# Superoxide Anion-Scavenging Effect of 2-Amino-1,3-selenazoles

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**We investigated the superoxide anion scavenging effects of thirteen 2-amino-1,3-selenazoles using a highly sensitive quantitative chemiluminescence method. At 166 $\mu$M, the 2-amino-1,3-selenazoles scavenged in the range of 14.3 to 96.7% of $O_2^-$. 2-Piperidino-1,3-selenazole and 4-phenyl-2-piperidino-1,3-selenazole exhibited the strongest superoxide anion-scavenging activity among the 2-amino-1,3-selenazoles. The 50% inhibitory concentrations ($IC_{50}$) of 2-piperidino-1,3-selenazole and 4-phenyl-2-piperidino-1,3-selenazole were determined to be 4.03 $\mu$M and 92.6 $\mu$M, respectively. Thus, these compounds acted *in vitro* as effective $O_2^-$ scavengers.**

**Key words** 2-amino-1,3-selenazole; superoxide radical; scavenging effect; superoxide anion-scavenging activities (SOSAs)

Aerobic cells are inevitably exposed to reactive oxygen species (ROS) formed as oxygen metabolites.[1] ROS such as superoxide anion ($O_2^{-\cdot}$), hydrogen peroxide ($H_2O_2$), and hydroxyl radical ($HO^\cdot$) may degenerate various biomacromolecules (DNA and proteins), resulting in oxidative and genotoxic stress.[2—4] $O_2^-$ is released from many types of immunologic cells including granulocytes and monocytes/macrophages *in vivo*.[5,6] Intracellular sources of ROS reportedly are mitochondoria and microsomes.[5,6] $O_2^-$ is spontaneously converted to $H_2O_2$ and $O_2$ in hydrophilic solvents such as water by a disproportion reaction.[7] $O_2^-$ also reacts with nitric oxide ($NO^\cdot$) to generate strongly toxic ROS including peroxynitrite ($ONOO^-$).[2,8]

Some antioxidative enzymes/substances, such as superoxide dismutases (SODs), catalase, glutathione peroxidases (GPXs), and certain vitamins (vitamin C and E), act as ROS scavengers since they quench ROS. GPX eliminates effectively $H_2O_2$ *in vitro* and *in vivo* in consequence, to be an important antioxidant enzyme.[9] The GPX active domain contains a selenium atom, supporting the importance of selenium atom in aerobic cells.[9] Various studies have reported that selenoproteins protect cells against oxidative stress.[10,11] Various organic selenium compounds effectively scavenge ROS. Excesses of superoxide anion in the human body are kept in check by an antioxidant enzyme system including SOD, GPX, and catalase (Cat). Superoxide anion has been reported to cause nerve degeneration[12] and heart failure.[13] SOD activity in blood sample from patients with thyroiditis, dwarfism, and Turner syndrome has been found to be lower than in healthy persons.[14] Therapy with a drug possessing SOSA may have in treatment of those diseases. Ebselen, a selenium-containing compound studied extensively for possible use as a drug, has been shown to attenuate oxidative stress.[15—17] As a representative organic selenium compound, ebselen is a five-membered ring selenium-containing heterocyclic compound showing glutathione peroxidase-like activity.[18] Thus, this is one of the promising synthetic antioxidants.[19] The antioxidative effects of ebselen is also attributed to its selective inhibition of leukocyte infiltration and activation, leading to attenuation of the $H_2O_2$ concentration *in vitro*.[19] Thus, the ebselen may be a multifunctional antioxidant and a potential chemopreventive agent in inflammation-associated carcinogenesis.[20]

We have showed superoxide anion-scavenging activities (SOSAs) of other organic selenium compounds such as selenocarbamates, selenoureas, and tertiary selenoamide compounds.[21—23] In the present study, we synthesized a series of five-membered ring selenium-containing heterocyclic compound, 2-amino-1,3-selenazoles and investigated SOSAs by them *in vitro*.

## Experimental

**Materials** 2-Amino-1,3-selenazoles **1**[24] were prepared according to procedures previously reported. A *Cypridina* luciferin analogue, 2-methyl-6-(4-methoxyphenyl)-3,7-dihydroimidazo-[1,2-*a*]pyrazin-3-one hydrochloride (MCLA) was obtained from Tokyo Kasei (Tokyo, Japan) for a use as a chemiluminescent probe for superoxide radicals. MCLA was dissolved in doubly distilled water and stored at −80 °C until needed. The concentration of MCLA solution was determined by absorbance at 430 nm using an absorbance coefficient value of $\varepsilon = 9600\,\mathrm{M}^{-1}\,\mathrm{cm}^{-1}$, as previously described.[25] SOD (Lyophilized powder, 3400 units/mg protein) and xanthine oxidase (XOD grade III) were purchased from Sigma Chemical (St. Louis, MO, U.S.A.). Hypoxanthine was purchased from Wako Pure Chemical (Osaka, Japan) and used without further purification. All other chemicals and solvents were analytical grade and used without further purification.

**Synthetic Methods for the Preparation of 2-Amino-1,3-selenazole Compounds** 2-Piperidino-1,3-selenazole **1a**[26]: 2-Chloro-1,1-dimethoxyethane (0.054 ml, 0.6 mmol) was added to stirred solution of 1-selenocarbamoyl-piperidine (38 mg, 0.2 mmol) in dry THF (1 ml) under an argon atmosphere then added. Acetic acid (0.6 ml) was added into the reaction mixture. The reaction mixture was refluxed for 3 h. The mixture was extracted with chloroform and washed with $H_2O$. The organic layer was dried over sodium sulfate and evaporated to dryness. The residue was purified by flash chromatography on silica gel with dichloromethane to give **1a** (6.4 mg, 15%) as yellow liquid. IR (neat): 2928, 1558 $\mathrm{cm}^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$) $\delta$ 1.75—1.83 (4H, m, $CH_2$), 2.56—2.59 (2H, m, $CH_2$), 2.67—2.69 (2H, m, $CH_2$), 3.04 (6H, s, $CH_3$); $^{13}$C-NMR (125 MHz, $CDCl_3$) $\delta$ 23.1, 23.9, 25.4, 27.9, 41.0, 121.1, 147.1, 170.5; $^{77}$Se-NMR (95 MHz, $CDCl_3$) $\delta$ 554.2; MS (FAB): $m/z$=230 [$M^+$].

4-Methyl-2-piperidino-1,3-selenazole **1b**: Acetone (0.10 ml, 1.5 mmol) was added to stirred solution of 1-selenocarbamoyl-piperidine (95 mg, 0.5 mmol) in dry ethanol (5 ml) under an argon atmosphere then added. Ferric chloride (0.29 mg, 1.8 mmol) was added into the reaction mixture. The reaction mixture was refluxed for 2 h. The mixture was extracted with diethyl ether and washed with $H_2O$. The organic layer was dried over sodium sulfate and evaporated to dryness. The residue was purified by flash chromatography on silica gel with dichloromethane : *n*-hexane (2 : 1) to give **1b** (97 mg, 85%) as yellow liquid. IR (neat): 2936, 2853, 1534 $\mathrm{cm}^{-1}$; $^1$H-NMR

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(500 MHz, $CDCl_3$): $\delta$ 1.64—1.68 (6H, m, $CH_2$), 2.21 (3H, s, $CH_3$), 3.40—3.42 (4H, m, $CH_2$), 6.56 (1H, s, CH) ($^2J$ ($^{77}$Se–$^1$H)=52.1 Hz); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 18.7, 24.2, 25.2, 50.7, 103.9, 150.2 ($^1J$ ($^{77}$Se–$^{13}$C)=93.6 Hz), 173.5; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 549.4; MS (CI): $m/z$=231 [$M^+$+1].

4-Phenyl-2-piperidino-1,3-selenazole **1c**: Yield: 32%. Yellow liquid. IR (neat): 2935, 2847, 1543 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.63—1.71 (6H, m, $CH_2$), 3.51 (4H, t, $J$=5.2 Hz, $CH_2$), 7.25 (1H, t, $J$=7.5 Hz, CH), 7.28 (1H, s, CH), 7.34 (2H, dd, $J$=7.5, 8.3 Hz, CH), 7.85 (2H, d, $J$=8.3 Hz, CH); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 24.3, 25.3, 50.8, 104.9 ($^1J$ ($^{77}$Se–$^{13}$C)=97.2 Hz), 126.3, 127.2, 128.4, 136.1, 152.8, 172.8; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 575.9; MS (CI): $m/z$=293 [$M^-$+1].

4-Ethyl-5-methyl-2-piperidino-1,3-selenazole **1d**: Yield: 73%. Yellow liquid. IR (neat): 2935, 2855, 1540 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.16 (3H, t, $J$=7.7 Hz, $CH_3$), 1.59—1.67 (6H, m, $CH_2$), 2.28 (3H, s, $CH_3$), 2.44 (2H, q, $J$=7.7 Hz, $CH_3$), 3.32—3.37 (4H, m, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 12.9, 13.9, 22.6, 24.3, 25.2, 50.5, 117.9, 150.5, 170.2; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 580.6; MS (CI): $m/z$=259 [$M^+$+1].

4-Butyl-2-piperidino-1,3-selenazole **1e** and 4-methyl-2-piperidino-5-propyl-1,3-selenazole **1f** were obtained by a reaction of 1-selenocarbamoylpiperidine with 2-hexanone. The reaction mixture was extracted with diethyl ether and washed with $H_2O$. The organic layer was dried over sodium sulfate and evaporated to dryness. The residue was purified by flash chromatography on silica gel with dichloromethane : *n*-hexane (2 : 1) to give **1e** and **1f** in 20% and 52% yields, respectively.

4-Butyl-2-piperidino-1,3-selenazole **1e**: Yield: 20%. Orange liquid. IR (neat): 2934, 2856, 1534 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 0.92 (3H, t, $J$=7.5 Hz, $CH_3$), 1.33—1.39 (2H, m, $CH_2$), 1.59—1.66 (10H, m, $CH_2$), 2.52 (2H, t, $J$=7.5 Hz, $CH_2$), 3.40—3.43 (4H, m, $CH_2$), 6.57 (1H, s, CH) ($^2J$ ($^{77}$Se–$^1$H)=52.1 Hz); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 14.0, 22.5, 24.3, 25.3, 30.8, 32.9, 50.7, 103.1, 155.4, 173.5; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 544.4; MS (CI): $m/z$=273 [$M^+$+1].

4-Methyl-2-piperidino-5-propyl-1,3-selenazole **1f**: Yield: 52%. Orange liquid. IR (neat): 2933, 2855, 1535 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 0.95 (3H, t, $J$=7.5 Hz, $CH_3$), 1.54—1.68 (8H, m, $CH_2$), 2.10 (3H, s, $CH_3$), 2.59 (2H, t, $J$=7.5 Hz, $CH_2$), 3.34—3.36 (4H, m, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 13.5, 15.5, 24.2, 25.2, 26.0, 30.4, 50.4, 125.3 ($^1J$ ($^{77}$Se–$^{13}$C)=92.4 Hz), 143.9, 170.2; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 561.5; MS (CI): $m/z$=273 [$M^+$+1].

4-(2-Methylpropyl)-2-piperidino-1,3-selenazole **1g** and 4-methyl-5-(2-methylethyl)-2-piperidino-1,3-selenazole **1h** were obtained by a reaction of 1-selenocarbamoylpiperidine with 4-methyl-2-pentanone. The reaction mixture was purified by flash chromatography on silica gel with dichloromethane : *n*-hexane (2 : 1) to give **1g** and **1h** in 45% and 19% yields, respectively.

4-(2-Methylpropyl)-2-piperidino-1,3-selenazole **1g**: Yield: 45%. Orange liquid. IR (neat): 2937, 2864, 1534 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 0.91 (6H, d, $J$=6.9 Hz, $CH_3$), 1.62—1.67 (6H, m, $CH_2$), 1.96—2.07 (1H, m, CH), 2.36 (2H, d, $J$=7.5 Hz, $CH_2$), 3.39—3.41 (4H, m, $CH_2$), 6.56 (1H, s, CH) ($^2J$ ($^{77}$Se–$^1$H)=52.1 Hz); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 22.5, 24.3, 25.2, 27.7, 42.5, 50.7, 104.3 ($^1J$ ($^{77}$Se–$^{13}$C)=93.6 Hz), 154.3, 173.4; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 542.6; MS (CI): $m/z$=273 [$M^+$+1].

4-Methyl-5-(2-methylethyl)-2-piperidino-1,3-selenazole **1h**: Yield: 19%. Yellow solid. mp: 38.0—40.0 °C; IR (KBr): 2934, 2853, 1541 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.20 (6H, d, $J$=6.9 Hz, $CH_3$), 1.59—1.67 (6H, m, $CH_2$), 2.12 (3H, s, $CH_3$), 3.00—3.07 (1H, m, $J$=6.9 Hz, CH), 3.37 (4H, t, $J$=5.2 Hz $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 15.7, 24.3, 25.3, 26.1, 29.2, 50.4, 134.3, 142.0, 170.0; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 528.9; MS (CI): $m/z$=273 [$M^+$+1].

2-Piperidino-4,5,6,7-tetrahydrobenzo-1,3-selenazole **1i**: Yield: 97%. Yellow liquid. IR (neat): 2931, 2939, 1535 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.63—1.66 (6H, m, $CH_2$), 1.75—1.82 (4H, m, $CH_2$), 2.53—2.57 (2H, m, $CH_2$), 2.66—2.68 (2H, m, $CH_2$), 3.34—3.39 (4H, m, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 23.1, 23.8, 24.2, 25.1, 25.4, 27.8, 50.5, 120.9, 146.6, 171.1; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 556.7; MS (CI): $m/z$=271 [$M^+$+1].

2-Dimethylamino-4,5,6,7-tetrahydrobenzo-1,3-selenazole **1j**: Yield: Quantitatively. IR (neat): 2928, 1558 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$) $\delta$ 1.75—1.83 (4H, m, $CH_2$), 2.56—2.59 (2H, m, $CH_2$), 2.67—2.69 (2H, m, $CH_2$), 3.04 (6H, s, $CH_3$); $^{13}$C-NMR (125 MHz, $CDCl_3$) $\delta$ 23.1, 23.9, 25.4, 27.9, 41.0, 121.1, 147.1, 170.5; $^{77}$Se-NMR (95 MHz, $CDCl_3$) $\delta$ 554.2; MS (FAB): $m/z$=230 [$M^+$].

2-Diethylamino-4,5,6,7-tetrahydrobenzo-1,3-selenazole **1k**: Yield: 87%. Yellow liquid. IR (neat): 2930, 1544 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.21 (6H, t, $J$=7.2 Hz, $CH_3$), 1.76—1.81 (4H, m, $CH_2$), 2.54—2.57 (2H, m, $CH_2$), 2.65—2.68 (2H, m, $CH_2$), 3.42 (4H, q, $J$=7.2 Hz, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 12.7, 23.2, 23.9, 25.4, 27.9, 46.0, 119.7, 146.9, 168.7; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 550.5; MS (CI): $m/z$=259 [$M^+$+1].

2-Morpholino-4,5,6,7-tetrahydrobenzo-1,3-selenazole **1l**: Yield: Quantitatively. Pink solid. mp: 52.0—54.0 °C; IR (KBr): 2922, 2857, 1547 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.77—1.83 (4H, m, $CH_2$), 2.55—2.58 (2H, m, $CH_2$), 2.68—2.70 (2H, m, $CH_2$), 3.38 (4H, t, $J$=4.9 Hz, $CH_2$), 3.77 (4H, t, $J$=4.9 Hz, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 23.0, 23.8, 25.4, 27.8, 49.5, 66.2, 122.4, 146.8, 171.5; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 562.5; MS (CI): $m/z$=273 [$M^+$+1].

2-Pyrrolidino-4,5,6,7-tetrahydrobenzo-1,3-selenazole **1m**: Yield: 83%. Yellow solid. mp: 75.0—78.5 °C; IR (KBr): 2924, 1540 $cm^{-1}$; $^1$H-NMR (500 MHz, $CDCl_3$): $\delta$ 1.76—1.83 (4H, m, $CH_2$), 1.98—2.03 (4H, m, $CH_2$), 2.58—2.60 (2H, m, $CH_2$), 2.67—2.70 (2H, m, $CH_2$), 3.38—3.41 (4H, m, $CH_2$); $^{13}$C-NMR (125 MHz, $CDCl_3$): $\delta$ 23.1, 23.9, 25.46, 25.51, 27.9, 50.1, 120.1, 147.0, 166.7; $^{77}$Se-NMR (95 MHz, $CDCl_3$): $\delta$ 551.1; MS (CI): $m/z$=257 [$M^+$+1].

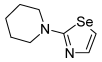
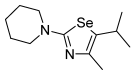
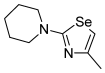
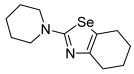
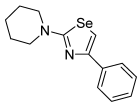
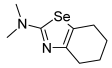
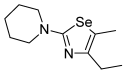
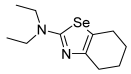
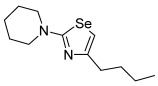
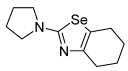
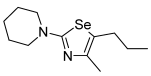
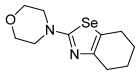
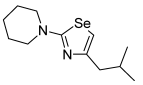
**Assay of Superoxide Anion-Scavenging Activity (SOSA)** The SOSA of 2-amino-1,3-selenazole compounds **1** was measured by a previously reported method.[25] In brief, the standard reaction mixture contained $5.8\times10^{-7}$ M MCLA, $5\times10^{-5}$ M hypoxanthine, xanthine oxidase (6.5 U), SOD (0.6 to 30 ng/ml), and 50 mM Tris–HCl buffer containing 0.1 mM EDTA at pH 7.8, in the presence or absence of various concentrations of one of the 2-amino-1,3-selenazole compounds **1**. Total volume was 3.0 ml. 2-amino-1,3-selenazole (25 mM) was dissolved in DMSO and stored at −80 °C prior to use. Chemiluminescence was measured using a luminometer (Aloka, BLR201) at 25 °C. Chemiluminescence measurement was initiated by the addition of 2-methyl-6-(4-methoxyphenyl)-3,7-dihydroimidazo[1,2-a]pyrazin-3-one hydrochloride (MCLA) to the standard incubation mixture excluding XOD, continued for 2 min without XOD and for an additional 2 min after addition of XOD. A representative result of a measurement of the effect of **1a** and **1c** on MCLA-dependent luminescence is shown in Fig. 1. When the compounds had strong SOSA at 166 $\mu$M, we also measured at 2.77, 4.16 and 8.33 $\mu$M for **1a** and at 27.7, 83.3 and 133 $\mu$M for **1c**. Percent of inhibition of superoxide-dependent chemiluminescence was calculated as a previously described.[25] The 50% inhibitory concentration ($IC_{50}$) was calculated by five concentrations of **1a** (1.67, 2.77, 4.17, 6.67, 8.33 $\mu$M) and six concentrations of **1c** (20.8, 27.7, 41.7, 83.3, 111, 133 $\mu$M). Each assay was performed in duplicate.

## Results and Discussion

Structures of these 2-amino-1,3-selenazole **1** are shown in Table 1, where the SOSAs of the compounds also are summarized. Among them, 2-piperidino-1,3-selenazole **1a** and 4-phenyl-2-piperidino-1,3-selenazole **1c** had the highest SOSAs at 166 $\mu$M (96.7%, 92.7%, respectively). The effects of compounds **1a** and **1c** were dose-dependent (Fig. 1). Compounds **1a** and **1c** were sufficiently active to suggest further testing, by serial dilutions, 50% inhibitory concentrations ($IC_{50}$) for the two compounds **1a** and **1c** were 4.03 $\mu$M and 92.6 $\mu$M, respectively. We have evaluated SOSAs of other selenium compounds including selenocarbamates, selenoureas, thioureas, and tertiary selenoamide compounds using a XOD-MCLA method.[21—23] $IC_{50}$ of these compounds were about 0.1 to 100 $\mu$M.[21—23] Thus, 2-amino-1,3-selenazoles had similar SOSAs when compared with previously mentioned synthesized organic selenium compounds. The results suggested that 2-amino-1,3-selenazoles were useful scavenger agents of superoxide, although we did not examine whether these compounds had cytotoxicity or not. Additional studies regarding applications *in vivo* should be needed.

This study considered the elimination of super oxide anion generated by XOD by 2-amino-1,3-selenazoles **1**. Exact SOSA cannot be measured if 2-amino-1,3-selenazoles **1** inhibit the activity of XOD. Thus, we measured XOD-produced uric acid as a metabolite in various experiments using

Table 1. Scavenging Activity of 2-Amino-1,3-selenazoles **1** on the Superoxide Radical Anion

| Entries | Compound | | Inhibition (%) | Entries | Compound | | Inhibition (%) |
|---|---|---|---|---|---|---|---|
| 1 |  | **1a** | 96.7 | 8 |  | **1h** | 36.6 |
| 2 |  | **1b** | 36.6 | 9 |  | **1i** | 22.9 |
| 3 |  | **1c** | 92.7 | 10 |  | **1j** | 25.7 |
| 4 |  | **1d** | 22.0 | 11 |  | **1k** | 22.9 |
| 5 |  | **1e** | 70.7 | 12 |  | **1l** | 25.7 |
| 6 |  | **1f** | 31.7 | 13 |  | **1m** | 14.3 |
| 7 |  | **1g** | 51.2 | | | | |

The luminescence intensity (count/min) of the solution which does not contain a substance at all, and the solution containing the 2-amino-1,3-selenazole compound **1** was measured, and the inhibition (%) was calculated.

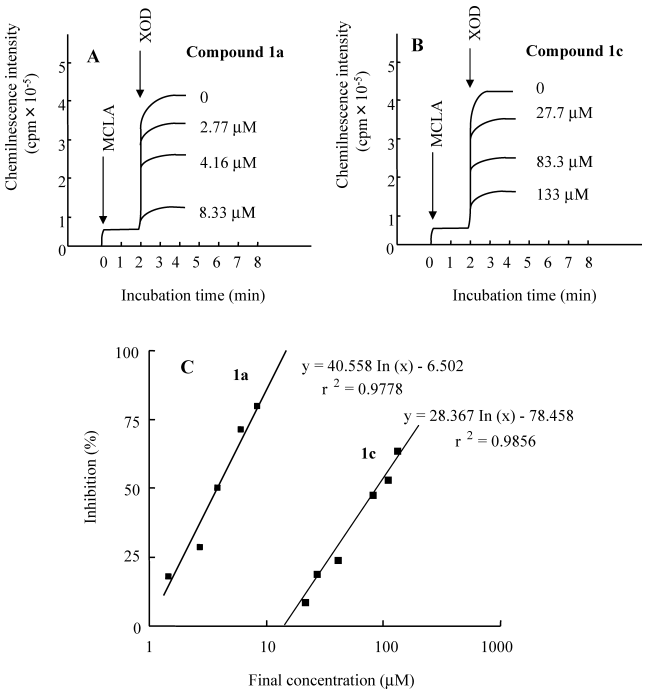



Fig. 1. Effects of 2-Piperidino-1,3-selenazole (**1a**) and 4-Phenyl-2-piperidino-1,3-selenazole (**1c**) on 2-Methyl-6-(4-methoxyphenyl)-3,7-dihydroimidazo-[1,2-*a*]pyrazin-3-one Hydrochloride (MCLA)-Dependent Luminescence

(A, B) Chemiluminescence mesurement curves by two compounds **1a** and **1c**. (C) Inhibition curves for these compounds Experimental procedures are described in the text. Arrows indicate the time at which MCLA or xanthine oxidase (XOD) was added.

$IC_{50}$ of the compounds.[27] No significant inhibition of uric acid productions by the compounds was found (data not shown). The results indicated that 2-amino-1,3-selenazoles did not significantly inhibit XOD activity.

In conclusion, 2-amino-1,3-selenazoles **1** were indicated to be potentially useful $O_2^-$ scavengers. Future studies will be directed toward elucidating the mechanism of action of the active compounds and toward synthesizing and studying additional analogues of 2-amino-1,3-selenazoles **1a** and **1c**.

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