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Influence of Wasabi(*Eutrema wasabi* Maxim.) Powder and L-Ascorbic Acid on Browning of Lettuce

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INTRODUCTION

Browning of cut surfaces and injured regions is one of the most important deterioration symptoms of lettuce. However, it is difficult to control the browning in horticultural products. Unoxidized phenolic compounds, such as chlorogenic acid and catechins, are usually present in a small amount in healthy tissue and in many cases are newly produced in injured tissue (1). Those are enzymatically oxidized by polyphenol oxidase to form quinones which easily react with nitrogen compounds to produce colored substances.

Recent report (2) showed that browning of shredded cabbage was inhibited by isothiocyanates.

The objective of this paper was to investigate whether Wasabi solution containing L-ascorbic acid could inhibit browning of lettuce or not.

MATERIALS AND METHODS

Sample preparation : Lettuce (*Lactuca sativa* L.) was obtained from CEASA in Brasilia on 24th of April. Five healthy samples (357±58g FW/ sample) of lettuce were chosen, and their midribs

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were taken with a knife from green leaves. The midribs were cut into 1cm segments. Fifty grams of them was used to test of browning, and another fifty grams served as a control.

Preparation of Wasabi suspended solution : Five ml of 10 mM L-ascorbic acid was added to one gram of Wasabi (San-Marú industria e comércio LTDA.) powder, and well mixed.

Evaluation of browning in lettuce: For a control, the excised 50 gram of midribs was placed and sealed in a 500ml flask after addition of 5ml of 10mM L-ascorbic acid, then held for 20 hours at room temperature (around 22°C). For a treatment, 5ml of Wasabi solution was applied to the flask with the excised midribs. This treated sample was also held at room temperature for 20 hours. After treatment, the colour of the midribs was evaluated by visual observation and a portable spectroradiometer (LI-1800, LI-COR INC.).

Visual observation: The browning of their cut ends was evaluated by 4 grades as shown in Table 1.

CIE Chromaticity coordinates: The reflectance of sample at 300~850nm was scanned, and the chromaticity coordinates (X, Y, Z, x, y, u', v') were calculated by LI-1800. For this measurement, each sample was homogenized for 3min in 50ml of ethanol, and chlorophyll was removed by a total of 200ml of ethanol using a glass filter. The residue was placed and spread into a Petri plate. After drying over one night at room temperature, the chromaticity was determined.

Determination of C_2H_4 and CO_2 production rates: After holding for 20 hours at room temperature, each sample gas was taken from the sealed flask by 1 ml of syringes for injection into GC.

RESULTS AND DISCUSSION

The browning of midribs in lettuce was inhibited by addition of Wasabi solution containing L-ascorbic acid (Table 1). This phenomenon was confirmed by visual observation and CIE chromaticity.

Respiration and ethylene production rates of the excised midribs were clearly lower in Wasabi solution than those in control. This result was consistent with a preliminary experiment. Also the browning of the excised mandioca (*Manihot utilissima*) was inhibited by this material in another test.

The browning inhibition mechanism is unknown at present time. It is well-known fact that Wasabi powder contains sinigrin and myrosinase, and that the enzymatic reaction between them is promoted by L-ascorbic acid and water. One hypothesis can be suggested as follows : Allyl isothiocyanate (AITC), which is enzymatically produced by hydrolysis of sinigrin, may be a key compound to solve this mechanism. AITC has an active chemical structure that reacts easily with other compounds such as the SH-group of proteins. Therefore, the enzymes which are related to the browning of polyphenol compounds and formation of ethylene may become inactive by AITC. A further investigation will be required to solve this problem.

REFERENCES

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Table 1. Effect of Wasabi powder and L-ascorbic acid on the browning, C_2H_4 and CO_2 production rates of cut surface of midribs in lettuce.

Treatment	Respiration ml CO_2 /kg/hr	Ethylene μ l C_2H_4 /kg/hr	Browning Visual	Browning CIE(chromaticity)		
				Y	x	y
Control	28	0.63	+++	.1796E06	.3407	.3543
Wasabi + L-ascorbic acid	7	0.24	-	.1827E06	.3539	.3620

NOTE : Visual observation of browning was done 20 hr after treatment. +++ ; severe, ++; medium, +; slight, -; non, respectively.

~~レタスの褐変に及ぼすワサビ粉末とL-アスコルビン酸
添加の影響~~

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~~要約~~

~~ブラジルで比較的消費量の多いレタスの品質劣化要因の1つには, 褐変がある。そこで, この防止法について検討するため, アリル芥子油配糖体を含むワサビ粉末とL-アスコルビン酸溶液を, 細断したレタス中肋に添加して, その効果を調べた。レタス切口の褐変は阻害され, 同時にエチレン生成と呼吸速度の抑制がみられた。~~

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