Antioxidant and semicarbazide-sensitive amine oxidase inhibitory activities of alginic acid hydroxamates

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Abstract

The commercial polysaccharides of alginic acid (medium (3500 cps, 2% solution) and low (250 cps, 2% solution) viscosities) were esterified with acidic methanol (1 mmol L-1 HCl) at 4 °C with gentle stirring for 5 days to obtain methyl esters of medium-viscosity alginic acid (ME-MVA) and low-viscosity alginic acid (ME-LVA). These ME-MVA and ME-LVA were reacted with alkaline hydroxylamine to obtain medium-viscosity alginic acid hydroxamates (MVA-NHOH) and LVA-NHOH. The percentages of hydroxamic acid content in MVA-NHOH and LVA-NHOH were calculated as 25% and 20%, respectively. The hydroxamate derivatives of alginic acid were used to test the antioxidant and semicarbazide-sensitive amine oxidase (SSAO) inhibitory activities in comparison with original materials (MVA and LVA). The half-inhibition concentrations, IC50, of scavenging activity against 1,1-diphenyl-2-picrylhydrazyl (DPPH) were 24.5 and 29.8 μg mL-1 for MVA-NHOH and LVA-NHOH, respectively. However, few scavenging activities of the MVA and LVA were found at the same concentrations. The IC50 of the positive control of butylated hydroxytoluene was 5 μg mL-1. The scavenging activity of DPPH radical was pH-dependent, and the optimal pH for both of MVA-NHOH and LVA-NHOH was the Tris-HCl buffer (pH 7.9). Using electron spin resonance (ESR) to detect the activity of scavenging hydroxyl radicals, both alginic acid hydroxamates showed dose-dependent scavenging activities, and the IC50 was 90 and 92 μg mL-1, respectively, for MVA-NHOH and LVA-NHOH. Both alginic acid hydroxamates also exhibited protection against hydroxyl radical-mediated DNA damage. Both MVA-NHOH and LVA-NHOH showed dose-dependent inhibitory activities against bovine SSAO (2.53 units); the IC50 was 0.16 and 0.09 μg mL-1, respectively, for MVA-NHOH and LVA-NHOH, compared with 3.81 μg mL-1 of semicarbazide (positive controls). Amine oxidase activity staining also revealed that both MVA-NHOH and LVA-NHOH exhibited SSAO inhibitory activities. Both MVA-NHOH and LVA-NHOH showed mixed non-competitive inhibition against bovine SSAO. It was found that the Vmax value was reduced and the Km value was either increased (added

MVA-NHOH, 0.05 µg mL-1) or reduced (added LVA-NHOH, 0.11 µg mL-1) in the presence of alginic acid hydroxamate.