sub>3</sub>). <sup>13</sup>C NMR (125 MHz, CD<sub>3</sub>OD): 163.7 (C-6), 150.4 (C-2), 140.4 (C-4), 109.7 (C-5), 95.3 (C-1'), 87.0 (C-4'), 73.3 (C-2'), 70.2 (C-3'), 60.1 (C-5'), 13.1 (5-CH<sub>3</sub>).

**Spongouridine (2)**. White solid. <sup>1</sup>H NMR (500 MHz, Py-d<sub>5</sub>,  $\delta$ , J/Hz): 13.01 (1H, br.s, 1-NH), 8.53 (1H, d, J = 8.5, H-4), 7.73 (1H, br.s, 5'-OH), 7.06 (2H, br.s, 2' and 3'-OH), 6.82 (1H, d, J = 3.5, H-1'), 5.80 (1H, d, J = 8.5, H-5), 4.91 (1H, m, H-3'), 4.90 (1H, m, H-4'), 4.65 (1H, m, H-2'), 4.31 (1H, d, J = 12.0, H-5'a), 4.20 (1H, d, J = 12.0, H-5'b). <sup>13</sup>C NMR (125 MHz, Pyr-d<sub>5</sub>): 164.3 (C-6), 152.1 (C-2), 141.0 (C-4), 102.4 (C-5), 90.4 (C-1'), 86.2 (C-4'), 75.9 (C-2'), 71.1 (C-3'), 61.7 (C-5').

**1-(2'-Deoxy- $\alpha$ -D-ribofuranosyl)thymine (3)**. White solid. <sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>,  $\delta$ , J/Hz): 11.27 (1H, br.s, 1-NH), 7.69 (1H, s, H-4), 6.16 (1H, t, J = 7.3, H-1'), 5.22 (1H, d, J = 4.2, 3'-OH), 5.01 (1H, t, J = 5.2, 5'-OH), 4.22 (1H, m, H-4'), 3.92 (1H, m, H-3'), 3.56 (2H, m, H-5'), 2.07 (2H, m, H-2'), 1.76 (3H, s, 5-CH<sub>3</sub>). <sup>13</sup>C NMR (125 MHz, DMSO-d<sub>6</sub>): 163.5 (C-6), 150.6 (C-2), 139.4 (C-4), 110.7 (C-5), 94.3 (C-1'), 87.1 (C-4'), 70.2 (C-3'), 61.1 (C-5'), 40.3 (C-2'), 13.2 (5-CH<sub>3</sub>).

**2'-Deoxyuridine (4)**. White solid. <sup>1</sup>H NMR (500 MHz, CD<sub>3</sub>OD,  $\delta$ , J/Hz): 8.00 (1H, d, J = 6.5, H-4), 6.82 (1H, t, J = 7.0, H-1'), 5.72 (1H, d, J = 6.5, H-5), 4.41 (1H, m, H-4'), 3.95 (1H, m, H-3'), 3.79 (1H, dd, J = 12.0, 3.5, H-5'a), 3.73 (1H, dd, J = 12.0, 4.0, H-5'b), 2.31 (1H, m, H-2'a), 2.21 (1H, m, H-2'b). <sup>13</sup>C NMR (125 MHz, CD<sub>3</sub>OD): 163.3 (C-6), 151.1 (C-2), 141.0 (C-4), 103.4 (C-5), 92.4 (C-1'), 87.2 (C-4'), 71.2 (C-3'), 61.3 (C-5'), 40.3 (C-2').

**2'-Deoxyinosine (5)**. White solid. ESI-MS *m/z* 253 [M + H]<sup>+</sup>. <sup>1</sup>H NMR (500 MHz, DMSO-d<sub>6</sub>,  $\delta$ , J/Hz): 12.11 (1H, br.s, 1-NH), 8.13 (1H, s, H-2), 8.07 (1H, s, H-8), 6.30 (1H, t, J = 6.9, H-1'), 5.32 (1H, d, J = 4.0, 3'-OH), 4.96 (1H, t, J = 5.5, 5'-OH), 4.38 (1H, m, H-4'), 3.94 (1H, m, H-3'), 3.61 (1H, m, H-5'a), 3.48 (1H, m, H-5'b), 2.61 (2H, m, H-2'). <sup>13</sup>C NMR (125 MHz, DMSO-d<sub>6</sub>): 166.2 (C-6), 157.2 (C-4), 155.2 (C-2), 148.0 (C-8), 133.9 (C-5), 97.1 (C-1'), 93.1 (C-4'), 80.1 (C-3'), 71.1 (C-5'), 45.6 (C-2').

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**2'-Deoxyadenosine (6).** White solid. <sup>1</sup>H NMR (500 MHz, CD<sub>3</sub>OD, δ, J/Hz): 8.33 (1H, s, H-2), 8.19 (1H, s, H-8), 6.45 (1H, t, J = 6.2, H-1'), 4.59 (1H, m, H-4'), 4.09 (1H, m, H-3'), 3.86 (1H, dd, J = 12.0, 3.0, H-5'a), 3.76 (1H, dd, J = 12.0, 3.3, H-5'b), 2.83 (1H, m, H-2'a), 2.43 (1H, m, H-2'b). <sup>13</sup>C NMR (125 MHz, CD<sub>3</sub>OD): 157.6 (C-6), 153.5 (C-2), 150.1 (C-4), 141.6 (C-8), 120.1 (C-5), 90.1 (C-1'), 87.2 (C-4'), 73.1 (C-3'), 63.7 (C-5'), 41.6 (C-2').

**1-(2'-Deoxy-β-D-erythro-pentofuranosyl)-1H-1,2,4-triazone (7).** Yellowish oil. <sup>1</sup>H NMR (500 MHz, CD<sub>3</sub>OD, δ, J/Hz): 8.35 (1H, s, H-4), 8.20 (1H, s, H-2), 6.45 (1H, t, J = 6.1 Hz, H-1'), 4.60 (1H, m, H-4'), 4.09 (1H, m, H-3'), 3.86 (1H, dd, J = 12.0, 3.0, H-5'a), 3.76 (1H, dd, J = 12.0, 3.3, H-5'b), 2.83 (1H, m, H-2'a), 2.42 (1H, m, H-2'b). <sup>13</sup>C NMR (125 MHz, CD<sub>3</sub>OD): 153.5 (C-2), 141.6 (C-4), 90.0 (C-1'), 87.2(C-4'), 73.1 (C-3'), 63.7 (C-5'), 41.6 (C-2').

**1-(β-D-Ribofuranosyl)-1H-1,2,4-triazone (8).** Yellowish oil. <sup>1</sup>H NMR (500 MHz, CD<sub>3</sub>OD, δ, J/Hz): 8.34 (1H, s, H-4), 8.20 (1H, s, H-2), 6.99 (1H, t, J = 6.4, H-1'), 4.76 (1H, m, H-3'), 4.34 (1H, m, H-4'), 4.19 (1H, m, H-2'), 3.86 (1H, dd, J = 12.0, 3.0, H-5'a), 3.76 (1H, dd, J = 12.0, 3.3, H-5'b). <sup>13</sup>C NMR (125 MHz, CD<sub>3</sub>OD): 153.6 (C-2), 142.1 (C-4), 91.3 (C-1'), 88.2 (C-4'), 75.5 (C-3'), 72.7 (C-2'), 63.5 (C-5').

## ACKNOWLEDGMENT

This study was supported by grants from National Natural Science Foundation of China (No. 40706046, 30973679, and 20902094), the National Key Basic Research Program of China (973)'s Project (2010CB833800 and 2011CB915503), Knowledge Innovation Program of Chinese Academy of Science (LYQY200703, SQ200904, and KSCX-YW-G-073), the Scientific Research Foundation for the Returned Overseas Chinese Scholars, State Education Ministry, and LMB (091002) Foundation.

## REFERENCES

1. Y. Liu, B. Yang, and J. D. Dong, *J. Trop. Oceanogr.*, **27**, 73 (2008).
2. W. Bergmann and R. J. Feeney, *J. Org. Chem.*, **16**, 981 (1951).
3. W. Bergmann and D. C. Burke, *J. Org. Chem.*, **20**, 1501 (1955).
4. T. Kamori, Y. Sanechika, Y. Ito, J. Matsuo, T. Nohara, T. Kawasaki, and H. R. Schulten, *Leibigs Ann. Chem.*, 653 (1980).
5. A. J. Jones, M. D. Grant, M. W. Winkley, and P. K. Robins, *J. Am. Chem. Soc.*, **92**, 4019 (1970).
6. A. J. Weinheimer, C. W. Chang, J. A. Matson, and P. N. Kaul, *J. Nat. Prod.*, **41**, 488 (1978).
7. J. Muller, D. Bohme, P. Lax, M. M. Cerda, and M. Ritzsch, *Chem. Eur. J.*, **11**, 6246 (2005).
8. J. T. Witkowski and R. K. Robins, *J. Org. Chem.*, **35**, 2635 (1970).