J. Korean Fish. Soc. 29(6), 914~916, 1996 한수지, 29(6), 914~916, 1996

〈TECHNICAL NOTE〉

Degradation of Nitrite as a Nitrosamine Precursor by Brown Algae, *Ecklonia cava*

Oe-Kyung KIM, Yeung-Beom PARK, Tae-Gee LEE, In-Soo KIM*, Jin-Hoon KANG, Kyung-Soo JUN, Douck-Chon PARK and Seon-Bong KIM**

Department of Food Science and Technology, Pukyong National University, Pusan 608-737, Korea

**Department of Food Science, Gyeongsang National University, Tongyeong 650-160, Korea*

***Department of Food and Nutrition, Koshin University, Pusan 606-080, Korea*

Key words : nitrite-scavenging, seaweed, *Ecklonia cava*

Nitrite plays an important role in the formation of carcinogenic nitrosamine. Nitrosamine is easily formed at the acidic condition, especially at the similar pH human stomach. In order to inhibit the formation of carcinogenic nitrosamine in food and biological systems effectively, the scavenging of residual nitrite is necessary. We have previously reported on the scavenging of nitrite by vegetables (Kim et al., 1987), roasted-barley extracts (Kim et al., 1990), traditional tea materials (Do et al., 1993), melanoidins (Kim et al., 1988) and active constituents from *Cassia tora* seed (Park et al., 1995). The present study was conducted to characterize an active nitrite scavenging principles from edible seaweed. One kilogram of seaweed, *Undaria pinnatifida, Ecklonia cava, Ecklonia stolonifera, Laminaria japonica, Sargassum fulvellum, Codium fragile, Enteromorpha compressa* and *Porphyra tenera* was extracted twice with 4l of methanol for 24hrs at an ambient temperature. The active fraction from *Ecklonia cava* was separated by silica gel column chromatography with a stepwise gradient of methanol and ethyl acetate (10 : 0~0 : 10), and the fractions were monitored by thin layer chromatography (TLC, silica gel 60 F_{254}, acetone : ethyl acetate : chloroform, 6/4/1). Fig. 1 shows the nitrite scavenging rate of edible seaweed examined. The scavenging rate were higher in brown algaes than in green and red algaes. Among the

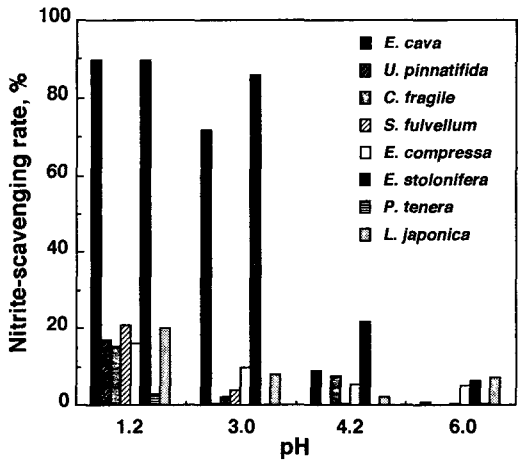

Fig. 1. Nitrite-scavenging rate of methanol extracts obtained from seaweed. Nitrite (1 mM) was incubated with 50μg/ml of each sample at different pH conditions 37℃ for 1hr.

brown algae family, Laminariaceae, *E. cava* and *P. stolonifera* that belong to genus *Ecklonia* showed a marked nitrite scavenging rate at pH 1.2 and 3.0, and the others showed a weak effect. In order to separate the scavenging factors from *E. cava*, methanol soluble fraction were divided into diethyl ether, ethyl acetate, chloroform and water fractions. Fig. 2 shows the nitrite scavenging rate of solvent fractions from *E. cava*. The rates were especially high in diethyl ether (90%/1 mg) and ethyl acetate (94%/1 mg) fractions as com-

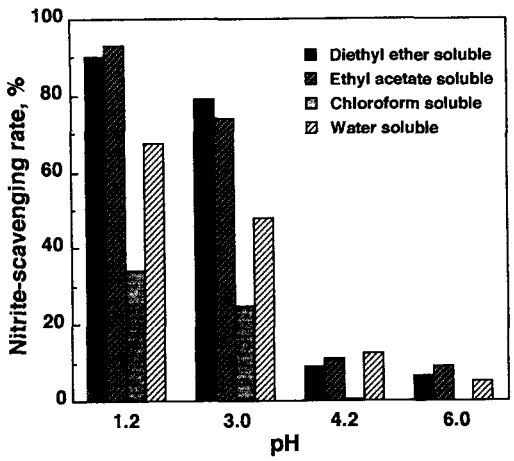

Fig. 2. Nitrite-scavenging rate of solvent solubles from *E. cava*. Nitrite (1 mM) was incubated with 50μg/ml of each sample at different pH conditions at 37℃ for 1hr.

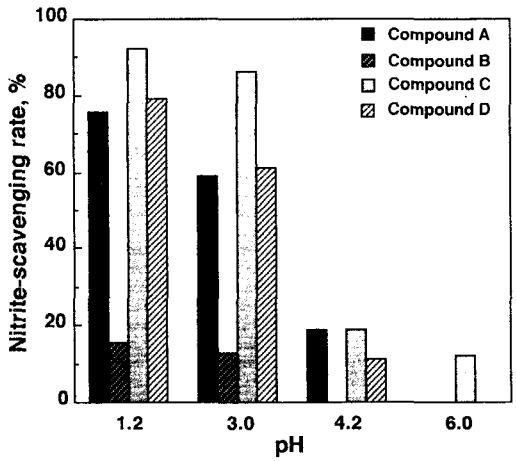

Fig. 3. Nitrite-scavenging rate of compounds A, B, C and D separated from ethyl acetate soluble of *E. cava*. Nitrite (1 mM) was incubated with 50μg/ml of each sample at different pH conditions 37℃ for 1hr.

pared with the others. For further investigation of nitrite scavenger, ethyl acetate soluble fractions were fractionated by silica gel column chromatography, and the fractions were monitored by TLC. From TLC profile, four nitrite scavengers with R_f value 0.90, 0.82, 0.58 and 0.15 were isolated. They were designated to compound A, B, C and D, respectively. Nitrite scavenging effects of these isolated compounds were also

Table 1. Reducing power of solvent fractions obtained from methanol extract of *Ecklonia cava*

Fractions	Reducing power*
Control	0.012
Diethyl ether	2.889
Chloroform	1.299
Ethyl acetate	2.973
Water	0.664

* Reducing power was indicated as absorbance at 700 nm with 1 mg of each solvent solubles fractionated from *E. cava*.

pH dependant and were higher at pH 1.2 and 3.0. The effects of isolated compounds were 76, 16, 92 and 78 % per 0.5 mg at pH 1.2, respectively (Fig.3). The most active compound C showed the maximum absorption at 209 nm and shoulder at 404 nm and 664 nm. Diethyl ether and ethyl acetate fractions with a strong nitrite scavenging activity also exhibited a higher reducing ability (Table 1). Since phenolic compounds possess higher reducing power, nitrite scavenging activity of the fractions might be due to phenolic compounds as a major scavenging factor. Theiler *et al.* (1984) reported that gamma-pyrones degrade nitrite. Recently, the authors isolated quinones containing a hydroxyl group adjacent to carbonyl as a powerful nitrite scavenger (Park et al., 1995). It has also been reported phenolic compounds are effective in nitrite-scavenging (Kang et al., 1996). Now, structure elucidation of active nitrite scavenging principles from seaweed is in progress.

Acknowledgement

This paper was supported in part by Dong-Won Arts and Sciences Promotion Association (1995).

References

Kim, D.S., B.W. Ahn, D.M. Yeum, D.H. Lee, S.B.

Kim and Y.H. Park. 1987. Degradation of carcinogenic nitrosamine formation factor by natural food components; 1. Nitrite-scavenging effects of vegetable extracts. Bull. Korean Fish. Soc., 20 (5), 463~468.

Kim, S.B., J.R. Do, Y.W. Lee, Y.S. Gu, C.N. Kim and Y.H. Park. 1990. Nitrite-scavenging effects of roasted-barley extracts according to processing conditions. Korean J. Food Sci. Technol., 22 (7), 748~752.

Do, J.R., S.B. Kim, Y.H. Park, Y.B. Park and D.S. Kim. 1993. The nitrite-scavenging effects by the component of traditional tea materials. Korean J. Food Sci. Technol., 25 (5), 530~534.

Kim, S.B., D.H. Lee, D.M. Yeum, J.W. Park, J.R. Do and Y.H. Park. 1988. Nitrite scavenging effect of Maillard reaction products derived from glucose-amino acids. Korean J. Food Sci. Technol., 20 (3), 453~458.

Park, Y.B., T.G. Lee, O.K. Kim, J.R. Do, S.G. Yeo, Y.H. Park and S.B. Kim. 1995. Characteristics of nitrite scavenger derived from seeds of Cassia tora L. Korean J. Food Sci. Technol., 27 (1), 124~128.

Theiler, R.F., K. Sato, T.G. Aspelund and A.F. Miller. 1984. Inhibition on N-nitrosamine formation in a crued ground pork belly model system. J. Food Sci., 49 (2), 341~344.

Kang, Y.H., Y.K. Park and G.D. Lee. 1996. The nitrite scavenging and electron donating ability of phenolic compounds. Korean J. Food Sci. Technol., 28 (2), 232~239.

Received October 5, 1996
Accepted November 11, 1996