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The Comparison of Chilli Varieties Suitable for Food Processing : Pepper Sauce

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ABSTRACT

Seventeen varieties of chilli fruits planted at Kasetsart University were comparatively studied for the suitability for using as a raw material for green and red hot and sour pepper sauce production. The materials were determined for the yield of destemmed chilli fruit and the waste after straining. After production, the products were sensory evaluated by 21 experienced food tasters with BIB design, and hedonic preference scale. The data was analysed by SAS program.

For red chilli, the average yield of the destemmed fresh chilli was 89.85% and the average waste after straining was 55.36%. The variety with the lowest quantity of waste after straining was CA 500, followed by CA 223, CA 133, CA 1107, CA 367, CA 1143 – B, CA 1018 – C, CA 161 and CA 1013 A respectively. All of these mentioned varieties gave the waste equal or lower than the average. The result from the sensory evaluation showed that CA 426 with the highest total preference score, color, and acceptability, got the high scores in appearance, odor, taste and texture that was not significantly different to the highest scores of the other samples in those characteristics. The control red pepper sauce sample got the lowest score in total preference score with significant difference in every character compared to the highest scores except odor and texture.

For the green hot and sour pepper sauce, the average yield of the destemmed fresh chilli was 91.48% while the average waste after straining was 71.20%. The variety with the lowest amount of waste was CA 919, followed by CA 1013 – A, CA 1096 – C, CA 426, CA 133, CA 1012 – C, CA 1107; CA 367, and CA 1143 – B respectively. All of these mentioned varieties gave the waste lower than the average. From the sensory evaluation, CA 426 got the highest total preference score followed by CA 398, CA 1013 – A, CA 1018 – C and CA 1012 – C. CA 426 got the preference scores in every characteristic higher than the control green pepper sauce, except in color

Key words: chilli products, pepper sauce, chilli varieties

INTRODUCTION

Many varieties of chilli (*Capsicum annuum L.* and *Capsicum frutescens*) can grow well in Thailand and have differences in color, size. shape, taste and aroma. Chilli has been used as an important condiment in foods since the ancient time, not only for Thai dishes but also for other important dishes of other nations. The advantages of chilli are known, not only as the flavor and color enhances in foods, but also in the medical purpose which concerns the human health. At the present, the world market for chilli products is growing.

Chilli or pepper can be processed or

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preserved for using in several forms, such as in dry, powder, paste, puree, pickle, sauces, etc. Each variety of chilli is suitable for each specific product. Some chilli products are important exported goods from Thailand, such as chilli powder, dried chilli, chilli paste and sauces. There are different types of chilli sauces which their characters differ from country to country of their original and consumer preference. However, the hot and sour pepper sauce, Tabasco, are still imported for the western dish consumer in Thailand.

During maturation and ripening, chilli undergoes physiological changes. Thirupath-aiah-V (1977) found that immature green and mature green contained very little water soluble pectin whereas red chilli fruits contained 4% of soluble pectin. Calcium and magnesium contents of the cell walls of mature green was high, but decreased during ripening. Methoxy content was highest in the cell walls of immature green. Cellulase activity increased during development and more significantly during ripening of the fruit. Wijeratne (1986) studied on effects of aging of red chilli capsicums on yield, flow properties, suspension stability, pungency and color of the pulp in the hot sauce manufacturing process. He found that capsaicin and dihydro capsaicin were the major pungent compounds in a cellulose model system.

From specification for red chilli sauce of Malaysia standard and Industrial Research Institute of Malaysia. The red chilli sauce is prepared from chilli paste or solids, sugar, vinegar and salt, with other optional ingredients and permitted thickeners.

Benzoic acid or its edible salts or SO_2 (less than 250 ppm or equal 100 ppm. are permitted). Requirement include : TS greater than or equal 30%, acidity (as acetic acid) greater than or equal 0.8%, pH less than or equal 4.0. However, product of the standard is likely to the product with adding sugar .

Maurya *et al.* (1984) found that the capsaicin content in green chilli is less than that in red chilli.

The objective of the study is to find out chilli varieties which suitable for making red and green pepper sauces.

MATERIALS AND METHODS

Seventeen varieties of red and green chilli fruits were harvested and transported from Kasetsart University, Kampangsan campus, to the Institute of Food Research and Product Development. The chilli fruits were weighed, picked out of stem, weighed, washed and drained. Then they were submerged into 10% sodium chloride solution for 1 week after that they were washed, drained, and ground with other ingredients with an electric blender into the following formula: 7.2% red chilli, 81% of 5% conc. vinegar, 1.8% sodium chloride and 10% water for the red pepper sauce, and 32.61% green chilli, 44.69% of 5% conc.vinegar, 6.04% sodium chloride, and 16.66% water for the green pepper sauce.

The sauces were strained on a seive, weighed the residue, boiled for 15 minutes, and fill hot into the prepared containers, seal the bottle cap and cool down. The samples were stored in room temperature.

The yield of the destemmed fresh chilli and the residue after straining were calculated.

All the samples were determined for pH by a pH meter, °B by a hand refractometer and measured the color of the sample by a Data Color International by using the control (commercial) pepper sauce samples as the references.

All the samples were preference tested by 21 scientists and using the Balanced Incomplete Block design (BIB design). The tasters expressed their preference in appearance, color, odor, taste, texture and acceptability on the samples by using Hedonic scale, where 1 = extremely dislike and 9 = extremely like. Each taster tasted 5 pepper sauce samples with plain steamed chicken, and rinsed their mouths with water.

RESULT AND DISCUSSION

Table 1 and Table 3 showed the yield of destemmed chilli, the residue after straining, pH, the total soluble solids (°B), and the color of sauces measured of red and green chilli,respectively. For the red chilli varieties, the average of the yield of destemmed chilli was 89.85% and the average amount of waste was 54.51%, while the green chilli got the average yield 91.48% and 71.34% of the average waste. The yield of the destemmed fresh chilli varied with the varieties of chilli, the variety which has larger stems will have lower yield than those with small stems. Chilli variety has great effect on the amount of residue left after straining. The variety which has tough texture and strong skin with difficulty to be grated into paste will have the high amount of waste. The average amount of waste from red chilli was smaller than those from green chilli.This due to the red chilli contains higher water soluble substances degraded by enzymes' activities from the insoluble pectic substances during the fruits' ripening, and thus also soften the tissue (Thirupath-aiah-V,1977). By these factors, the green pepper sauce had to use more chilli in the recipe than the red pepper sauce, in order that the good texture of the sauce was obtained.

Since the type of the product is hot and sour.

Table 1 The percentage of destemmed red chilli and residue during saucing process, and pH, °B and color of red hot and sour chilli sauce samples.

Chilli varieties	Destemmed fresh chilli (%)	Residue after straining (%)	pH	°B	CIE color co-ordinate		
					L^*	a^*	b^*
CA 1096	NA	NA	2.89	6.8	38.04	25.31	12.77
CA 1012-C	91.67	NA	2.83	5.8	44.55	19.78	31.07
CA 363	90.23	90.63	2.77	5.8	40.50	25.86	25.09
CA 1018-C	NA	NA	2.84	6.0	40.07	25.68	25.31
CA 133	90.68	39.27	2.91	6.0	39.40	25.30	23.95
CA 1143-B	86.99	50.00	2.81	6.0	38.49	26.77	22.17
CA-1096-C	94.59	59.17	2.81	6.0	40.12	25.38	25.02
CA 161	92.04	53.00	2.81	6.0	39.84	25.53	24.68
CA 1107	86.23	43.42	2.73	6.0	37.87	25.90	21.49
CA 500	86.97	26.57	2.74	6.0	43.90	27.77	31.26
CA 1013-A	89.74	51.85	2.79	6.2	37.75	26.65	21.81
CA 1018-C	90.55	51.88	2.86	6.6	37.85	26.82	21.44
CA 426	89.17	58.24	2.86	7.0	38.04	26.53	21.52
CA 367	87.46	45.41	2.61	6.0	38.75	26.36	22.27
CA 398	87.50	90.63	2.78	6.0	39.18	25.29	23.17
CA 223	89.80	37.50	2.81	5.8	48.63	10.39	38.03
CA 941	94.10	65.63	2.81	5.8	46.56	14.08	35.49
Control*	NA	NA	2.94	8.0	34.15	16.86	12.15
Avg.	89.85	54.51					

• = a commercial red Tabasco® sauce

The pH and the total soluble solids of the products were low. The pH of all red sauce samples were among 2.61-2.91 and the total soluble solids as °B were among 5.8-7.0 °B, whereas the control sample had pH 2.94 and 8.0 °B. The pH and the °B of the green sauce were higher than the red sauce. These were due to the higher percentage of green chilli and sodium chloride, and the lower amount of vinegar in the recipe than those of the red sauce.

The color of the chilli took effect on the color of the sauces. From the measurement of color, the red sauce samples had the lightness (L^*) between 37.75-48.63, a^* (redness) between 10.39-27.77 and b^* (yellowness) between 12.77-38.03 while the control red pepper sauce had the L^* 34.15, a^* 16.86 and b^* 12.15 These meant that the control had darker color and less yellow than the prepared samples. For the green sauce samples, the lightness (L^*) of the color of the prepared samples was among 39.18-52.02, the redness (a^*) was 2.14-6.68 and the yellowness (b^*) was among 19.61-33.19 whereas the control had the L^* 41.60, a^* 1.30, and b^* 19.48. These meant that the control sample was more green and less yellow than all prepared samples. However, from the observation, all green sauce samples had shorter shelflife than the red sauces. This due to the rapid discoloration of chlorophyll during storage (Trongpanich,1985).

Table 2 showed the data from the sensory evaluation of the red chilli sample. CA1143-B got the highest score in appearance, whice CA 1018-C got the highest scores in odor, taste and texture. CA426 got the highest scores in color and the overall acceptability. Thus for the sum of all

Table 2 The sensory evaluation scores of the red hot and sour chilli sauce samples.

Chillis varieties	L.S. means (21 tasters)						Total
	Appearance	Color	Odor	Taste	Texture	Acceptability	
CA 1096	6.61^{ack}	7.21^{ac}	5.83^{a}	5.45^{acde}	5.65^{a}	$5.78^{abdfghjklmnpq}$	36.53
CA 1012-C	5.40^{bc}	5.17^{b}	6.42^{a}	6.21^{ade}	5.53^{a}	5.90^{aeoq}	34.63
CA 363	6.09^{acd}	6.43^{bce}	6.35^{a}	5.73^{acde}	5.58^{a}	6.00^{aeop}	36.18
CA 1018-G	6.85^{a}	6.79^{aef}	6.18^{a}	5.00^{bd}	5.06^{a}	$5.80^{bdfghijkmno}$	35.68
CA 133	6.42^{ace}	6.29^{betg}	6.69^{a}	5.88^{acde}	5.58^{a}	6.33^{aem}	37.19
CA 1143-B	7.33^{a}	7.00^{aegh}	6.30^{a}	6.16^{ade}	6.44^{a}	6.28^{aem}	39.51
CA 1096-C	6.19^{acf}	6.81^{aegi}	7.02^{a}	5.78^{acde}	5.82^{a}	5.99^{aef}	37.61
CA 161	6.80^{a}	6.71^{aegi}	5.40^{a}	5.97^{ade}	5.63^{a}	5.28^{be}	35.79
CA 1107	7.14^{a}	7.52^{aegk}	6.40^{a}	5.88^{acde}	6.15^{a}	6.71^{af}	39.80
CA 500	6.23^{acg}	$6.38^{bcfhijkimno}$	6.21^{a}	5.35^{acde}	6.01^{a}	5.90^{aeg}	36.08
CA 1013-A	7.23^{a}	7.29^{aegi}	6.54^{a}	6.40^{a}	6.15^{a}	6.80^{ad}	40.41
CA 1018-C	6.69^{ach}	7.36^{aegm}	7.16^{a}	5.59^{a}	6.96^{a}	6.71^{ac}	41.47
CA 426	7.09^{a}	7.95^{a}	6.54^{a}	6.30^{adc}	6.63^{a}	7.09^{a}	41.60
CA 367	7.38^{a}	7.93^{a}	6.30^{a}	6.38^{a}	5.65^{a}	6.07^{aeh}	39.71
CA 398	6.90^{a}	7.10^{aegn}	6.54^{a}	6.26^{adc}	6.10^{a}	6.04^{aei}	38.94
CA 223	6.57^{aci}	6.74^{aego}	6.38^{a}	5.50^{acde}	6.01^{a}	6.30^{aej}	37.50
CA 941	6.71^{acj}	4.95^{b}	6.07^{a}	4.97^{be}	5.82^{a}	6.14^{aek}	34.66
Control	$5.38^{bdefghijk}$	3.05^{bd}	5.45^{a}	4.54^{bc}	5.25^{a}	3.42^{b}	27.09

- In a column, means followed by the same letter are not significantly different at the 5% level
- Control = a commercial red tabasco® sauce

characteristic scores (the total score), CA 426 became the most preferred sample with the scores of its each character were not significantly difference with the highest score of each character. Following the highest total score were CA1018-C, CA1013A, CA1107 CA367, and CA1143-B respectively. However CA426 got the less yield of destemmed fresh chilli and higher waste after straining than the average. CA 1018-C became the most suitable variety for red pepper sauce production. The control sample got the lowest scores in appearance, color, taste, overall acceptability and the total score.

Table 4 showed the data from sensory evaluation of the green chilli sauce samples. CA426 got the highest scores in the sauce appearance, taste, texture, the overall acceptability and the total score. Following was CA398, CA1013-A, CA1018-C and CA 1012-C. However these varieties except CA1018-C and CA1012-C had yield of destemmed fresh chilli less than the average, and these varieties except CA1018-C had the waste less than the average.

Since the products were high acidity, the color degradation rate trended to be very fast during storage or aging (Wijeratne, 1986). Addition of color or the use of non-transparent packaging material may necessary to protect the products' color.

Table 3 The percentage of destemmed green chilli and residue during saucing process, and pH, °B and color of green hot and sour chilli sauce samples.

Green chilli varieties (%)	Destemmed fresh green chilli (%)	Residue after straining	pH	°B	CIE color co-ordinate		
					L^*	a^*	b^*
CA 1012-C	91.67	64.81	3.29	17.2	42.97	6.68	25.99
CA 363	90.90	98.64	3.26	18.2	44.76	4.78	25.08
CA 133	94.66	65.50	3.35	17.8	44.78	3.79	23.36
CA 1143-B	95.00	70.37	3.20	16.0	44.46	6.32	27.52
CA 1096-C	93.96	55.00	3.22	18.8	44.28	3.85	23.23
CA 161	94.33	93.75	3.16	22.0	47.19	5.38	24.75
CA 1107	87.76	65.43	3.30	20.0	43.77	5.67	24.78
CA 500	89.57	NA	3.25	17.6	52.02	4.34	28.10
CA 1013-A	87.37	55.36	3.25	16.4	46.58	4.33	28.28
CA 1018-C	93.13	93.57	3.32	16.0	45.69	4.90	26.40
CA 426	88.00	66.62	3.18	17.8	49.48	4.25	30.03
CA 367	91.07	68.75	3.31	23.0	39.18	4.80	19.61
CA 398	85.47	NA	3.23	18.6	42.31	3.27	21.65
CA 223	94.17	75.93	3.34	17.8	50.31	4.60	33.19
CA 941	93.08	76.54	3.37	18.2	39.57	3.37	21.46
CA 843	89.09	NA	3.18	19.6	44.09	5.31	21.23
CA 919	95.93	51.26	3.08	14.0	51.11	2.14	27.96
Control*	NA	NA	3.05	12.8	41.60	1.30	19.48
Avg.	91.48	71.34					

*Commercial green Tabasco® sauce

Table 4 The sensory evaluation scores of the green hot and sour chilli sauce samples.

Varieties of green chilli	Least Squares Means						Total
	Appearance	Color	Odor	Taste	Texture	Acceptability	
CA 1012-C	7.03^{adefghikmonp}	6.98^{a}	6.43^{acfgmo}	5.61^{ac}	6.08^{bdfghjimnpq}	5.96^{bc}	38.09
CA 363	5.65^{cjip}	5.74^{a}	6.57^{acgmno}	5.61^{ac}	5.12^{celikop}	5.39^{bdk}	34.08
CA 133	6.41^{bcjlo}	6.77^{a}	5.57^{bdehijlmn}	5.37^{ac}	5.98^{bdfghljimno}	6.18^{acde}	36.28
CA 1143-B	6.89^{adefgnikmnop}	6.67^{a}	5.95^{bdhijklmo}	5.42^{ac}	6.12^{aceikog}	5.72^{bc}	36.77
CA 1096-C	5.98^{bchj}	6.22^{a}	5.81^{bdg}	5.32^{be}	6.70^{aceikor}	6.44^{clk}	36.47
CA 161	5.70^{ci}	5.05^{a}	4.29^{e}	4.32^{cd}	5.46^{bafghip}	3.65^{g}	28.47
CA 1107	5.84^{cdl}	6.77^{a}	7.43^{a}	5.42^{ac}	5.12^{cd}	5.18^{beghjko}	35.72
CA 500	5.65^{cjlm}	5.58^{a}	4.67^{cegk}	3.09^{d}	5.12^{celkm}	4.34^{cdg}	28.45
CA 1013-A	6.98^{adefghij}	6.24^{a}	6.14^{acfgmo}	5.85^{ac}	7.74^{acj}	6.56^{acdj}	39.51
CA 1018-C	6.22^{bejln}	6.39^{a}	6.62^{acglmo}	6.47^{ac}	7.03^{aceikn}	6.75^{acdf}	39.48
CA 426	8.12^{a}	7.48^{a}	6.33^{acfgi}	6.90^{ac}	7.89^{a}	7.32^{a}	44.04
CA 367	6.27^{bef}	5.62^{a}	4.29^{e}	5.37^{ac}	5.12^{ect}	5.46^{befghjkm}	32.13
CA 398	7.31^{adefhlkimnop}	7.10^{a}	6.57^{acgjm}	5.99^{ac}	6.65^{acelki}	6.46^{acdn}	40.08
CA 223	6.65^{ac}	6.58^{a}	5.76^{bc}	5.23^{c}	5.70^{bce}	5.65^{befghjkp}	35.57
CA 941	6.31^{bce}	6.67^{a}	6.62^{acd}	5.85^{ac}	5.89^{bdek}	5.51^{befghjkn}	36.85
CA 843	5.65^{ejk}	5.03^{a}	4.33^{e}	4.66^{bc}	5.36^{bdfhk}	5.01^{beghi}	30.04
CA 919	4.03^{cdefh}	5.53^{a}	4.19^{e}	6.13^{ac}	5.12^{celkm}	5.32^{bdk}	30.32
Control	7.65^{ab}	8.20^{a}	6.24^{ab}	5.94^{abc}	6.93^{abi}	6.13^{acdlfmnop}	41.09

- In a column, means followed by the same letter are not significantly different at the 5% level
- Control = a commercial green Tabasco® sauce

CONCLUSION

CA426 was the variety that got the highest total preference scores for both red and green pepper sauce. However CA1018C was the most suitable variety for red pepper sauce production, due to the higher yield of destemmed fresh chilli and lower amount of waste as compared to the average.

For green pepper sauce production, the most varieties that were suitable for the production were CA426, followed by CA1013-A, which had the lower waste than the average and high preference score with no significant difference with the highest scores in all characters.

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