Chemical Constituent of *Aloe capensis*

Man Ki Park[1], Jeong Hill Park[1], Young Geun Shin[1], Yong Seok Choi[1], Kyeong Ho Kim[2], Tae Hyeong Cho[3] and Seung Ki Lee[1]

[1]College of Pharmacy, Seoul National University, Seoul 151-742, Korea, [2]College of Pharmacy, Kwangwon National University, Chuncheon 220-701, Korea, [3]Namyang Aloe Co., Chopyung, Jincheon, Chungbuk 365-850, Korea

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A C-glycosyl chromone, named as 7-O-methylaloesinol, was newly isolated from the leaf exudate of *Aloe capensis* and identified as 8-C-β-D-glucopyranosyl β-2-[2-(R)-hydroxypropyl]-7-methoxy-5-methyl-4H-1-benzopyran-4-one by chemical and spectral evidence.

Key words : *Aloe capensis*, Liliaceae, 8-C-β-D-glucopyranosyl-2-[2-(R)-hydroxypropyl]-7-methoxy-5-methyl-4H-1-benzopyran-4-one, 7-O-methylaloesinol

INTRODUCTION

Aloe is the dried latex of *Aloe ferox* Miller and its hybrids (Cape aloe) or *Aloe barbadensis* Miller (Curacao aloe) and it has long been used in folk medicine to treat constipation, burns and dermatitis. Several anthraquinones, anthrones, chromones, and their C-glycosyl derivatives were isolated from various species of aloe (Park *et al.*, 1995; Park *et al.*, 1996; Reynolds, 1985; Conner *et al.*, 1989; 1990, Speranza *et al.*, 1986; 1993). In the course of isolating chromone components from the leaf exudate of *Aloe capensis*, a C-glycosylchromone (Fig. 1) was newly isolated from the *n*-BuOH extract.

MATERIALS AND METHODS

Materials

The dried leaf exudate of *Aloe capensis* was purchased from Wha-Il Pharmaceutical Co. Ltd., in Seoul.

Instruments

Melting point was recorded on a Gallenkamp melting point apparatus and was uncorrected. UV spectra were measured on a Shimadzu UV-2100 UV/VIS spectrometer. ^1H and ^{13}C NMR spectra were recorded on Jeol JNM-LA300 spectrometer. IR spectra were obtained on Perkin-Elmer 1710 spectrometer. Mass spectra were obtained using VG TRIO-II GC/MS system and Jeol AX505WA mass spectrometer. Silica gel 60 and TLC plates were purchased from Merck (Germany). HPLC was carried out on Samsung SLC-100 system (Samsung, Korea) using μ-Bondapak C_{18} column (4 mm × 300 mm, 10 μm, Waters, USA).

Correspondence to: Jeong Hill Park, College of Pharmacy, Seoul National University, Seoul 151-742, Korea

Extraction and isolation

Dried exudate (500 g) of *Aloe capensis* was dissolved in H_2O (3L) and extracted with EtOAc (3L × 3) stirring vigorously for 3 hours at room temperature. The aqueous layer was further extracted with water-saturated *n*-BuOH (3L × 3). The *n*-BuOH layer was concentrated *in vacuo* and the residue (180 g) was subjected to column chromatography on silica gel (800 g, 230-400 mesh, column : 80 mm × 1 m) using $CHCl_3$/MeOH (5/1, v/v) as eluent. Six fractions were obtained and Fr. III (9.5 g) was further chromatographed on silica gel (200 g, 230-400 mesh, column : 4 × 50 cm) using EtOAc/MeOH/H_2O (10/1/0.5, v/v/v) as eluent. Compound 1 (900 mg) was isolated from the 7th fraction in 0.18% yield.

Compound 1: amorphous powder (EtOAc/MeOH),

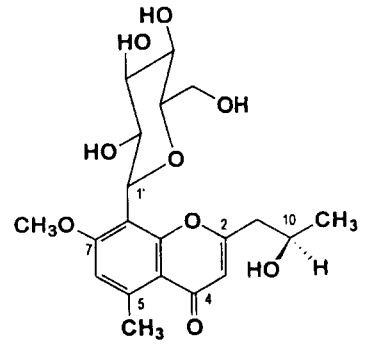

Fig. 1. The structure of compound 1.

mp: 140-142°, $[\alpha]_D^{24}$:-11.5° (MeOH, c 0.2), R_f:0.22 ($CHCl_3$/MeOH=5/1; Kieselgel $60F_{254}$), UV λmax (log ε) MeOH:226 (4.27), 242 (4.20), 250 (4.17), 292 (4.00), IR ν_{max} (KBr):3401, 2361, 1651, 1598, 1385 cm^{-1}, ^{1}H-NMR (300 MHz, DMSO-d_6, δ ppm):1.16 (3H, d, *J*=6.0 Hz, 11-H), 2.57 (2H, brd, *J*=6.0 Hz, 9-Hz), 2.74 (3H, s, 12-H), 3.2-4.0 (5H, m, sugar-H), 3.88 (3H, s, 7-OCH_3), 4.13 (1H, m, 10-H), 4.73 (1H, d, *J*=9.6 Hz, 1'-H), 6.03 (1H, s, 3-H), 6.93 (1H, s, 6-H), ^{13}C-NMR (75 MHz, DMSO-d_6, δ ppm):165.3 (C-2), 111.6 (C-3), 179.2 (C-4), 116.3 (C-4a), 141.5 (C-5), 111.9 (C-6), 160.4 (C-7), 113.2 (C-8), 157.6 (C-1a), 43.6 (C-9), 64.3 (C-10), 24.2 (C-11), 23.3 (C-5-$\underline{C}H_3$), 56.7 (C-7-O$\underline{C}H_3$), 73.4 (C-1'), 71.4 (C-2'), 79.1 (C-3'), 71.2 (C-4'), 82.2 (C-5'), 62.2 (C-6'), Mass [EI+, m/z] (rel.int. %):410[M^+] (11), 392 (10), 366 (14), 277 (19), 259 (81), 233 (100), 217 (49), 193 (94), 121 (63), positive FAB-MS:411[M+H]$^+$.

Synthesis of compound 1

Aloesin (100 mg), which was isolated in our laboratory, was methylated with CH_2N_2 in diethylether to give 7-O-methylaloesin and $NaBH_4$ (200 mg) was added to a solution of 7-O-methylaloesin in MeOH (5 ml). The solution was stirred for 3.5 hrs at room temperature and acidified to pH 3 with 1M-HCl. The solution was extracted with *n*-BuOH and *n*-BuOH soluble part was evaporated *in vacuo* to give a mixture of diastereomers (60 mg). HPLC of the product showed two peaks; (10,R)-form at 7.5 min and (10,S)-form at 8.3 min. HPLC conditions; column: Waters μ-Bondapak C_{18} (4 mm×300 mm, 10 μm), mobile phase:linear gradient from 10% CH_3CN in H_2O to 20% CH_3CN for 10 min, flow rate:1.0 ml/min, detection:UV 293 nm. Compound **1** was separated from the product mixture by semi-prep HPLC; column: Lichrosorb C_{18} (7 μm, 10 mm×250 mm), mobile phase: linear gradient from 10% MeOH to 40% MeOH in H_2O for 30 min, flow rate: 2.5 ml/min, detection:UV 293 nm.

RESULTS AND DISCUSSION

Compound **1**, $C_{20}H_{26}O_9$, gave blue fluorescence under long wavelength UV (365 nm). Positive FAB-MS spectrum showed $[M+H]^+$ ion peak at *m/z* 411. The EI-MS spectrum showed fragmentation pattern very similar to that of aloeresin D (Speranza *et al.*, 1986), except that it lacked a fragment arising from p-coumaroyl moiety (*m/z* 164). The ^{1}H NMR spectrum of **1** showed two methyl proton signals at δ 1.16 and δ 2.74, a methoxy proton signal at δ 3.88, an olefinic proton signal at δ 6.03 and an aromatic proton signal at δ 6.93. The anomeric proton signal of compound **1** appeared at δ 4.73 (1H, d, *J*=9.6 Hz) and its coupling constant suggests a β-glucosidic linkage (Overend, 1972). These data indicated that compound **1** has an aloeresin D analogue lacking p-coumaroyl moiety. The ^{13}C NMR spectrum of **1** showed two methyl carbons at δ 23.3 and δ 24.2, one methoxy carbon at δ 56.7. By comparison of ^{13}C-NMR of C- or O-glycosyl compounds (Markham, 1982), hexose carbons of **1** appeared at δ 73.4 (anomeric carbon), 71.4, 79.1, 71.2, 82.2 and 62.2 suggesting the existence of C-glycosidic linkage and a glucose moiety in the molecule. All ^{13}C and ^{1}H NMR signals of compound **1** were assigned using DEPT, ^{1}H-^{1}H COSY, ^{13}C-^{1}H COSY and were confirmed by comparison of chemical shifts and coupling constants with those of aloesin analogues (Park *et al.*, 1995; Park *et al.*, 1996; Conner *et. al.*, 1989; 1990; Speranza *et al.*, 1986, 1993). The configuration of C-10 in compound **1** was determined by Speranza's procedure (Speranza *et al.*, 1986) as follows. Aloesin was treated with CH_2N_2 to give 7-O-methylaloesin, which was then reduced with $NaBH_4$. In HPLC analysis, the product showed two peaks arising from (10,R) and (10,S) stereoisomers (R_t=7.5 and 8.3 min). Compound **1** coincided with former peak (R_t=7.5 min) which is (10,R)-form of 8-C-glucosyl-7-O-methylaloesol. Alkaline hydrolysate of authentic aloeresin D also coincided with former peak (R_t=7.5 min) which is (10,R)-form (Speranza *et al.*, 1986).

Thus, compound **1** was identified as 8-C-β-D-glucopyranosyl-2-[2-(R)-hydroxypropyl]-7-methoxy-5-methyl-4H-1-benzopyran-4-one, and designated as 7-O-methylaloesinol. Although compound **1** and its stereoisomer were synthesized from aloesin to elucidate the structure of aloeresin D (Speranza *et al.*, 1986), compound **1** has not been reported in the nature so far.

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