

CHAPTER 4

RESULT AND DISCUSSION

4.1 Visual assessment

Visual Assessment to color specification with the significant 50% level implies that the word for color perception and color chips were chosen by the observers more than 50% or 15 observers up from 30 observers For made the establish table of the result of experiment. The English words translated from Thai words are represented the same meaning, but may have different color perception.

4.1.1 Result of experiment I

The table 4-1 was derived from the results of the experiment I. It was developed on the color chip numbers and choices word for color perception, where 50% above of the response were counted. They were represented by “color chip number (word / frequency)”. Some data of the table were missing because some color sample could not be distinguished by the observers. The result showed that the highest frequency color chip number was 5R6 (Heavy (Nuck)/30), and the highest frequency of words in color chip number was 6words.

Table 4-1 Result of experiment I (table1) (1)

Color chips	Words/ Frequency			
	Acceptable		Unacceptable	
5R1	Creamy (Nual) /17	Light (Bow) /16		
5R2	Cool (Yen) /17	Velvety (Wann) /15		Creamy (Noal)/9
5R3	Somber (Mon) /16			
5R4				
5R5	Clear (Sai) /16	Velvety (Wann) /15		
5R6	Heavy (Nuck) /30	Dark (Klam) /17	Dark (Mued) /16	Deep (Kae) /10
5R7				
5R8	Fresh (Sod) /17	Distinct (Jerd Jar) /16		
5R9	Dark (Mued) /25	Dark (Ta Muen) /23	Hard (Kang) /16	Dirty (cham) /11
5R10				
5R11	Deep (Khem) /17			
5R12				
10R1	Light (Bow) /16	Pale (Jang) /16		
10R2	Creamy (Nual) /17	Clear (Sai) /16		
10R3	Dusky (Mou) /16			
10R4				
10R5				
10R6	Dark (Mued) /18	Turbid (Tube) /17		Somber (Mon) /10
10R7			Dim (Tuem) /16	Clear (Sai) /11
10R8	Light (Sawang) /17	Penetrating (Saeb) /16	Strong (Raeng) /15	Motionless (Ning) /11
10R9	Dark (Mued) /23	Turbid (Tube) /18	Dim (Tuem) /17	Dry (Haeng) /9
10R10				Deep (Khem) /13

Table 4-1 Result of experiment I (table1) (2)

Color chips	Words/ Frequency			
	Acceptable		Unacceptable	
10R11				
10R12	Fresh (Sod) /18	Gaudy(Chood Chad)/16	Intense (Jad) /15	Deep (Khem) /11
5YR1				Transparent (Prong)/10
5YR2	Subdued (Seed) /18	Colourless (Jued) /18		Dusky (Mou) /11
5YR3				Somber (Mon) /7
5YR4				
5YR5	Fresh (Sod) /17	Light (Sawang) /16	Clear (Sai) /15	
5YR6	Turbid (Tube) /18	Dim (Tuem) /18	Dark (Mued) /16	
5YR7	Mocky (Koon) /17			Somber (Mon) /15
5YR8	Fresh (Sod) /18	Gaudy (Paed) /16		
5YR9	Turbid (Tube) /15			
5YR10				Dim (Tuem) /10
5YR11				Deep (Kae) /11
5YR12	Strong (Raeng) /18	Glaring (Jaa) /17	Clear (Sai) /16	
10YR1	Somber (Mon) /15	Mucky (Koon) /16		
10YR2	Creamy (Nual) /16			
10YR3	Dim (Tuem) /15			
10YR4	Songer (Mon) /18	Condensed (Kon) /15		
10YR5	Light (Sawang) /18	Fresh (Sod) /17	Sparkling (Wow) /15	
10YR6	Turbid (Tube) /19	Dim (Tuem) /17	Dark (Mued) /15	
10YR7				Dim (Tuem) /10
10YR8	Light (Sawang) /17	Glaring (Jaa) /16		Dirty (Cham) /10

Table 4-1 Result of experiment I (table1) (3)

Color chips	Words/ Frequency					Unacceptable
	Acceptable					
10YR9	Dark (Mued) /20	Turbid (Tube) /17	Gloomy (Kruem) /15	Glaring (Jaa) /17	Distinct (Jerd Jar) /15	Deep (Kae) /10
10YR10	Mucky (Koon) /17	Creamy (Nual) /16	Light (Sawang) /16	Dark Grey (Mong) /15	Gloomy (Kruem) /15	
5Y1	Light (Bow) /17	Clear (Sai) /17	Light (Sawang) /16	Clear (Sai) /16		Glassy brushcolor (Luab)/11
5Y2	Light (Bow) /19	Somber (Mon) /15	Somber (Mon) /15	Somber (Mon) /17		
5Y3	Dim (Tuem) /15	Light (Sawang) /18	Clear (Sai) /16	Clear (Sai) /16		Creamy (Nual) /9
5Y4	Greyish (Tun) /15	Turbid (Tube) /19	Somber (Mon) /15	Somber (Mon) /17		
5Y5	Fresh (Sod) /20	Light (Sawang) /16	Clear (Sai) /17	Clear (Sai) /16		Pale (Rua) /8
5Y6	Dim (Tuem) /20	Turbid (Tube) /19	Clear (Sai) /17	Clear (Sai) /16		
5Y7	Fresh (Sod) /17	Turbid (Tube) /16	Fresh (Sod) /16	Shining (Jaem) /16	Sheer (Pong) /15	Shiny (Luam) /8
5Y8	Dark (Mued) /17	Turbid (Tube) /16	Fresh (Sod) /16	Shining (Jaem) /16	Sheer (Pong) /15	
10Y1	Creamy (Nual) /16	Clear (Sai) /17	Fresh (Sod) /16	Dark (Mued) /15	Gloomy (Kruem) /15	Glaring (Jaa) /9
10Y2	Sparkling (Wow) /15	Light (Sawang) /15	Clear (Sai) /15	Dark (Mued) /15	Gloomy (Kruem) /15	
10Y3	Dusky (Mou) /16	Turbid (Tube) /19	Dim (Tuem) /17			Dark (Klam) /9
10Y4	Light (Sawang) /21	Light (Sawang) /15	Dim (Tuem) /17			
10Y5	Dim (Tuem) /15	Turbid (Tube) /19				
10Y6	Fresh (Sod) /20					
10Y7	Dark (Ta Mouen) /19					
10Y8						
10Y9						
10Y10						

Table 4-1 Result of experiment I (table1) (4)

Color chips	Words/ Frequency				Unacceptable
	Acceptable				
5GY1	Creamy (Nual) /16	Light (Bow) /15			
5GY2	Light (Sawang) /15	Clear (Sai) /15			
5GY3	Dark (Ta Muen) /18	Mucky (Koon) /16			Fresh (Sod) /12
5GY4					
5GY5	Light (Sawang) /23	Clear (Sai) /20	Fresh (Sod) /17		
5GY6	Somber (Mon) /16	Dim (Tuem) /15	Gloomy (Kruem) /15		
5GY7	Deep (Khem) /15				
5GY8	Fresh (Sod) /20	Light (Sawang) /19	Clear (Sai) /15	Distinct (Jerd Jar) /15	Shining (Jaem) /15
5GY9	Dark (Mued) /23	Turbid (Tube) /20	Dark (Ta Muen) /16	Gloomy (Kruem) /15	
5GY10	Dull (Dann) /20	Dim (Tuem) /17	Greyish (Tun) /16	Discoloured (Nao) /16	Clear (Sai) /12
5GY11					
5GY12	Fresh (Sod) /23	Clear (Sai) /16	Light (Sawang) /15		
10GY1	Light (Bow) /16	Creamy (Nual) /15	Motionless (Ning) /15		
10GY2	Cool (Yen) /18	Light (Bow) /16	Pale (Jang) /16		
10GY3	Dusky (Mou) /15				
10GY4	Creamy (Nual) /17	Weak (Oan Aer) /15			
10GY5					
10GY6	Dim (Tuem) /16				
10GY7	Deep (Khem) /17				
10GY8					
10GY9	Dark (Mued) /24	Turbid (Tube) /18	Dark (Ta Muen) /15	Deep (Kae) /15	
10GY10	Deep (Khem) /18	Turbid (Tube) /16	Deep (Kae) /15		

Table 4-1 Result of experiment I (table I) (5)

Color chips	Words/ Frequency				Unacceptable
	Acceptable				
10GY11	Fresh (Sod) /16				
5G1	Light (Bow) /17				
5G2	Creamy (Nual) /15	Creamy (Nual) /15			
5G3	Mucky (Koon) /18	Light (Sawang) /15			
5G4		Gloomy (Kruem) /17	Dark Grey (Mong) /16		Clear (Sai) /12
5G5					
5G6	Dim (Tuem) /17	Somber (Mon) /16	Dark (Ta Muen) /16	Turbid (Tube) /15	
5G7					
5G8					Fresh (Sod) /11
5G9	Dark (Mued) /23	Dark (Ta Muen) /18	Turbid (Tube) /21	Dim (Tuem) /15	
5G10	Deep (Kae) /15	Deep (Khem) /15	Turbid (Tube) /15		
5G11					
10G1	Transparent (Prong) /15	Light (Bow) /15	Pale (Jang) /15		Clear (Sai) /12
10G2	Cool (Yen) /18	Clear (Sai) /16			
10G3	Somber (Mon) /17	Mucky (Koon) /16			
10G4					
10G5					
10G6	Dim (Tuem) /20	Turbid (Tube) /18	Somber (Mon) /16	Gloomy (Kruem) /15	Creamy (Nual) /10
10G7					
10G8					Oily (Mann) /10
10G9	Deep (Khem) /19	Dim (Tuem) /17	Dark (Mued) /16	Turbid (Tube) /16	
10G10					Deep (Khem) /10

Table 4-1 Result of experiment I (table I) (6)

Color chips	Words/ Frequency				Unacceptable
	Acceptable				
10G11	Fresh (Sod) /15				
5BG1	Dusky (Mou) /17	Mucky (Koon) /15			
5BG2	Light (Sawang) /17	Pale (Jang) /15			
5BG3	Dusky (Mou) /15	Mucky (Koon) /15			
5BG4					Transparent (Prong) /8
5BG5					
5BG6	Dim (Tuem) /17	Deep (Khem) /16	Turbid (Tube) /15	Gloomy (Kruem) /15	
5BG7					Dark Grey (Mong) /10
5BG8					
5BG9	Dark (Mued) /20	Turbid (Tube) /15	Deep (Khem) /15		
5BG10	Deep (Kae) /16				
5BG11	Deep (Khem) /17				
10BG1	Light (Bow) /20	Mucky (Koon) /18	Dark Grey (Mong) /17	Dusky (Mou) /16	
10BG2	Light (Sawang) /16	Clear (Sai) /16	Creamy (Nual) /15		
10BG3	Somber (Mon) /16	Vague (Ka Muk Ka Mou) /15	Dark Grey (Mong) /15		
10BG4	Light (Sawang) /16	Creamy (Nual) /15			
10BG5					
10BG6	Dim (Tuem) /17	Turbid (Tube) /15	Dark (Mued) /15		
10BG7					Light (Sawang) /7 Deep (Kae) /7
10BG8					Fresh (Sod) /7
10BG9	Dark (Mued) /16	Turbid (Tube) /15			

Table 4-1 Result of experiment I (table1) (7)

Color chips	Words/ Frequency					Unacceptable
	Acceptable					
10BG10	Deep (Khem) /16	Dark (Klam) /15	Plain (Reab) /15			
5B1	Light (Bow) /18	Creamy (Nual) /16	Fresh (Sod) /15			
5B2	Light (Bow) /18	Pale (Jang) /16				
5B3	Dim (Tuem) /15	Somber (Mon) /15				
5B4	Cool (Yen) /18	Light (Sawang) /15	Plain (Reab) /15			
5B5						
5B6	Dark (Klam) /22	Deep (Khem) /19				
5B7	Dark Grey (Mong) /23	Clear (Sai) /20				
5B8						
5B9	Dark (Mued) /24	Turbid (Tube) /19	Dark (Klam) /18	Dim (Tuem) /17	Somber (Mon) /15	
5B10	Gloomy (Kruem) /15	Deep (Khem) /19	Dark (Klam) /17	Dim (Tuem) /16	Dark (Ta muen) /16	
10B1	Transparent (Prong) /19	Creamy (Nual) /17	Light (Bow) /17	Cool (Yen) /15	Velvety (Wann) /15	
10B2	Clear (Sai) /20	Cool (Yen) /18	Creamy (Nual) /17	Light (Bow) /16		
10B3	Dim (Tuem) /19	Somber (Mon) /17	Gloomy (Kruem) /15			Clear (Sai) /11
10B4						
10B5	Clear (Sai) /20					
10B6	Dark (Mued) /22	Turbid (Tube) /19	Dim (Tuem) /17			
10B7	Deep (Khem) /17	Gloomy (Kruem) /17				
10B8	Fresh (Sod) /20	Clear (Sai) /20				
10B9	Dark (Mued) /24	Turbid (Tube) /20				

Table 4-1 Result of experiment I (table1) (8)

Color chips	Words/ Frequency				
	Acceptable			Unacceptable	
10B10	Deep (Khem) /19	Gloomy (Kruem) /17	Transparent (Prong) /15	Light (Sawang) /15	
5PB1	Creamy (Nual) /22	Mucky (Koon) /20			Somber (Mon) /13
5PB2	Light (Bow) /17	Creamy (Nual) /16			Somber (Mon) /12
5PB3					
5PB4					
5PB5	Clear (Sai) /19	Light (Sawang) /15			
5PB6	Turbid (Tube) /18	Dark (Mued) /15			
5PB7	Deep (Khem) /17	Deep (Khem) /15			
5PB8	Fresh (Sod) /19				
5PB9	Dark (Mued) /20	Turbid (Tube) /20	Heavy (Nuck) /18		
5PB10	Deep (Khem) /20	Turbid (Tube) /17			Deep (Khem) /12
5PB11					
5PB12	Fresh (Sod) /20				
10PB1	Transparent (Prong)/17	Creamy (Nual) /16			
10PB2	Clear (Sai) /15				
10PB3					
10PB4	Mucky (Koon) /19	Creamy (Nual) /19			
10PB5	Light (Sawang) /22	Clear (Sai) /19	Creamy (Nual) /16		
10PB6	Dark (Mued) /17	Turbid (Tube) /17	Gloomy (Kruem) /16	Dark (Ta Muen) /15	
10PB7	Deep (Khem) /17				
10PB8	Shining (Jaem) /17	Fresh (Sod) /15			
10PB9	Dark (Mued) /22	Deep (Khem) /16	Turbid (Tube) /15		

Table 4-1 Result of experiment I (table1) (9)

Color chips	Words/ Frequency						Unacceptable
	Acceptable			Unacceptable			
10PB10	Turbid (Tube) /17	Deep (Kae) /16	Intense (Jad) /15				
10PB11	Glaring (Jaa) /19	Dim (Tuem) /17	Deep (Kae) /15				
10PB12	Fresh (Sod) /16	Deep (Khem) /15	Apparent (Kom Chad)/15				
5P1	Pale (Jang) /19	Light (Bow) /17					
5P2	Creamy (Nual) /19	Pure (Bo Ri Sood) /18	Plain (Reab) /16				
5P3	Dark Grey (Mong) /17	Dusky (Mou) /15					Dirty (Cham) /10
5P4							
5P5	Fresh (Sod) /15	Clear (Sai) /15					
5P6	Dark (Mued) /17	Turbid (Tube) /16	Dim (Tuem) /15				
5P7	Deep (Khem) /15						
5P8	Fresh (Sod) /19						
5P9	Dark (Mued) /18	Turbid (Tube) /17	Strong (Khem Kang) /15				
5P10	Deep (Khem) /18	Turbid (Tube) /16					
5P11	Deep (Khem) /20						
5P12	Fresh (Sod) /16	Apparent (Kom Chad)/16					
10P1	Dusky (Mou) /22	Light (Bow) /19					
10P2	Clear (Sai) /17	Light (Sawang) /15					Dark Grey (Mong) /9 Creamy (Nual) /10
10P3							
10P4							
10P5	Velvety (Wann) /17	Clear (Sai) /15					
10P6	Dark (Mued) /17	Turbid (Tube) /16	Gloomy (Kruem) /15				
10P7	Deep (Khem) /21	Greyish (Tun) /19	Condensed (Kon) /18				Heavy (Nuck) /16 Dirty (Cham) /17

Table 4-1 Result of experiment I (table1) (10)

Color chips	Words/ Frequency			
	Acceptable		Unacceptable	
10P8	Fresh (Sod) /17	Light (Sawang) /15		
10P9	Dark (Mued) /18	Vague (Ka Muk Ka Mou)/16		
10P10	Deep (Khem) /19	Turbid (Tube) /15		
10P11	Deep (Khem) /17	Deep (Kae) /15		
10P12	Fresh (Sod) /19	Striking (Den) /15		
5RP1	Pale (Jang) /25	Creamy (Nual) /19	Light (Sawang) /17	Velvety (Wann) /12
5RP2				Mucky (Koon) /11
5RP3				Dark (Klam) /11
5RP4	Dark Grey (Mong) /19	Dark (Klam) /18	Mucky (Koon) /16	
5RP5	Clear (Sai) /18	Light (Sawang) /17	Fresh (Sod) /15	
5RP6	Dark (Klam) /16	Dirty (Cham) /15	Turbid (Tube) /15	
5RP7				Deep (Kae) /10
5RP8	Light (Sawang) /16	Clear (Sai) /15		
5RP9	Dark (Mued) /20	Turbid (Tube) /18		
5RP10	Dark Grey (Mong) /21	Deep (Kae) /20	Deep (Khem) /20	
5RP11	Deep (Khem) /17	Gloomy (Kruem) /15	Heavy (Nuck) /15	
5RP12	Fresh (Sod) /17	Clear (Sai) /15		
10RP1	Light (Bow) /22	Transparent (Prong)/21	Smooth (Nian) /20	
10RP2	Creamy (Nual) /20	Clear (Sai) /16	Cool (Yen) /16	Light (Bow) /15
10RP3	Somber (Mon) /18	Mucky (Koon) /16	Dusky (Mou) /15	
10RP4				Creamy (Nual) /8
10RP5	Clear (Sai) /19	Fresh (Sod) /17	Velvety (Wann) /15	

Table 4-1 Result of experiment I (table1) (11)

Color chips	Words/ Frequency					Unacceptable
	Acceptable					
10RP6	Turbid (Tube) /17	Gloomy (Kruem) /16	Deep (Kae) /15			
10RP7	Dark (Klam) /19	Dirty (Cham) /16				
10RP8	Fresh (Sod) /20	Luminous (Jae) /19				
10RP9	Turbid (Tube) /21	Dim (Tuem) /18	Rough (Kar Dang) /17	Dull (Dann) /16		
10RP10	Somber (Mon) /20	Rough (Kar Dang) /19	Dirty (Cham) /17	Dark (Klam) /16		Deep (Khem) /10
10RP11						
10RP12	Fresh (Sod) /20	Shining (Jaem) /18	Deep (Khem) /17			
N1	Dark (Mued) /20	Turbid (Tube) /18	Dim (Tuem) /16			
N2	Turbid (Tube) /19	Dark (Mued) /18	Dim (Tuem) /17	Gloomy (Kruem) /16		
N4	Somber (Mon) /24	Dusky (Mou) /22	Mucky (Koon) /20	Dark Grey (Mong) /19	Motionless (Ning) /17	
N6	Dusky (Mou) /16	Vague (Ka Muk Ka M0u)/15				
N8	Clear (Sai) /23	Light (Bow) /22	Smooth (Nian) /22	Pure (Bo Ri Sood) /21	Light (Sawang) /20	
N9.5	Pure (Bo Ri Sood) /17	Light (Bow) /16	Motionless (Ning) /15	Light (Sawang) /15		

4.1.2 Result of experiment I in Munsell hue plane

The result of experiment I was located in the Munsell hue plane in figure 4-1. It was developed on highest acceptable words in each color chip numbers. The underlined term was unacceptable, but it was the most selected for a particular color. The color chart, which was used to show the color chip numbers, are divided into 3 ranges according to the characteristic of group words, approximately at color chip numbers 1-5, 6-10, 10-12, they were available from the color chip numbers 1-5 around light color group, color chip numbers 6-10 around Deep color group, and color chip numbers 10-12 around Fresh color group. The table could be used as guideline in observing the color



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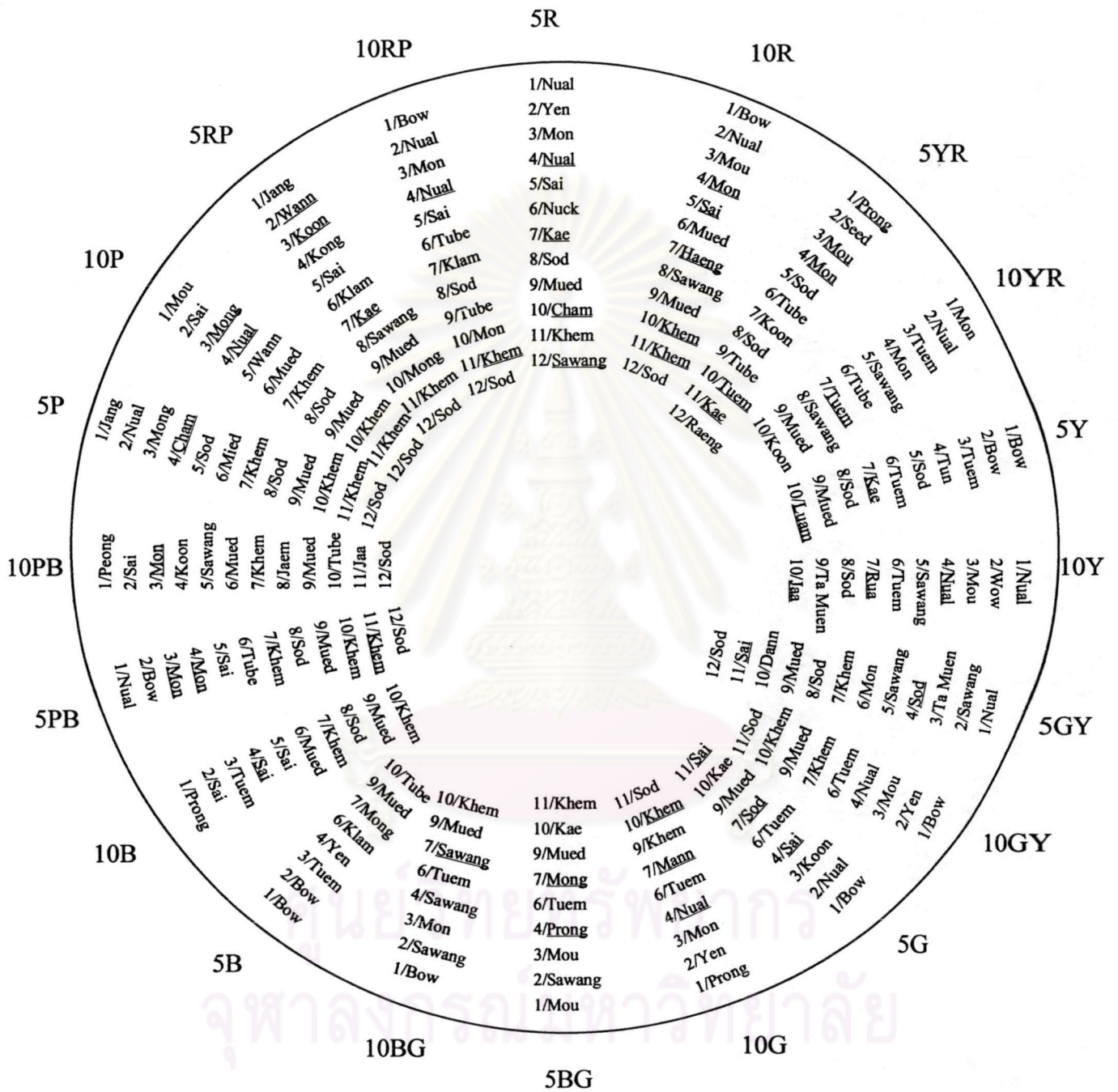


Figure 4-1 Result of experiment I in Munsell hue plane.

4.1.3 Result of experiment II

The table 4-2 was derived from the results of the experiment II. It was developed on the words for color perception and choices of color chip numbers, with 50% significance. They were represented by “word (color chip number / frequency)”. Warm the groups of words for colors with warm tone, e.g. bright, fresh, clear, can be named by an observer more than those of cool and mild nature. Conclusively the observers can tell a shade of intense and warm color easier than a faint and cool tone of a color. The highest frequency word was Dark (Mued) (10R9/30), and the highest frequency of color chip numbers in word was 33 color chip numbers.



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Table 4-2 Result of experiment II (table2) (1)

Words	Color chips/ Frequency														Unacceptable
	Acceptable														
Light (Sawang)	5Y5/28	10Y8/23	10Y5/22	10Y8/21	10Y2/19	10Y2/19	10BG2/19	5B2/19	5GY5/18						
	10B5/18	10R5/17	5Y5/17	5GY8/17	5P5/17	5R5/16	10P5/16	5RP5/16	10YR5/15						
	5BG2/15	10BG4/15	10PB5/15												
	5RP8/27	10YR8/26	10Y8/26	10RP12/24	5R12/24	10B8/24	10PB8/24	10R12/23	5PB8/22						
	5P8/22	5BG7/21	10R8/20	5Y5/19	5GY8/19	10BG7/19	10P8/19	10P12/19	5GY12/18						
Fresh (Sod)	10PB12/18	5RP12/18	10G11/17	5PB12/17	10Y5/16	10GY11/16	5B7/15								
	10P5/23	5Y5/21	10B5/21	5B2/20	5RP5/19	5BG2/18	10R5/17	10Y2/17	5GY8/17						
	10YR8/16	10Y8/16	10B2/16	10RP2/16	5Y2/15	5GY5/15									
	5R12/22	10R12/19	10RP12/17												
	10PB12/23	5P12/20	10P12/19	5R12/18	5PB12/17	5RP12/17	10R12/16	10RP12/16							
Intense (Jad)	5R9/23	10G10/21	5YR10/20	5BG10/20	5PB10/19	10RP10/19	10R9/18	10Y9/18	5B9/18						
	10P11/17	5R11/16	10R10/16	5YR9/16	10YR9/16	10BG9/16	10BG10/16	5B10/16	10P10/16						
	5RP11/16	5R10/15	10YR10/15	5G10/15	10B10/15	10PB10/15									
	10YR8/24	10PB8/24	10B8/20	10R12/19	10Y8/19	5R12/18	5PB8/18	5P8/18	10PB12/17						
	10P8/17	5RP8/17	10RP8/17	5RP12/16	10R8/15	10RP9/15	10RP12/15								
Deep (Khem)	10R10/25	10B10/24	5BG10/23	10BG10/22	5B10/22	5PB11/22	5RP11/22	10R9/21	5YR9/21						
	5G10/20	5PB10/20	10G10/19	5P11/19	5YR10/18	5BG9/18	10P11/18	10RP10/18	5R9/17						
	10YR9/17	10Y9/17	5BG11/17	10PB12/17	10P10/17	5RP10/17	5R11/16	10G9/16	10PB10/16						
	5R10/15	10R6/15	10R11/15	10Y6/15	5P10/15	10RP9/15									
	5GY8/20	10R12/19	10YR8/19	10Y8/19	5RP8/18	10B8/15	10P12/15								
Condensed (Kon)	10G10/19	5BG10/18	5RP11/18	5B9/17	5PB10/17	10P10/17	10R10/16	5YR10/16	5RP10/15						
	5R12/18	10P12/18	10Y8/17	5GY8/17	10R12/16	10YR8/16									
Gaudy (Paed)															

Table 4-2 Result of experiment II (table2) (3)

Words	Color chips/ Frequency										Unacceptable	
	Acceptable											
Dusky (Mou)	10BG1/16	10Y3/15										10BG1/13
Vague (Ka Muk Ka Mou)	5YR9/23	5R9/22	10R8/22	10B9/22	5BG9/21	10YR9/20	5Y9/20	10Y9/20	5RP9/20			
Dark (Ta Muen)	5GY9/19	10BG9/19	10PB9/18	10P9/18	10RP9/18	10GY9/17	10G9/17	5PB9/17	5B9/16			
Gloomy (Kruem)	10GY6/18	5BG6/16	10P6/15									
Dark Grey (Mong)	10RP1/19											
Mucky (Koon)	10B3/16	10PB3/16	5R3/15	5YR3/15	10BG1/15	5P3/15						
Sparkling (Wow)	5Y1/17	10YR1/15										
Pale (Rua)	10P2/15	10RP2/15										
Glassy brushcolor (Luab)												5R4/11
Glittering (Pra Kay)												10Y7/11
Oily (Mann)												5P5/13
Shiny (Luam)												10YR1/9
Colourful (Praew Prao)												10Y7/8
Velvety (Wann)	10P5/22	5R5/19	10BG2/19	5B2/19	10R2/16	5RP5/16	10G2/15	10B5/15	5PB5/15			5RP8/10
Cool (Yen)	10R2/23	10BG2/22	10Y2/20	5B2/20	10B2/19	10RP2/18	5GY2/17	10GY2/17	5BG2/17			
	5Y2/16											
Creamy (Nual)	10Y2/26	5Y2/22	5GY2/21	10R2/19	10GY2/18	5BG2/18	5B2/18	5RP2/18	10YR2/17			
	10BG2/17	5G2/16	10P2/16	5YR2/15	10B2/15							
Transparent (Prong)	10Y2/23	10R2/21	10GY2/19	5Y2/18	5BG2/18	5B2/18	5YR2/17	10YR2/15	5GY2/15			
	10BG2/15	5RP2/15										
Light (Bow)	10R2/23	10GY2/23	10P2/23	10YR2/22	10Y2/22	5RP2/22	5Y2/20	5GY2/20	5BG2/20			

4.1.4 Result of experiment II in Munsell hue plane

The results of the experiment II was located in the Munsell hue plane in figure 4-2. It was developed on highest acceptable color chip numbers in each word. For the vigorous tone of red, yellow, purple, etc., people are able to distinguish more neatly than the cool tones of colors, e.g. green, blue.



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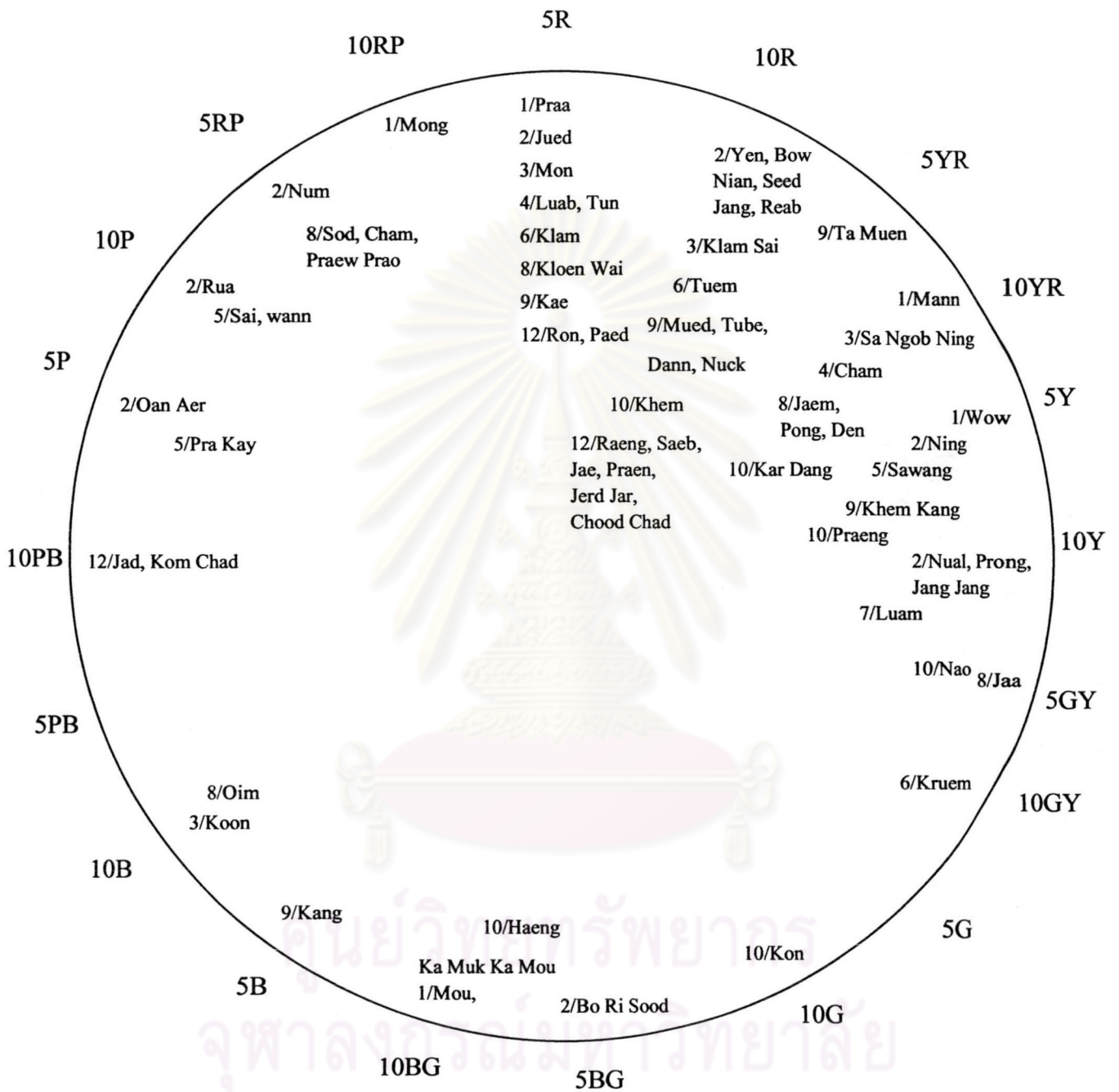


Figure 4-2 Results of experiment II in Munsell hue plane.

4.1.5 Comparative of results of experiments I and II.

The data from experiment I and II were compared in the table 4-3. The results in experiment I in which color chip numbers are given for identifying the terms were used to against the experiment II where the words terms were given for naming the color chip numbers. Obviously, some could name correspond to certain colors, Whereas some other terms could not. However, they were in the sense group of words. The test results were conclusively quite reliable. For certain color codes that were left blanks, the value scales were chosen by less than 50% or 15 observers. It implies that the reliability was controversial.

Table 4-3 show that humans can understand the color perceiving terms, given the color chip numbers and choose the words, better expressions than when given the words and choosing the color chip numbers and thinking of a same color. This may be due to the fact that individuals have different reference in their mind

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Table 4-3 Comparative table of experiments I and II (1)

	1	2	3	4	5	6	7	8	9	10	11	12
5R	1 Creamy (Nual) 2 Blurry (Praa)	1 Cool (Yen) 2 Colourless (Jued)	1 Somber (Mon) 2 Somber (Mon)	1 Creamy (Nual) 2 Glassy brushcolor (Luab) Greyish (tun)	1 Clear (Sai) 2 -	1 Heavy (Nuck) 2 Dark (Kiam)	1 Deep (Kae) 2 -	1 Fresh (Sod) 2 Dynamic (Kioen Wai)	1 Dark (Mued) 2 Deep (Kae)	1 Dirty (Cham) 2 Warm (Ron)	1 Deep (Khem) 2 -	1 Light (Swang) 2 Warm (Ron) 3 Caudy (Paed)
10R	1 Light (Bow) 2 -	1 Creamy (Nual) 2 Cool (Yen) 3 Light (Bow) 4 Smooth (Nian) 5 Subdued (Seed) 6 Pale (Jang) 7 Plain (Reab)	1 Dusky (Mou) 2 Oily Dark (Kiam Sai)	1 Somber (Mon) 2 -	1 Clear (Sai) 2 -	1 Dark (Mued) 2 Dim (Tuem)	1 Dry (Haeng) 2 -	1 Light (Swang) 2 -	1 Dark (Mued) 2 Dark (Mued) 3 Turbid (Tube) 4 Dull (Dann) 5 Heavy (Nuck)	1 Deep (Khem) 2 Deep (Khem)	1 Deep (Khem) 2 -	1 Fresh (Sod) 2 Strong (Raeng) 3 Penetrating (Saeb) 4 Luminous (Jae) 5 Flashy (Praen) 6 Distinct (Jerd Jar) 7 Gardy (Chood Chad)
5YR	1 Transparent (Prong) 2 -	1 Subdued (Seed) 2 -	1 Dusky (Mou) 2 -	1 Somber (Mon) 2 -	1 Fresh (Sod) 2 -	1 Turbid (Tube) 2 -	1 Mucky (Koon) 2 -	1 Fresh (Sod) 2 -	1 Turbid (Tube) 2 Dark (Ta Muen)	1 Dim (Tuem) 2 -	1 Deep (Kae) 2 -	1 Strong (Raeng) 2 -
10YR	1 Somber (Mon) 2 Oily (Mann)	1 Creamy (Nual) 2 -	1 Dim (Tuem) 2 Passive (Sa Ngob Ning)	1 Somber (Mon) 2 Dirty (Cham)	1 Light (Swang) 2 -	1 Turbid (Tube) 2 -	1 Dim (Tuem) 2 -	1 Light (Swang) 2 Shining (Jaem) 3 Sheer (Pong) 4 Striking (Den)	1 Dark (Mued) 2 -	1 Mucky (Koon) 2 Rough (Kar Dang)	1 - 2 -	1 - 2 -
5Y	1 Light (Bow) 2 Sparkling (Wow)	1 Light (Bow) 2 Motionless (Ning)	1 Dim (Tuem) 2 -	1 Greyish (tun) 2 -	1 Fresh (Sod) 2 Light (Swang)	1 Dim (Tuem) 2 -	1 Deep (Kae) 2 -	1 Fresh (Sod) 2 -	1 Dark (Mued) 2 Strong (Khem Kang)	1 Glassy brushcolor (Luab) 2 Out Of Tonne (Praeng)	1 - 2 -	1 - 2 -
10Y	1 Creamy (Nual) 2 -	1 Sparkling (Wow) 2 Creamy (Nual) 3 Transparent (Prong) 4 Faded (Jang Jang)	1 Dusky (Mou) 2 -	1 Creamy (Nual) 2 -	1 Light (Swang) 2 -	1 Dim (Tuem) 2 -	1 Pale (Rual) 2 Shiny (Luam)	1 Fresh (Sod) 2 -	1 Dark (Ta Muen) 2 -	1 Glaring (Jaa) 2 -	1 - 2 -	1 - 2 -
5GY	1 Creamy (Nual) 2 -	1 Light (Sawang) 2 -	1 Dark (Ta Muen) 2 -	1 Fresh (Sod) 2 -	1 Light (Swang) 2 -	1 Somber (mon) 2 -	1 Deep (Khem) 2 -	1 Fresh (Sod) 2 Glaring (Jaa)	1 Dark (Mued) 2 -	1 Dull (Dann) 2 Discoloured (Nao)	1 Clear (Sai) 2 -	1 Fresh (Sod) 2 -
10GY	1 Light (Bow) 2 -	1 Cool (Yen) 2 -	1 Dusky (Mou) 2 -	1 Creamy (Nual) 2 -	1 - 2 -	1 Dim (Tuem) 2 Gloomy (Kruem)	1 Deep (Khem) 2 -	1 - 2 -	1 Dark (Mued) 2 -	1 Deep (Khem) 2 -	1 Fresh (Sod) 2 -	1 - 2 -
5G	1 Light (Bow) 2 -	1 Creamy (Nual) 2 -	1 Mucky (Koon) 2 -	1 Clear (Sai) 2 -	1 - 2 -	1 Dim (Tuem) 2 -	1 Fresh (Sod) 2 -	1 - 2 -	1 Dark (Mued) 2 -	1 Deep (Kae) 2 -	1 Clear (Sai) 2 -	1 - 2 -
10G	1 Transparent (Prong) 2 -	1 Cool (Yen) 2 -	1 Somber (Mon) 2 -	1 Creamy (Nual) 2 -	1 - 2 -	1 Dim (Tuem) 2 -	1 Oily (Mann) 2 -	1 - 2 -	1 Deep (Khem) 2 -	1 Deep (Khem) 2 Condensed (Kon)	1 Fresh (Sod) 2 -	1 - 2 -
5BG	1 Dusky (Mou) 2 -	1 Light (Sawang) 2 Pure (Bo Ri Sood)	1 Dusky (Mou) 2 -	1 Transparent (Prong) 2 -	1 - 2 -	1 Dim (Tuem) 2 -	1 Dark Grey (Mong) 2 -	1 - 2 -	1 Dark (Mued) 2 -	1 Deep (Kae) 2 -	1 Deep (Khem) 2 -	1 - 2 -

4.2. CIE L* C* h chart

The outcome, with 50% significance from experiment II on defining terms and selecting the color chip numbers, were employed to designate positions in CIE L* C* h color system. The setting of the data must conform with the color chart. The graph was plotted with L* a* b* values indicating the color codes and pointing the same positions as the by CIE L* C* h color system. The difference was only the value system (See Chapter 2 and Appendix C). Since the value in both CIE L* a* b* and CIE L* C* h each were in 3 dimensions standing in X, Y, Z axis, 3 patterns were thus used in indicating the color value.

1. In a* and b* plane, the Y-axis, represented volume b*, blue to yellow from -100 to 100, whereas the X-axis, represented a* value, green to red and from -100 to 100.
2. In L* and a* plane, the Y-axis indicates the L* lightness in from 0 to 100 (dark to light), and the X-axis, represents a*, green to red and again from -100 to 100
3. In L* and b* plane, the Y-axis indicates the L* lightness from 0 to 100 (dark to light), and the X axis represents b* value, blue to yellow and from -100 to 100.

The three patterns of graph, L* , a* , b* , indicated the color positions in the color system, When L illumination on L* and a* and L* versus b* , were examined, the illumination on the Y-axis represented each one value. This was verified by measuring the color value with spectrophotometer in the Light Control cabinet and a value for each

color was obtained to indicate the finest hue. The a^* and b^* will be investigated for grouping together with the L^* value and will be discussed in the next section. At this point, the study showed that the illumination L^* has nothing to do with the experiment since the latter aims primarily to examine any relationship by specifying the positions to find the tendency and direction of the hue. (specifying a^* and b^* value).

The graph, showing a^* and b^* values, in fact did not show L value. It illustrated the hue of each color and used to analyze in the trendy relationship. As there is no criteria in grouping the color terms, the researcher attempted to group them into six groups, with reference to the research by Sato (26) in "Opponent words pairs of Colors". (see data in Appendix E) The English words translated from Thai words are represented the same meaning, but may be different color perception.

Six groups of them are shown in Figure 4-4 to 4-9.

Table 4-4 Words for color perception for bright colors. (16 words)

(English words) (Thai words)

Light	Sawang
Fresh	Sod
Warm	Ron
Intense	Jad
Striking	Den

Shining	Jaem
Glaring	Jaa
Gaudy	Paed
Strong	Raeng
Penetrating	Saeb
Apparent	Kom Chad
Luminous	Jae
Flashy	Praen
Sheer	Pong
Distinct	Jerd Jar
Gaudy	Chood Chad

Table 4-5 Words for color perception for dark colors. (7 words)

(English words) (Thai words)

Dark	Mued
Turbid	Tube
Dim	Tuem
Vague	Ka Muk Ka Mou
Dark	Ta Muen
Gloomy	Kruem
Dark	Klam

Table 4-6 Words for color perception for light colors. (22 words)

(English words) (Thai words)

Velvety	Wann
Cool	Yen
Creamy	Nual
Transparent	Prong
Light	Bow
Motionless	Ning
Smooth	Nian
Passive	Sa Ngob Ning
Soft	Num
Subdued	Seed
Pale	Jang
Blurry	Praa
Colorless	Jued
Faded	Jang Jang
Weak	Oan Aer
Pure	Bo Ri Sood
Plain	Reab
Oily Dark	Klam Sai
Dirty	Cham

Discolored	Nao
Out Of Tone	Praeng
Clear	Sai

Table 4-7 Words for color perception for heavy colors (7 words)

(English words) (Thai words)

Heavy	Nuck
Deep	Kae
Deep	Khem
Condensed	Kon
Strong	Khem Kang
Dynamic	Kloen Wai
Hard	Kang

Table 4-8 Words for color perception for glossy appearance colors (9 words)

(English words) (Thai words)

Sparkling	Wow
Pale	Rua
Glassy brush color	Luab
Glittering	Pra Kay

Oily	Mann
Shiny	Luam
Colorful	Praew Prao
Moist	Cham
Rich	Oim

Table 4-9 Words for color perception for non-glossy appearance colors (8 words)

(English words) (Thai words)

Somber	Mon
Dusky	Mou
Dark Grayish	Mong
Mucky	Koon
Rough	Kar dang
Dull	Dann
Grayish	Tun
Dry	Haeng

4.2.1. Words for color perception for bright colors.

Locations of bright colors, would be found by looking on the plane graph which show a^* and b^* value. The colors are distributed out in a big area around the a^* and b^* plane. They were generally high chroma, but in the $-a^*$ and $-b^*$ axis they were at low

chroma. When looking on the $L^* - a^*$ plane, and $L^* - b^*$ plane, color locations of high lightness values were higher than L^* value at the 50, but in the $+a^*$ and $-b^*$ axis they were lower lightness than L^* value at 50. In 3 dimensions diagram, it was, similar to a big circular shape that the bright colors were distributed out in a big area. It indicated that the word for color perception for bright colors point clearly to high chroma, high lightness value.

4.2.2. Words for color perception for dark colors.

Locations of dark colors could be seen by, looking on the plane graph of a^* and b^* value. The colors were concentrated near the L^* axis and they were ring shape. When looking on the plane graph $L^* - a^*$, $L^* - b^*$, they were lower lightness than L^* value at 50. So the graph indicated that words for color perception for dark color point to low chroma color and, low lightness value. Comparing with the words for color perception for bright color, it could be like a small circular pad stacked on the larger circle.

4.2.3. Words for color perception for light colors.

Locations of light colors, could be seen on the plane graph a^* and b^* values were shown. The colors were concentrated at near L^* axis and distributed out to the $+b^*$ axis. Looking on the plane graph $L^* - a^*$, they are higher than L^* value at 50 and distributed along L^* . However when looking on the plane graph L^* and b^* , the lightness were higher

than L^* . So the graph indicated word for color perception for light color with high lightness, and it contains more the yellow to blue than the red to green.

4.2.4. Words for color perception for heavy colors.

Locations of heavy color would be found on, the plane graph that show a^* and b^* value. The colors were concentrated along the center of the plane and scattered to a^* axis. Looking on L^* and a^* , L^* and b^* , they were lower lightness than L^* value at 50. The colors obtained were apposite to the colors gained from the word for color perception for light color. It contains more dark and the available colors trend to have more the red to green than the yellow to blue.

4.2.5. Words for color perception for glossy appearance colors.

Locations of glossy colors group could be spotted on, plane graph a^* and b^* value in which there were broad similar to the bright color group but were adjacent to either a^* or b^* . From plane graph L^* and a^* and L^* and b^* , the color location of high illumination value was similar to that of the bright colors group, but was more distinctive at certain side than the bright color group. It indicated that the word for color perception for bright colors have high chroma and high lightness value.

4.2.6. Words for color perception for non-glossy appearance colors.

Examining plane graph a^* and b^* , locations of the non-glossy colors group were found to be dense like the dark colors group. They were concentrated near the L^* axis, but not to be ring shape. When looking at L^* and a^* and L^* and b^* , the colors were high L^* value and distributed near the L^* axis. So the colors in this group have high lightness but low chroma.

* Graphs of words for color perception (see in figure 4-19 to 4-24) were made to show each word. Graphs of words for color perception (area) (see in figure 4-22 to 4-24) were made for easy to show each group of words.



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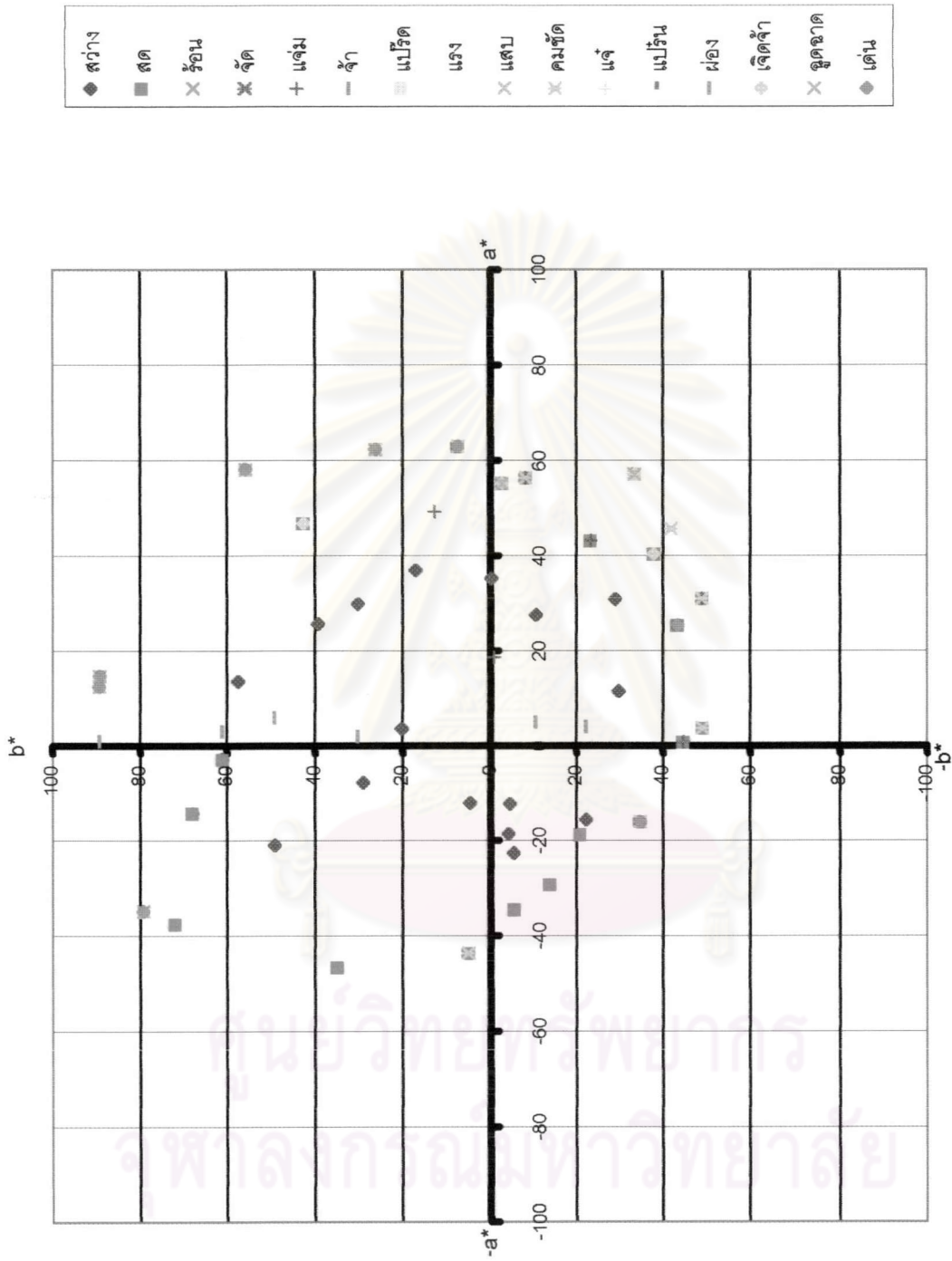


Figure 4-3 Color perception words of group 1 (bright color group), CIE a^* and b^*

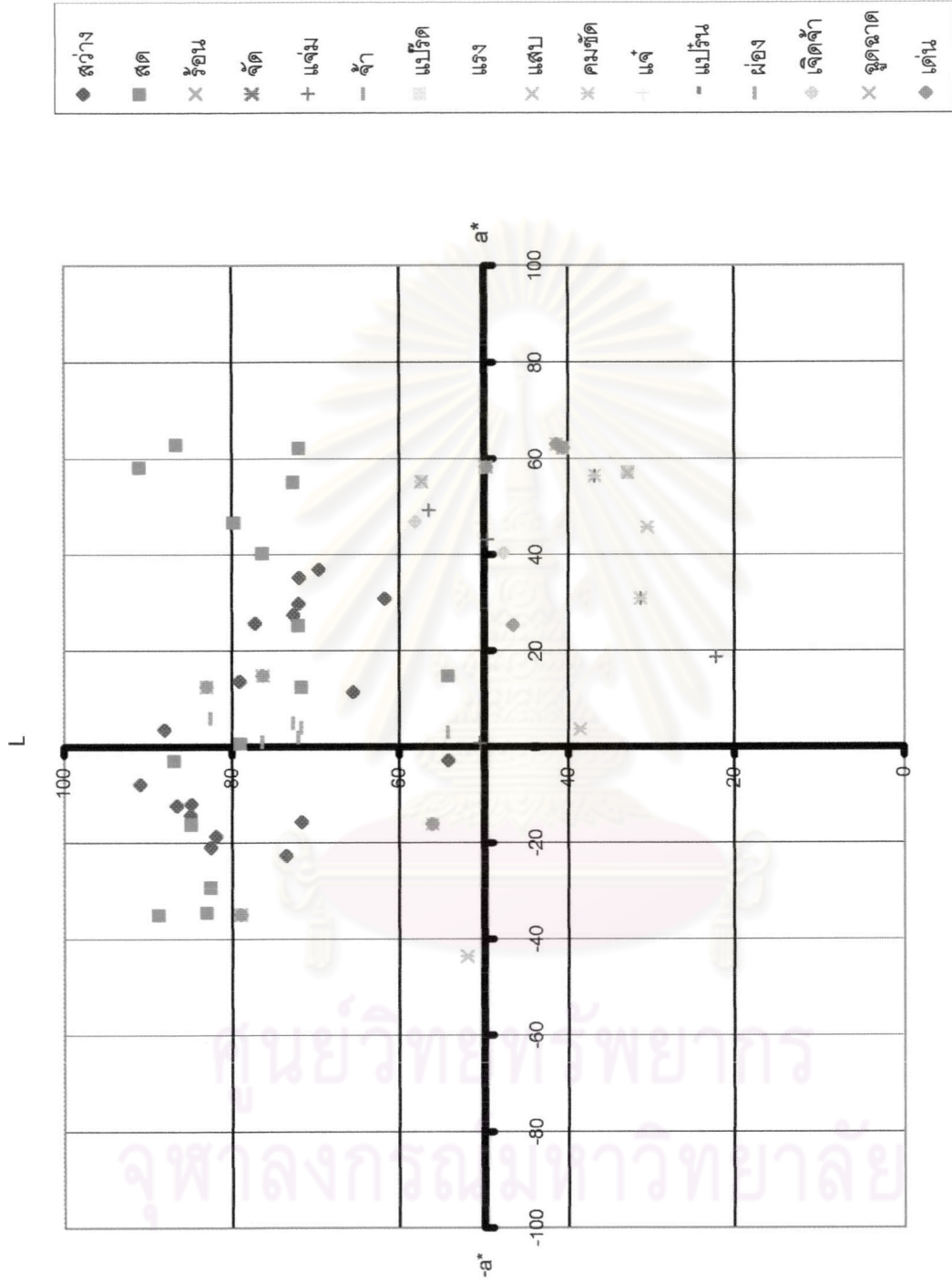


Figure 4-4 Color perception words of group 1 (bright color group), CIE L* and a*

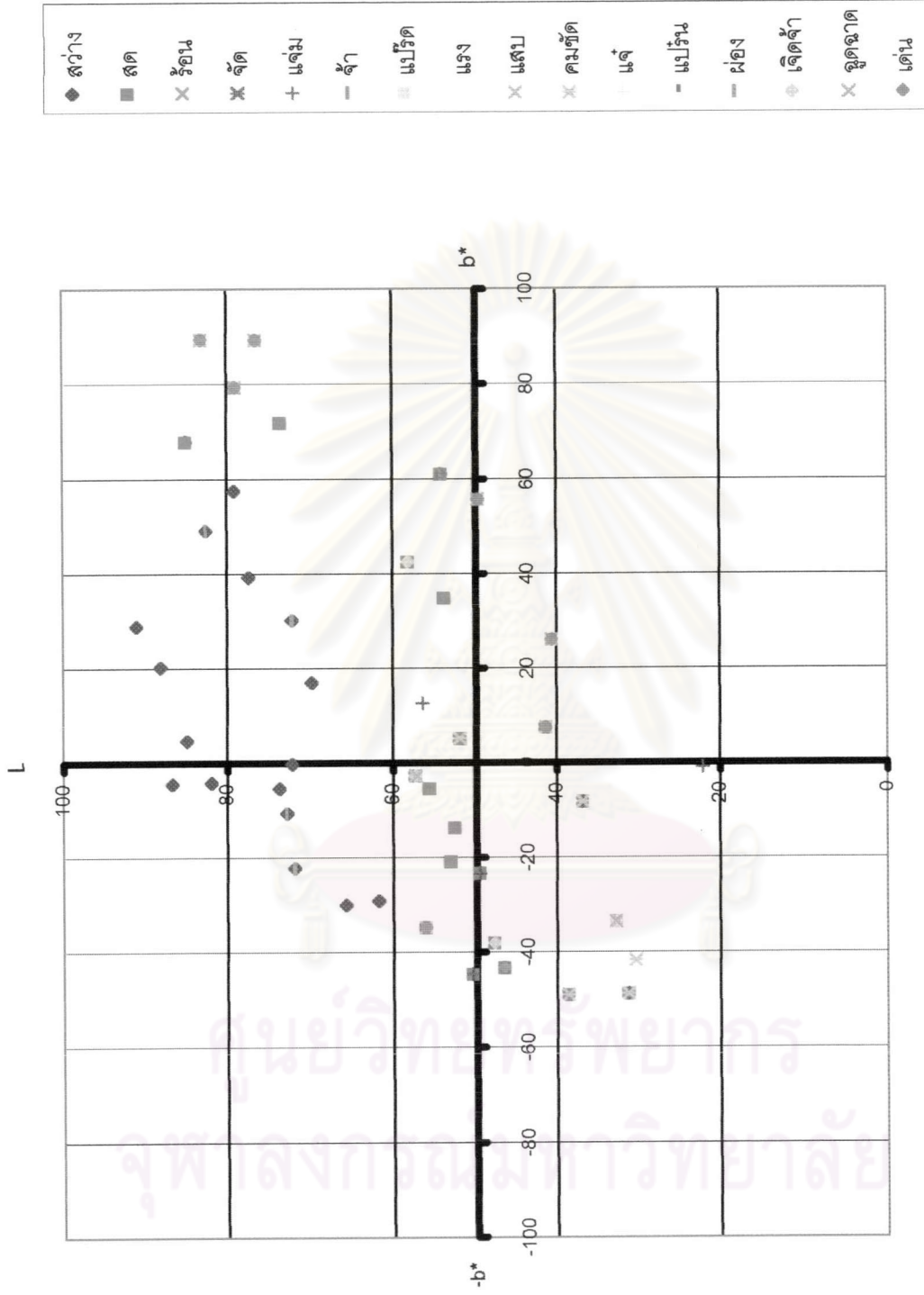


Figure 4-5 Color perception words of group 2 (dark color group), CIE L* and b*

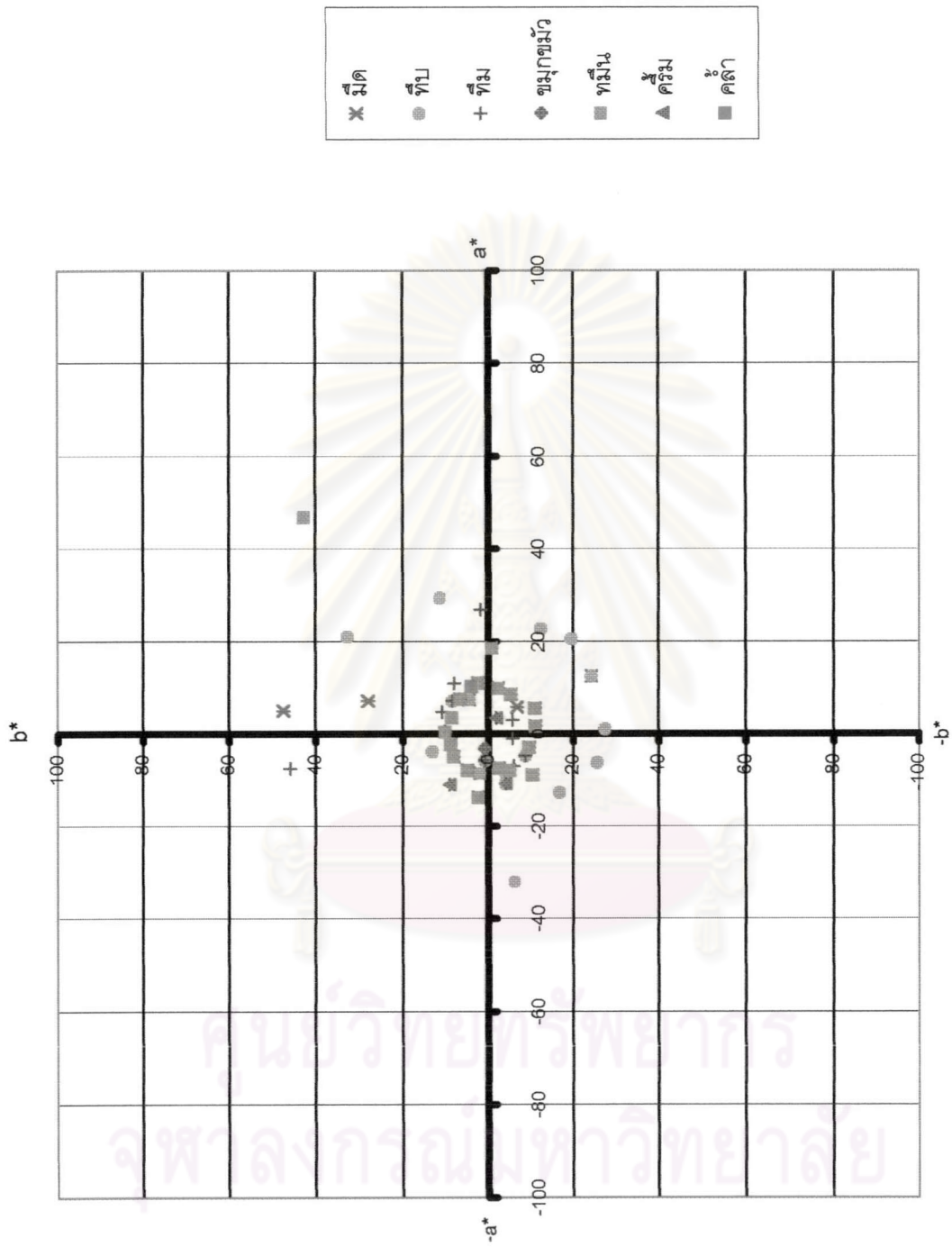


Figure 4-6 Color perception words of group 2 (dark color group), CIE a^* and b^*

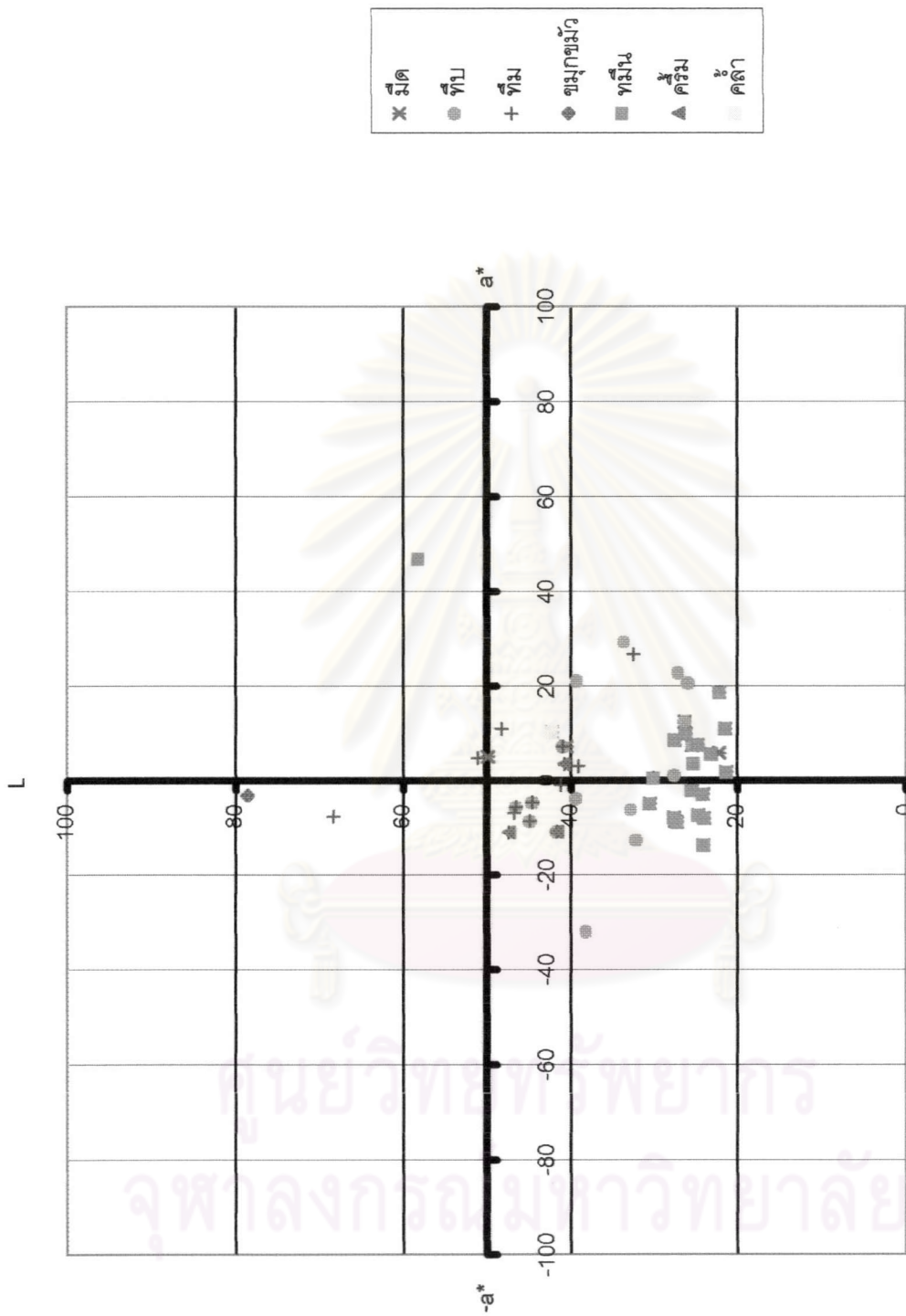


Figure 4-7 Color perception words of group 2 (dark color group), CIE L* and a*

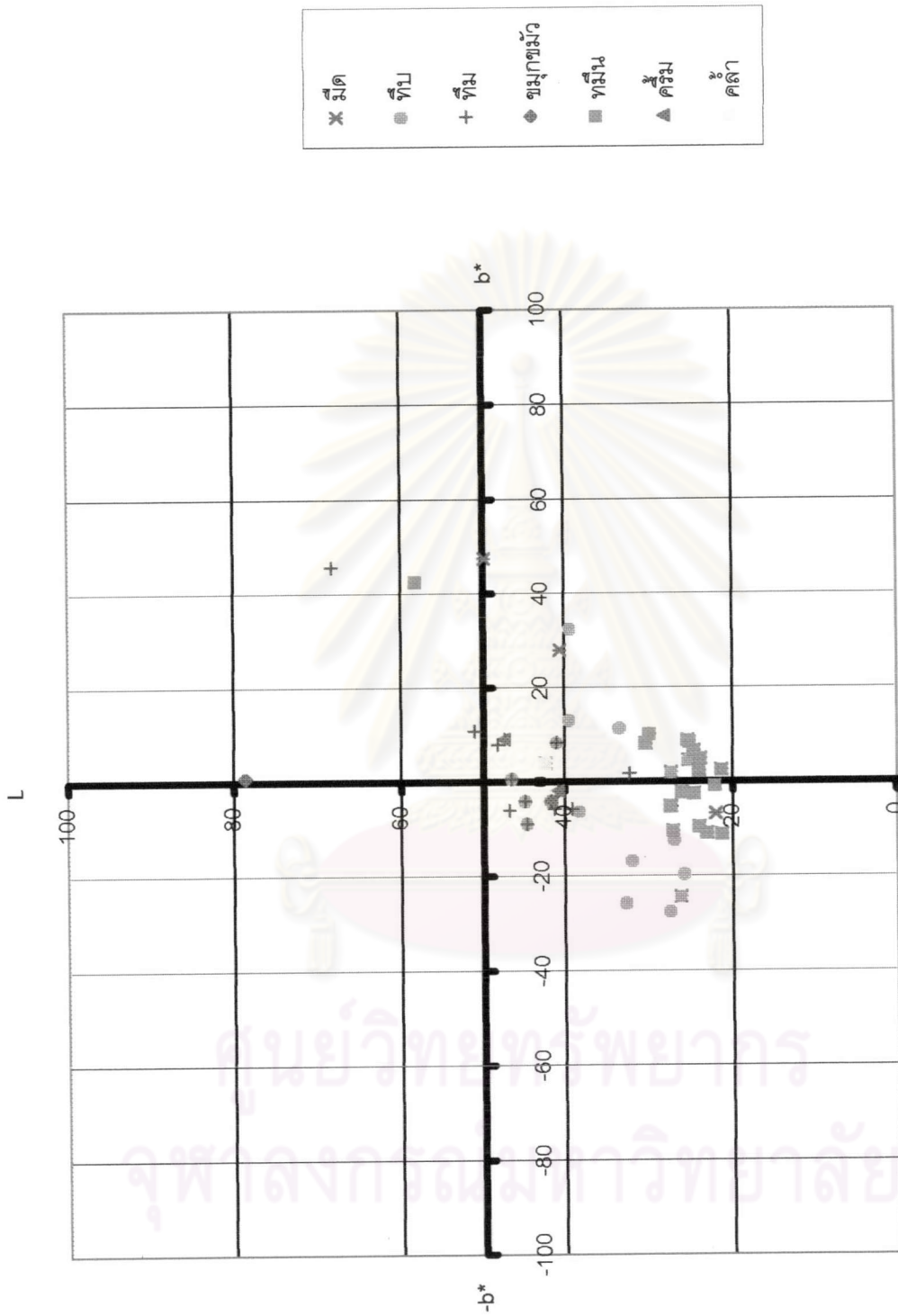


Figure 4-8 Color perception words of group 2 (dark color group), CIE L* and b*

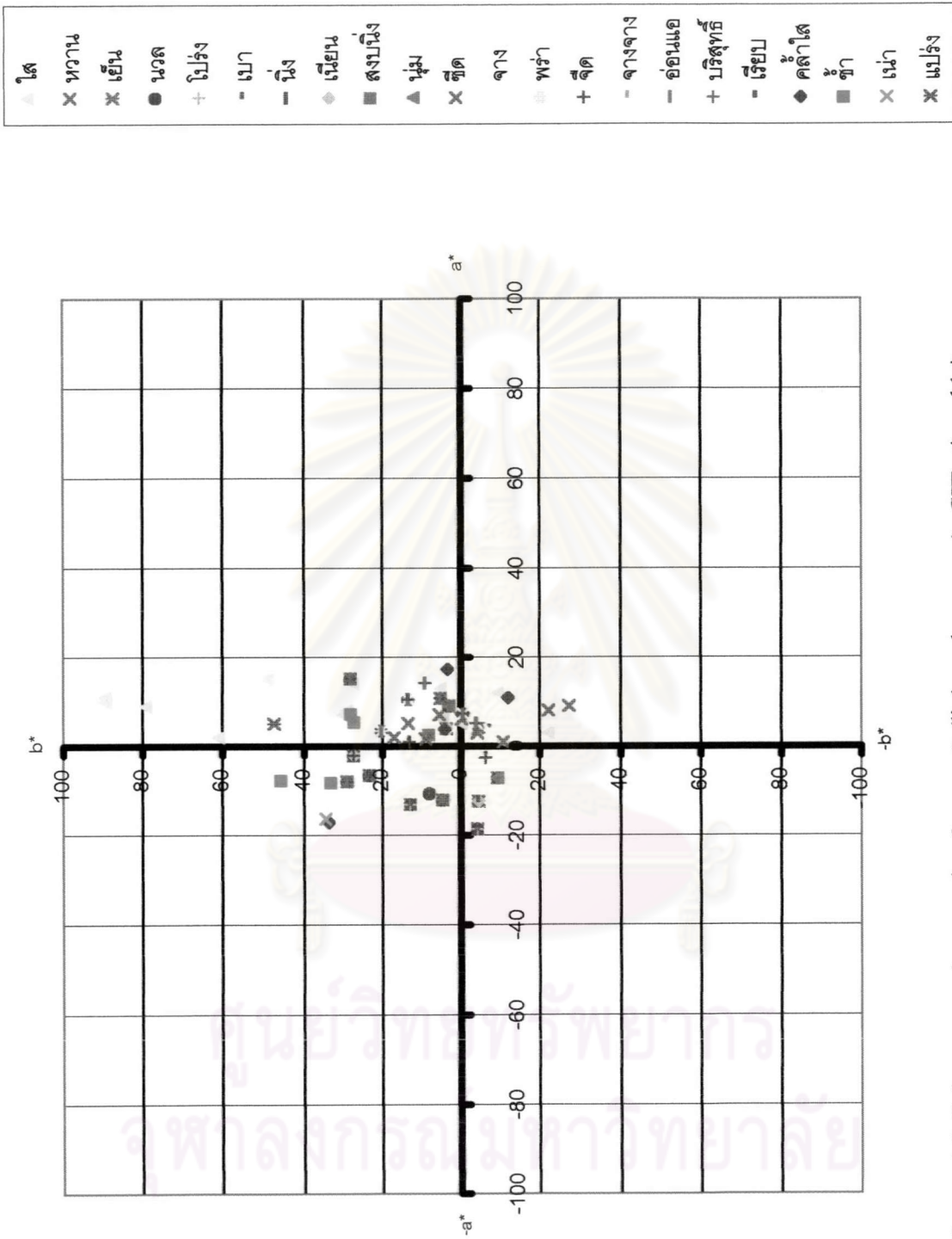


Figure 4-9 Color perception words of group 3 (light color group), CIE a* and b*

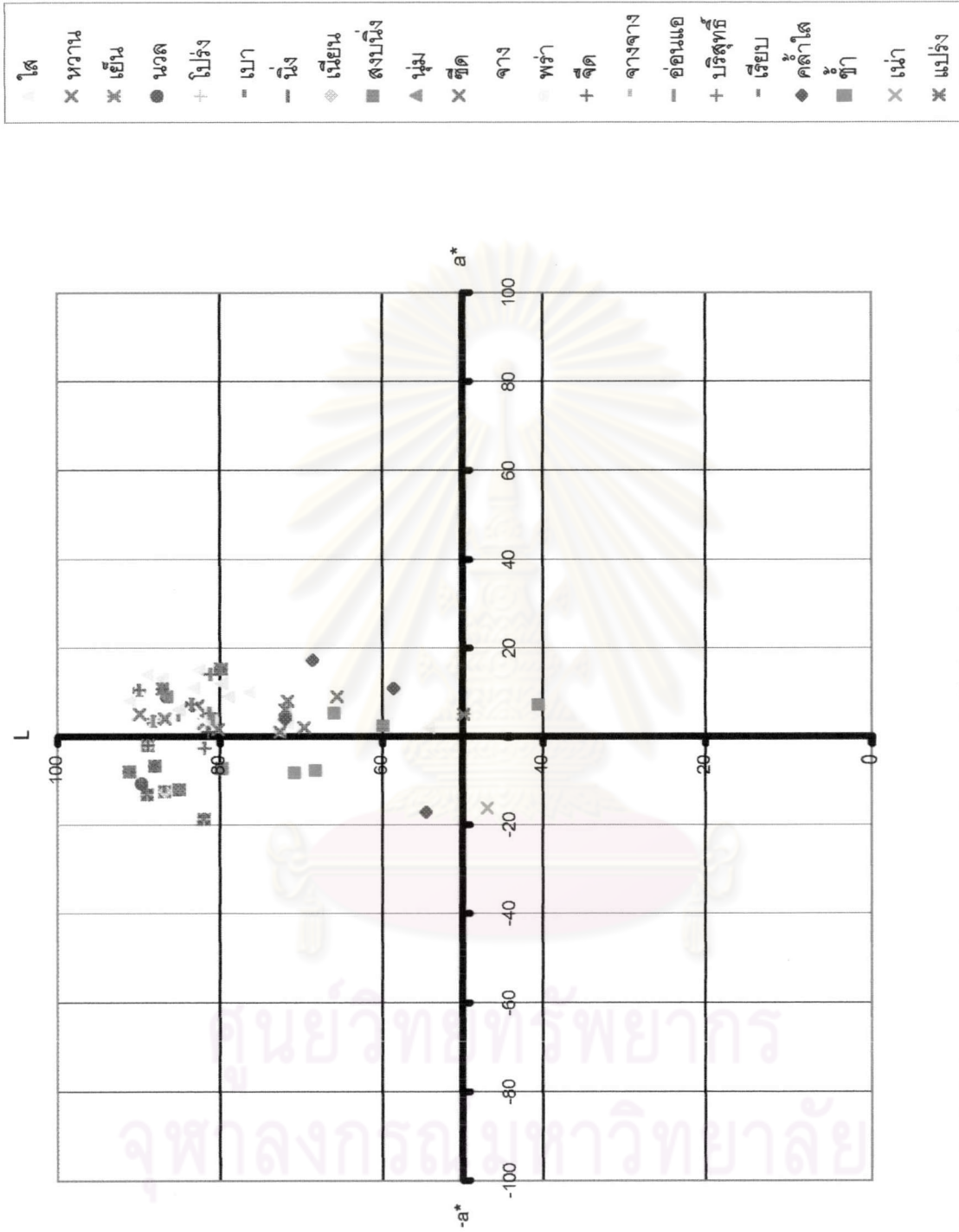


Figure 4-10 Color perception words of group 3 (light color group), CIE L* and a*

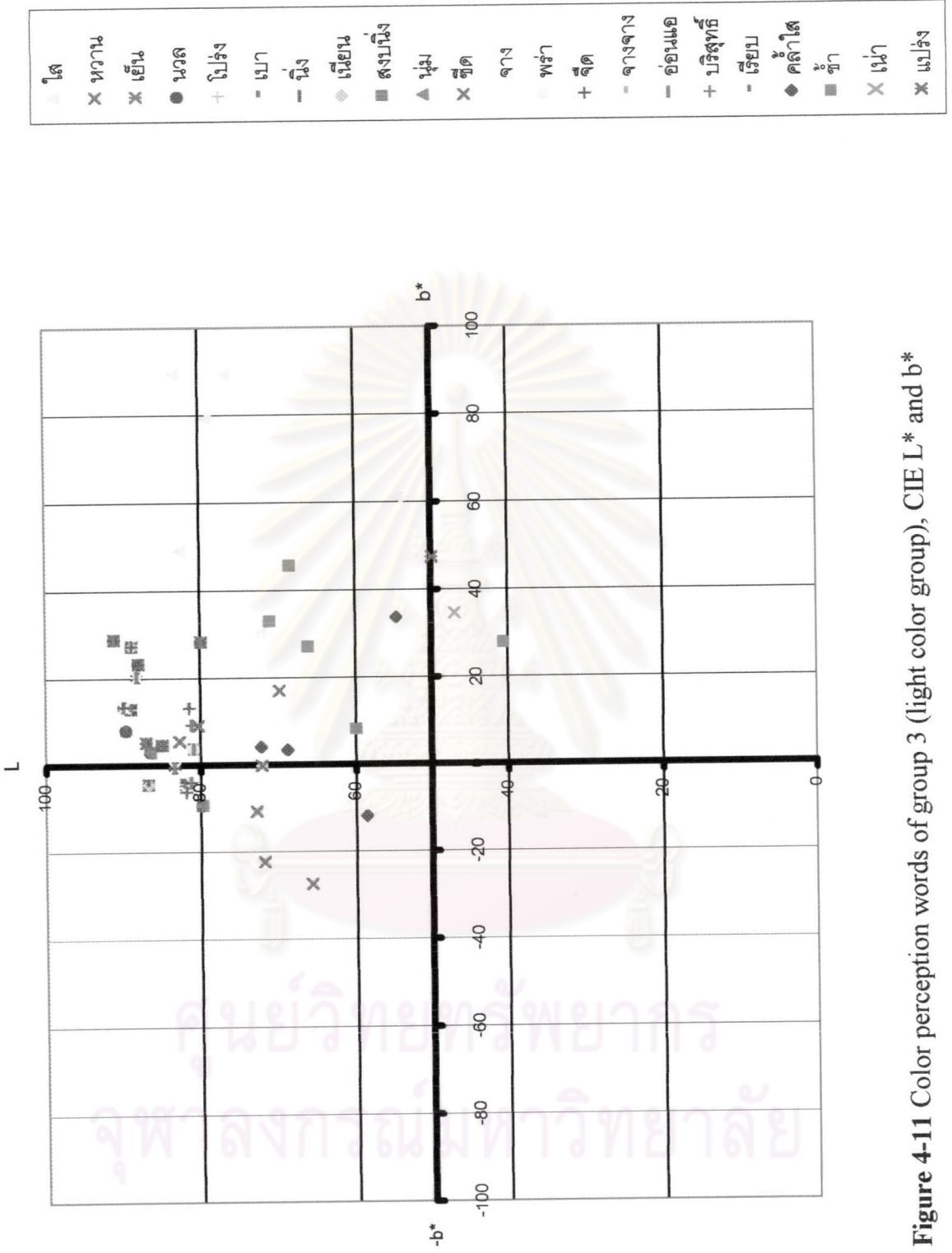


Figure 4-11 Color perception words of group 3 (light color group), CIE L* and b*

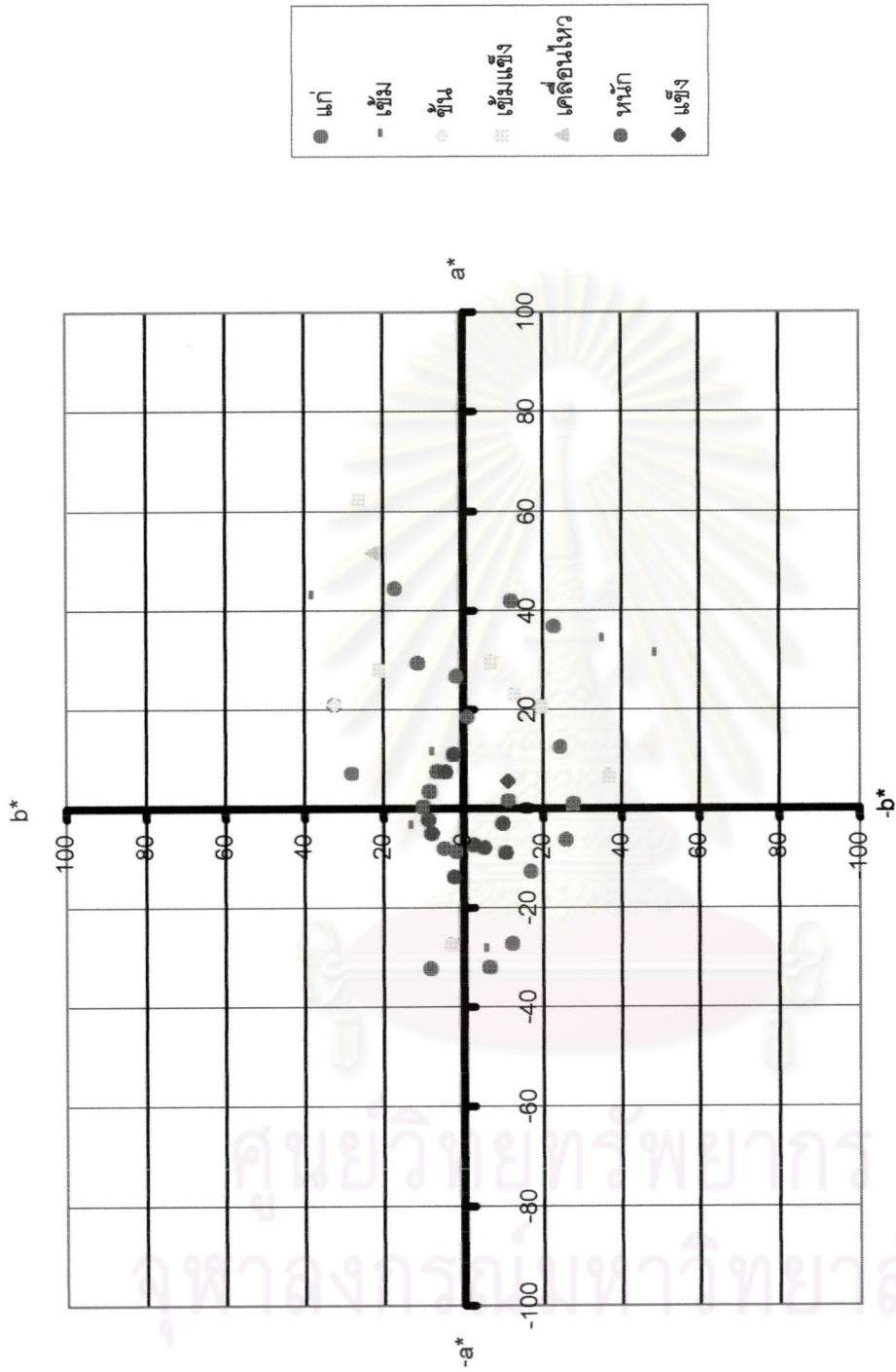


Figure 4-12 Color perception words of group 4 (heavy color group), CIE a^* and b^*

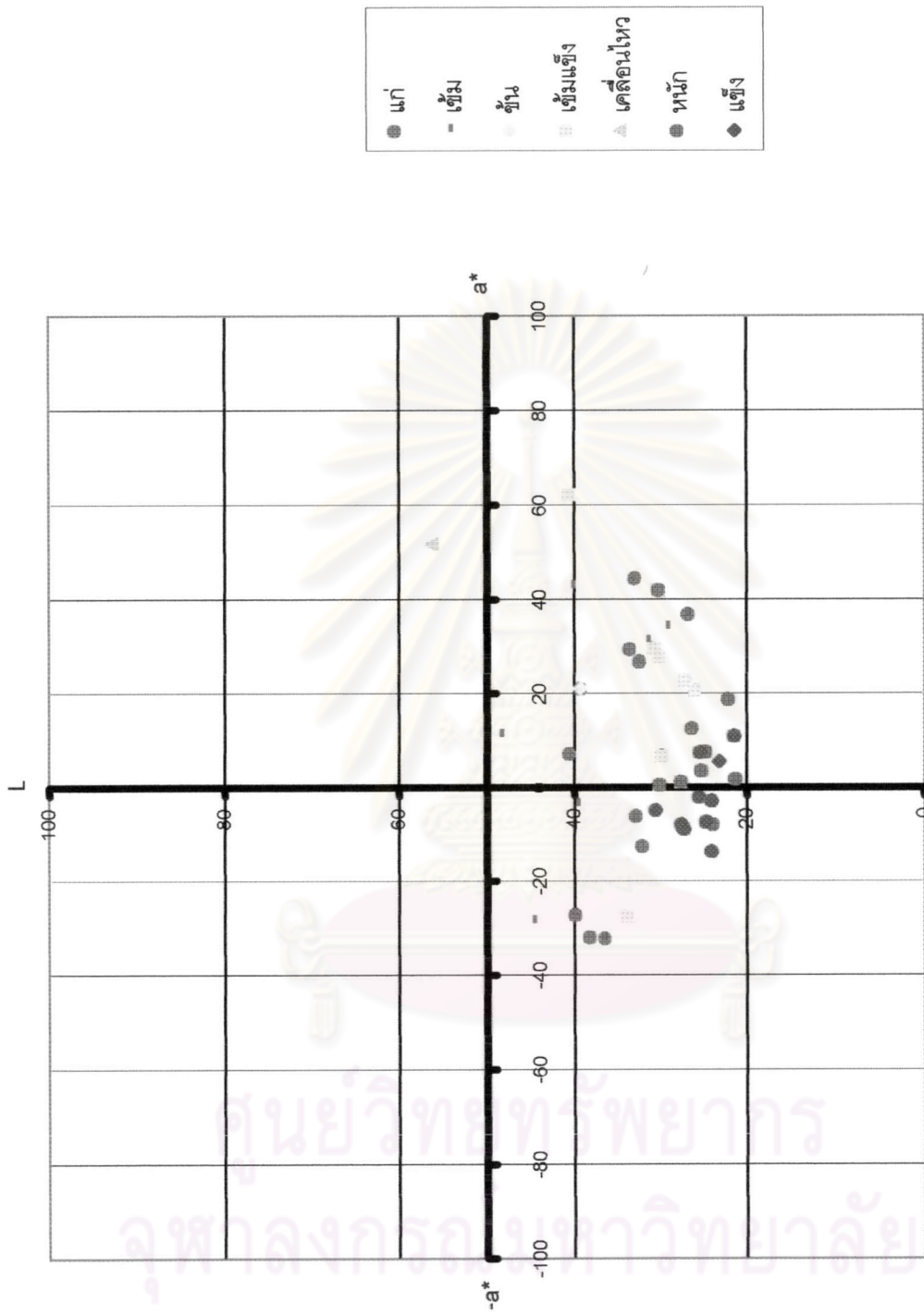


Figure 4-13 Color perception words of group 4 (heavy color group), CIE L* and a*

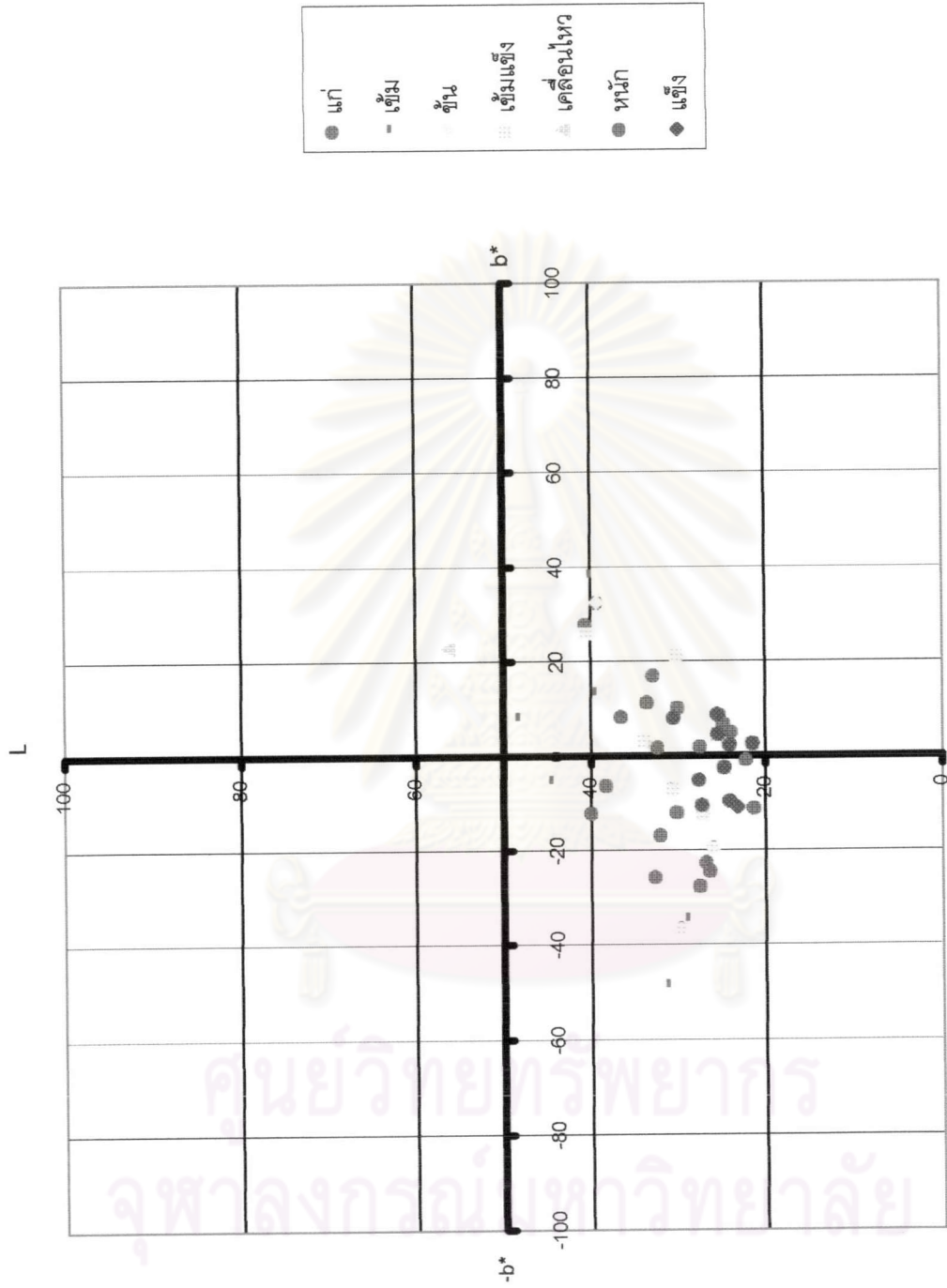


Figure 4-14 Color perception words of group 4 (heavy color group), CIE L* and a*

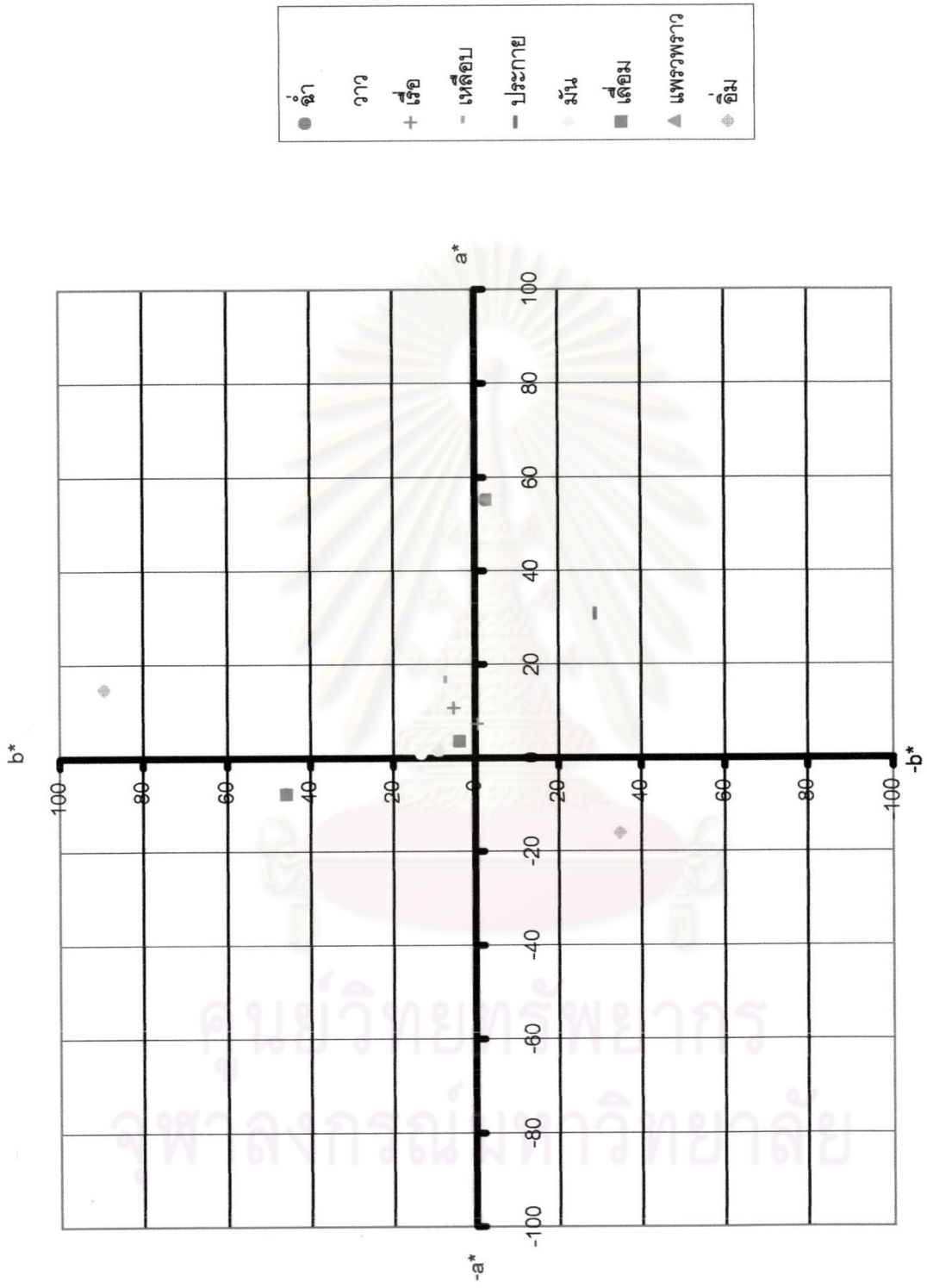


Figure 4-15 Color perception words of group 5 (glossy appearance color group), CIE a* and b*

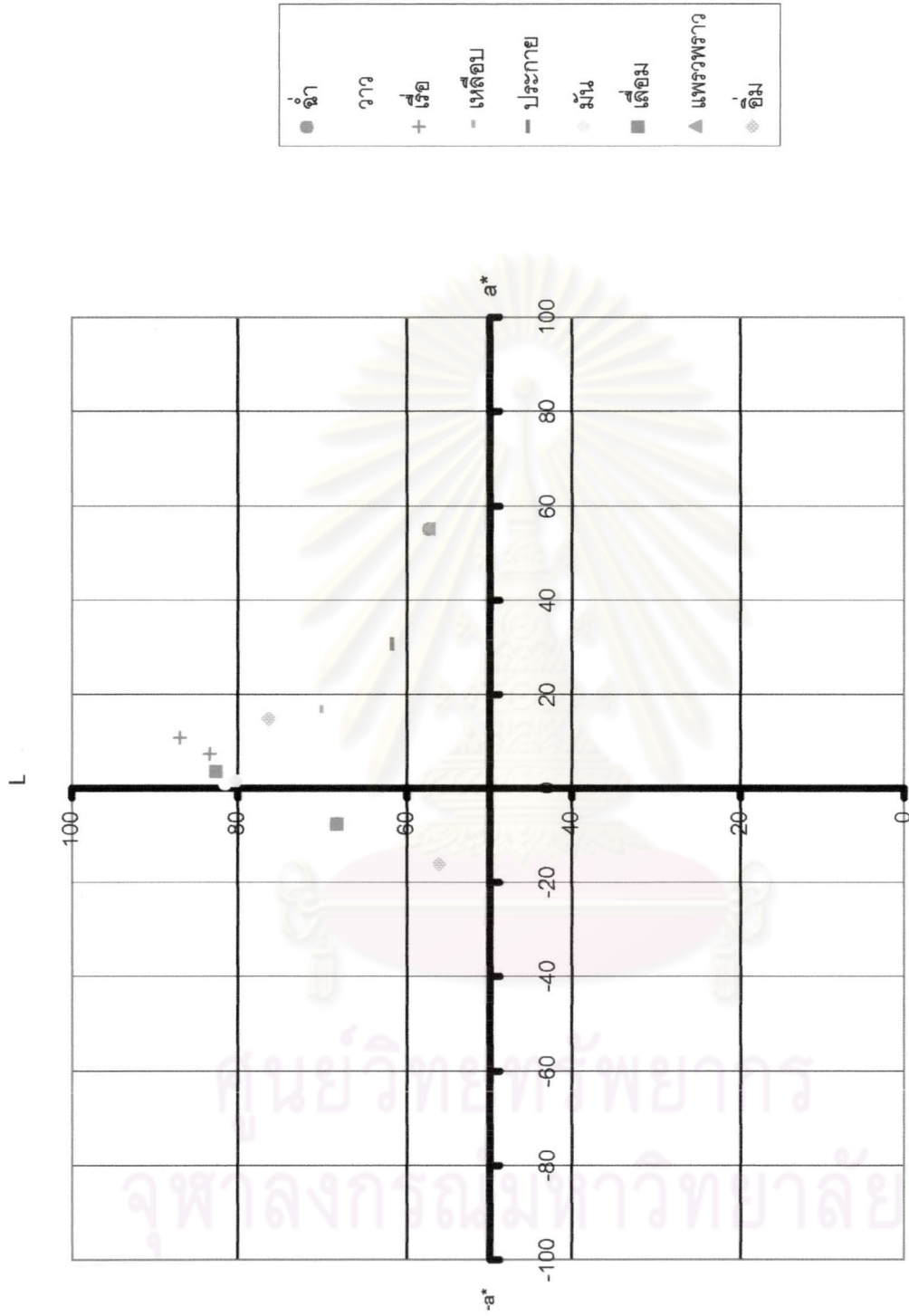


Figure 4-16 Color perception words of group 5 (glossy appearance color group), CIE L* and a*

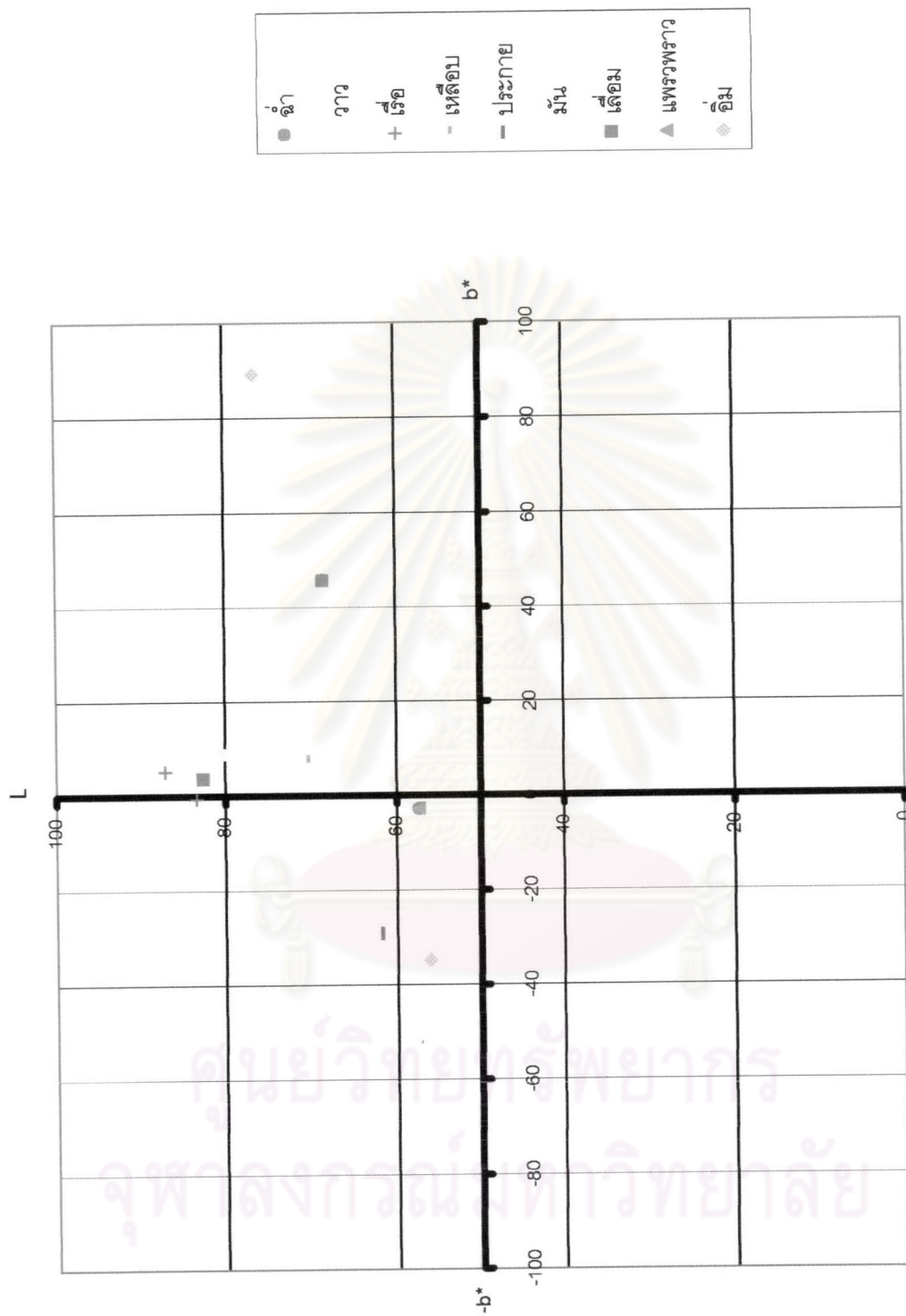


Figure 4-17 Color perception words of group 5 (glossy appearance color group), CIE L*

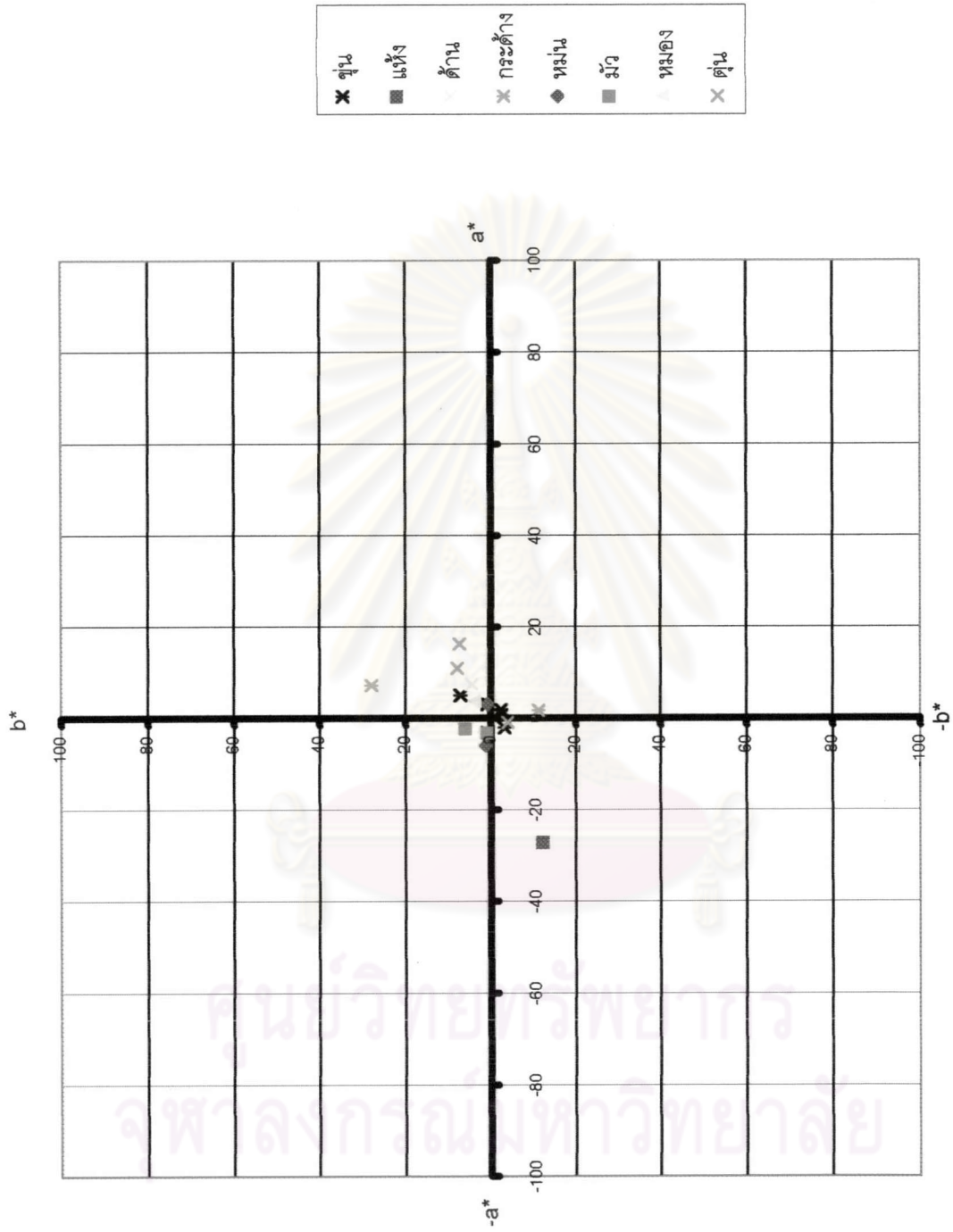


Figure 4-18 Color perception words of group 6 (non-glossy appearance color group), CIE a* and b*

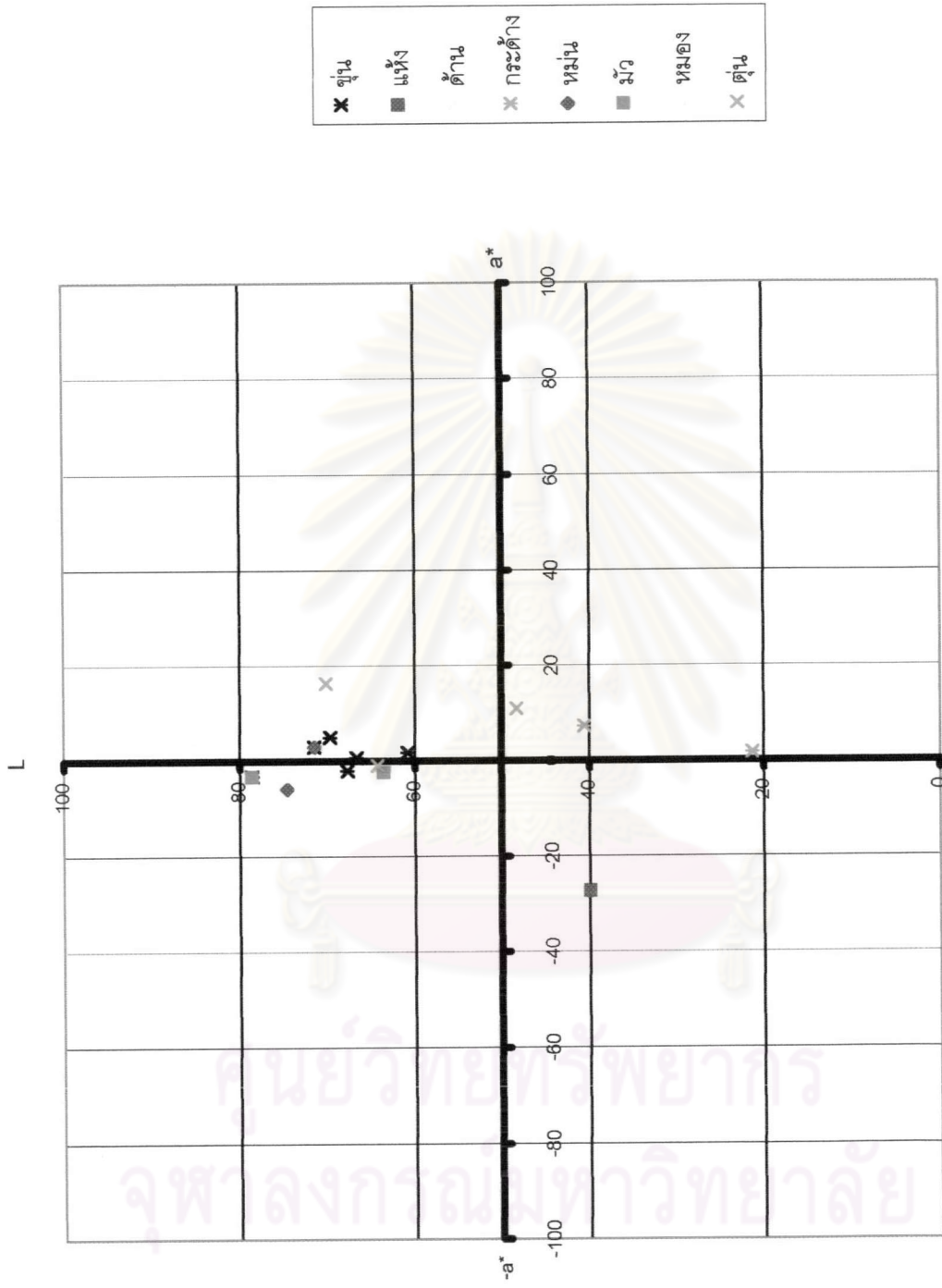


Figure 4-19 Color perception words of group 6 (non-glossy appearance color group), CIE L* and a*

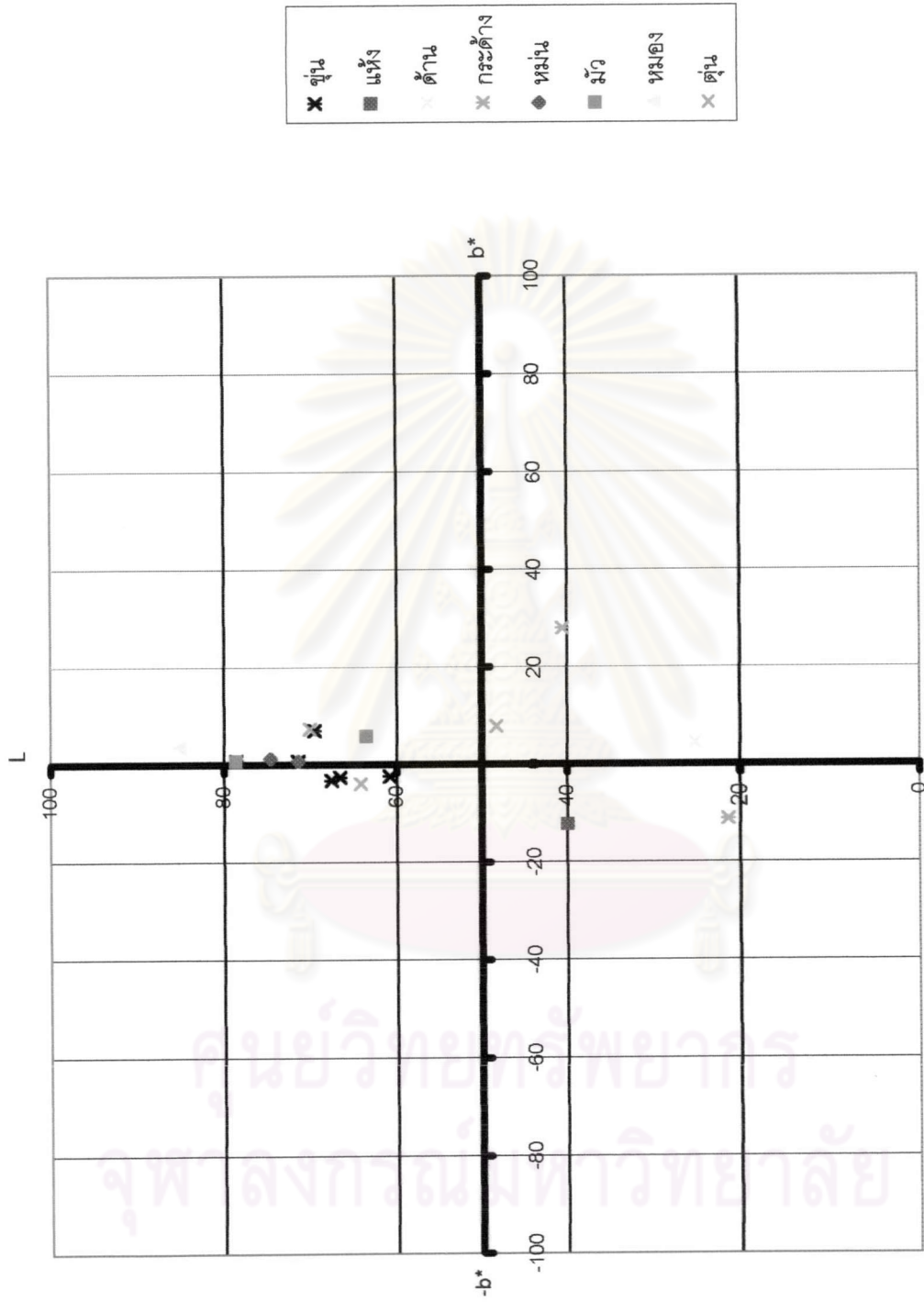


Figure 4-20 Color perception words of group 6 (non-glossy appearance color group), CIE L* and a*

◆ sawang	■ Sod	▲ Sai	✕ Ron	✕ Jad	● Kae	+ Jaem	- Khem
- Jaa	◆ Kon	■ Paed	Raend	✕ Saeb	✕ Kom Chad	● Cham	+ Jae
- Praen	- Pong	◆ Jerd Jar	■ Khem Kang	▲ Kloen Wai	✕ Chood Chad	✕ Mued	● Tube
+ Tuem	- Mon	- Mou	◆ Ka Muk Ka Mou	■ Ta Muen	▲ Kruem	✕ Mong	✕ Koon
Wow	+ Rua	- Luam	- Pra Kay	● Mann	● Luam	▲ Praew Prao	✕ Wann
✕ Yen	● Nual	+ Prong	- Bow	- Ning	◆ Nian	■ Sa Ngob Ning	▲ Num
✕ Seed	Jang	● Praa	+ Jued	- Jang Jang	- Oan Aer	◆ Oim	■ Haeng
▲ Kang	✕ Dann	✕ Kar Dang	● Nuck	+ Bo Ri Sood	- Reab	- Klam Sai	◆ Den
■ Klam	▲ Cham	Tun	✕ Nao	● Praeng			

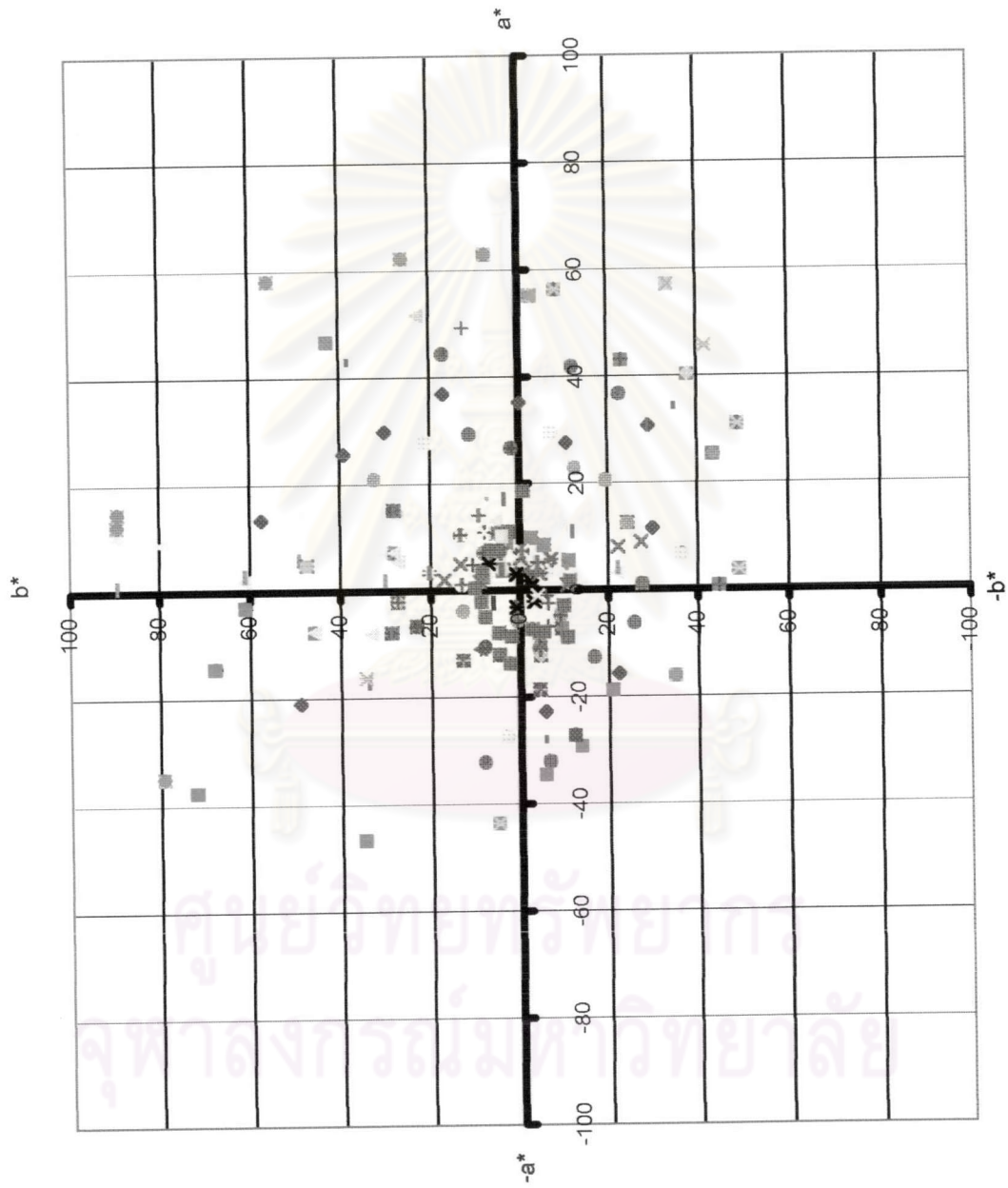


Figure 4-21 Color perception words CIE a^* and b^*

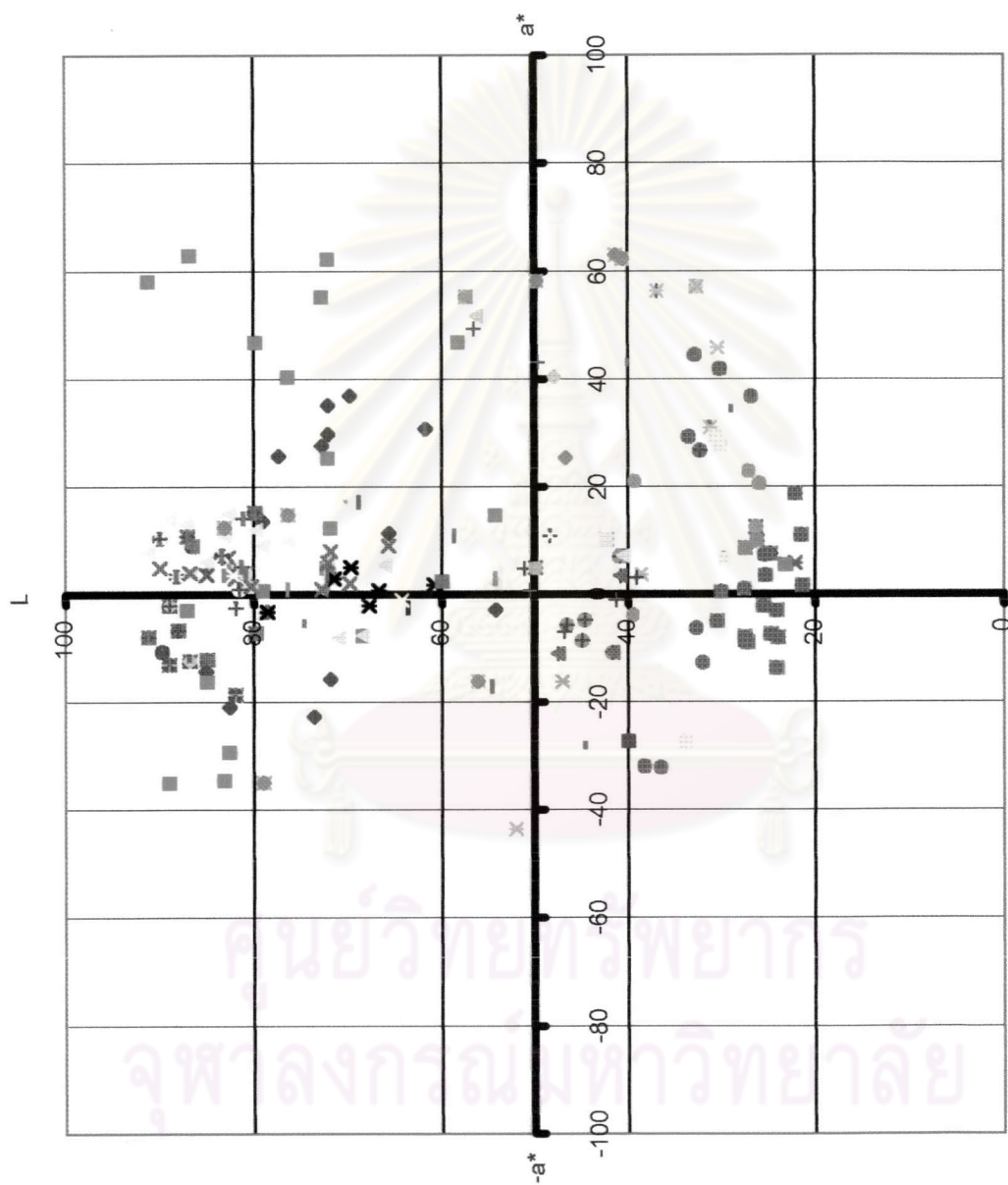


Figure 4-22 Color perception words CIE L* and a*

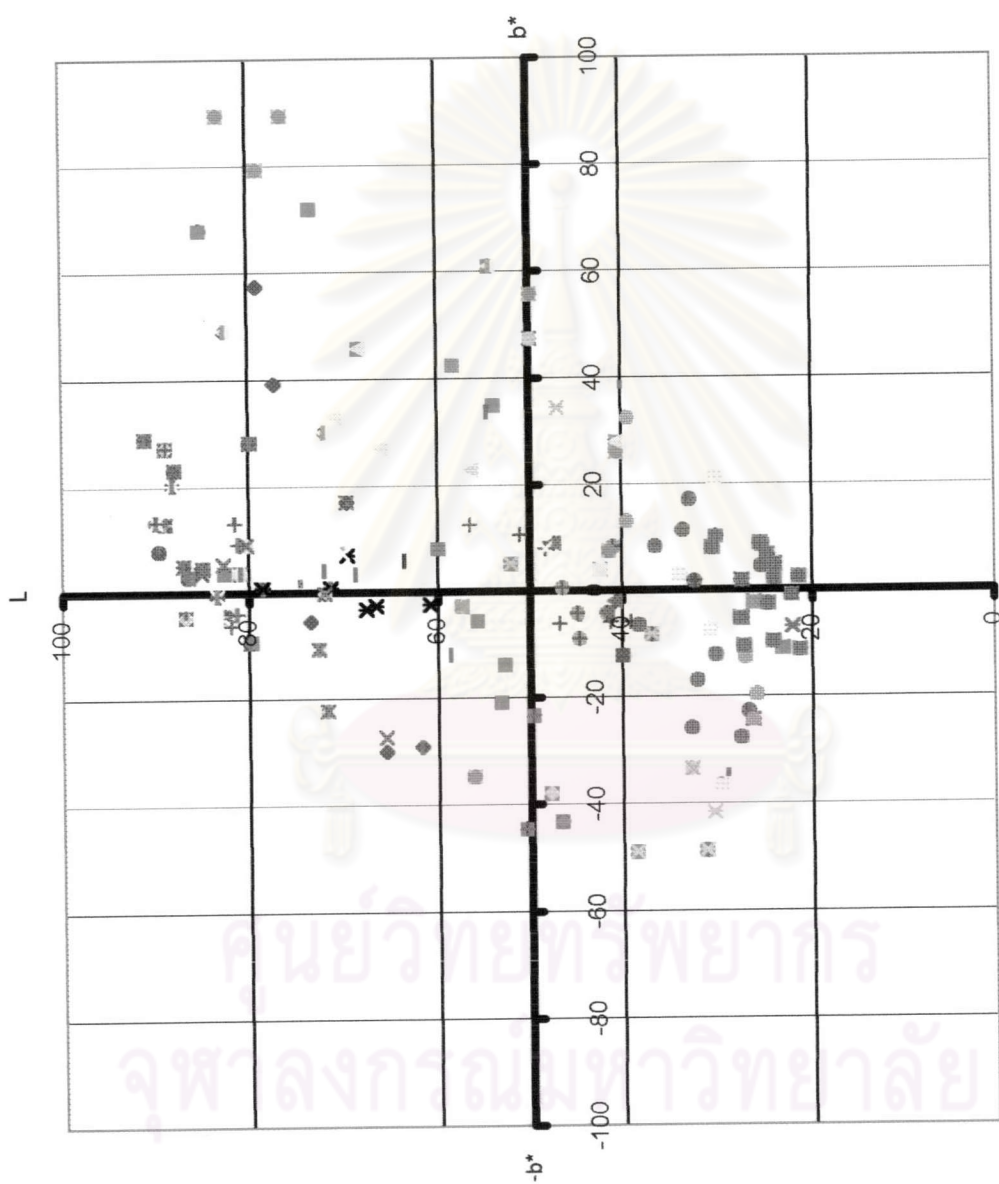
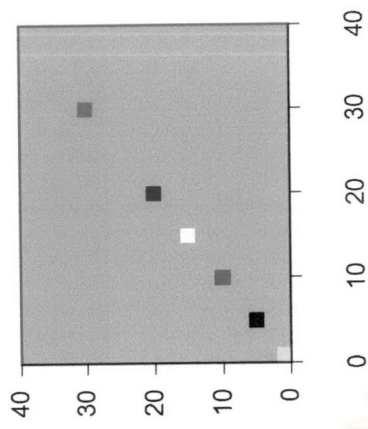


Figure 4-23 Color perception words CIE L* and b*



- Group1 (color image word for bright colors)
- Group2 (color image word for dark colors)
- Group3 (color image word for light colors)
- Group4 (color image word for heavy colors)
- Group5 (color image word for glossy colors)
- Group6 (color image word for non-glossy colors)

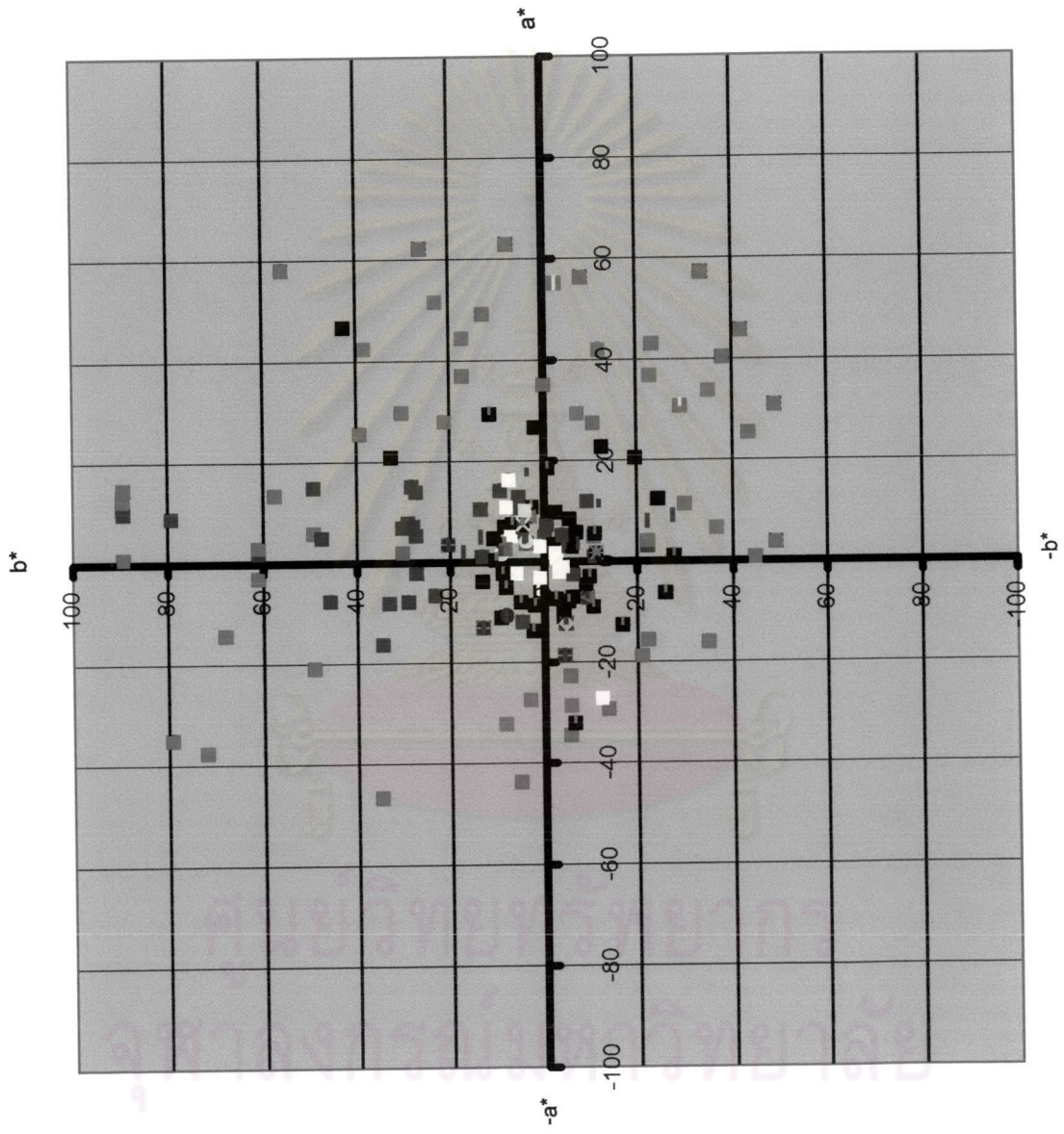


Figure 4-24 Color perception words CIE a^* and b^* (area)

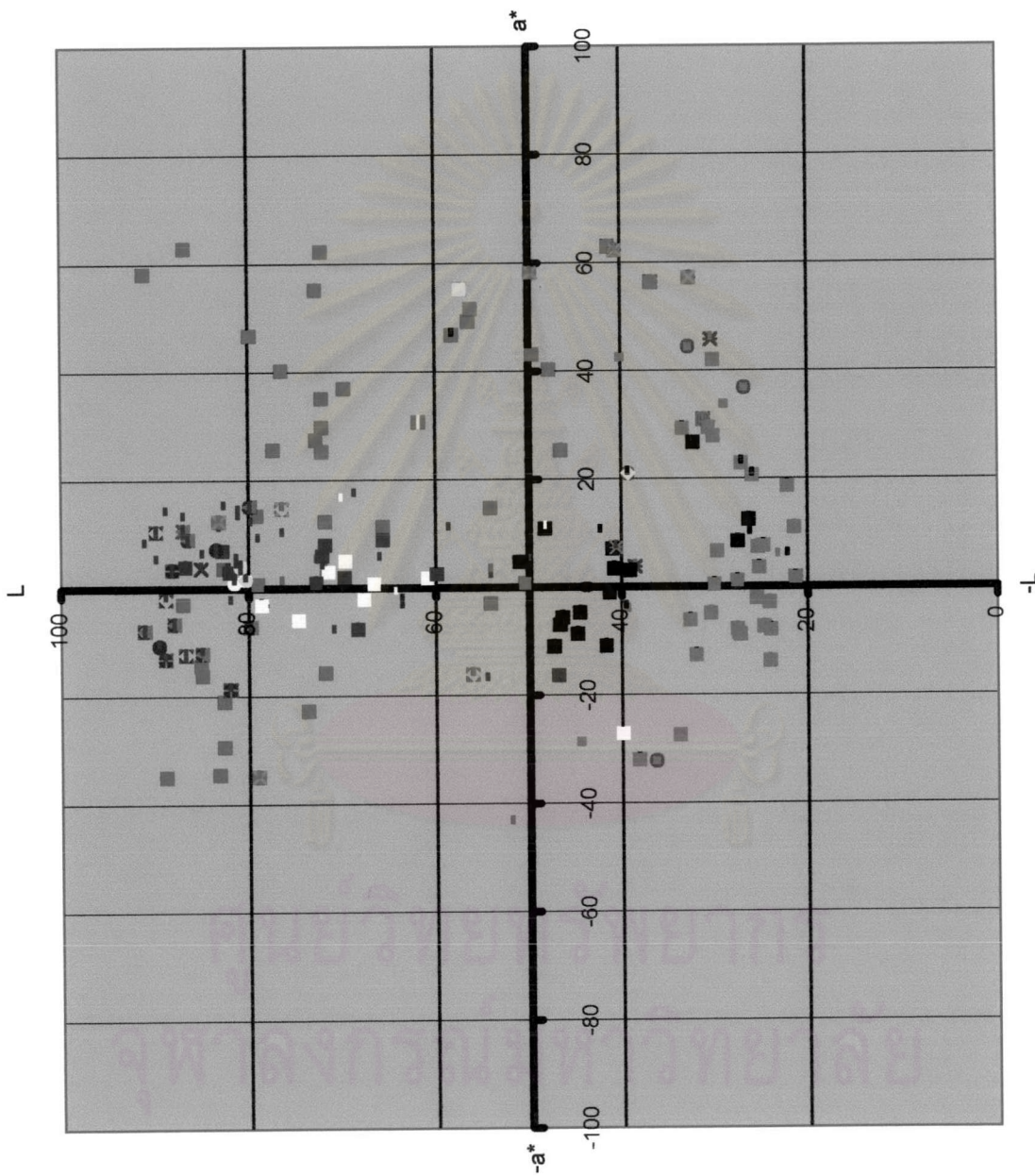


Figure 4-25 Color perception words CIE L* and a* (area)

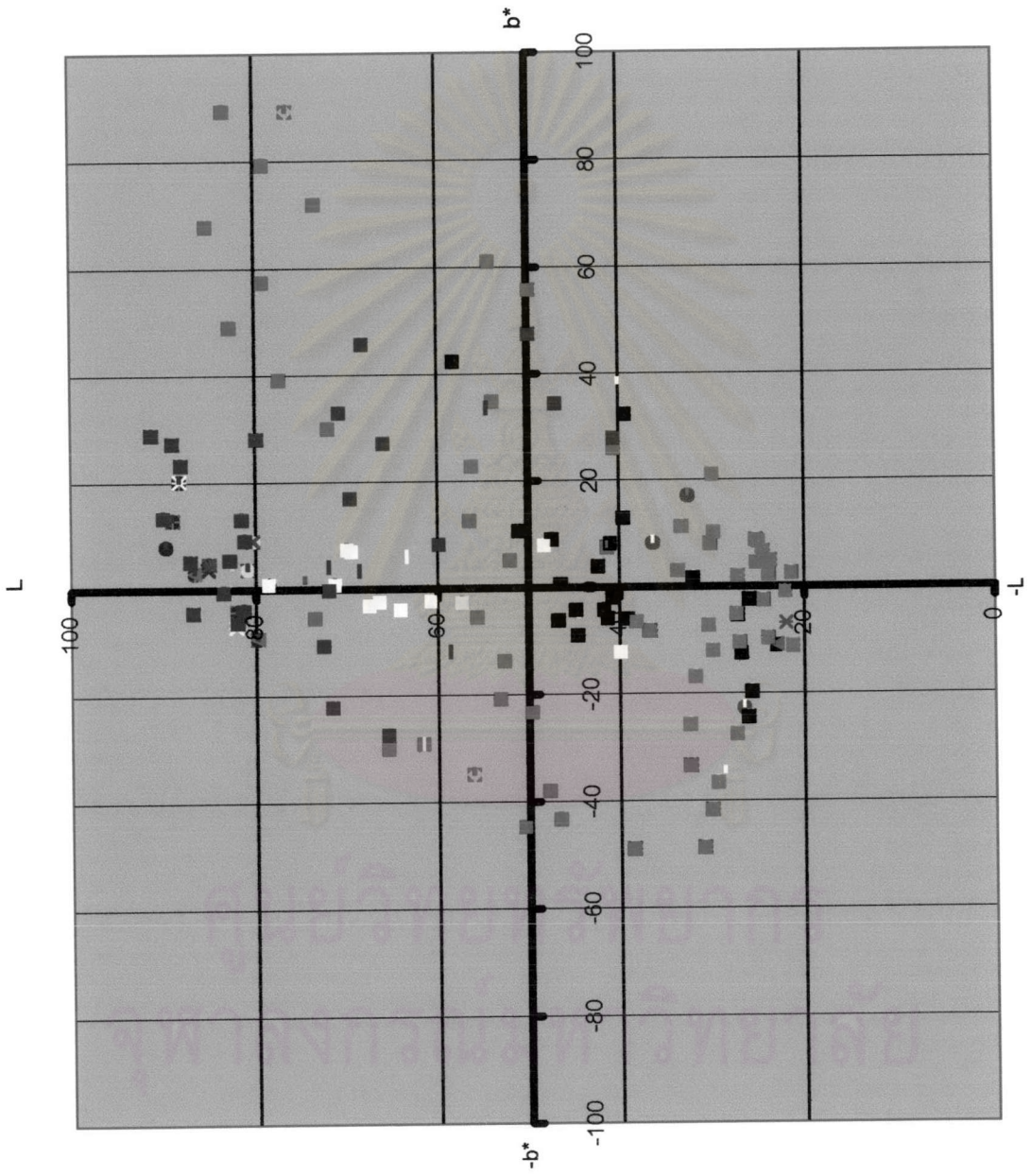


Figure 4-26 Color perception words CIE L* and b* (area)