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LIGHT CHARACTERISTICS OF PARTICLES SIZE FOR WHEAT FLOUR USING COLOR ANALYSIS

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ABSTRACTS

Grain crops consider very important, may store for long time, grow up under different conditions of fertility, soils and weather. The main goal of this research work was to classify wheat flour according to its particles size and color: Milling is the mechanical process in which wheat kernels are ground into a powder or flour, and sieving process was used to grading wheat flour according the particles size and studying its quality. A.O.A.C. method is used to determine the chemical composition of flour extracting stages as follows: a) Ash percentage; b) protein content; c) Moisture content; and d) Fiber percentages, while, Different flour samples were evaluated for color using Hunter lab color. (model D25) color according to hunter methods. The obtained results were as following: (1) The ash, protein, and fiber percentages were decreased by decreasing particles size of wheat flour. So, particles size may be led to produce different types of flour in chemical composition for specific uses; (2) The purity of wheat flour was increased by decreasing particles size of flour according to reduce ash percentages; (3) L color value of particles size of 500 µm was about 66.74 (dark color) while, particles size of <160 µm was 88.72 (white color) according to color measurements; (4) Size of total difference (ΔE) was 32.06 in particles size of 500 µm, whereas it was 11.47 in particles size; (5) The large whiteness index, the large white color. So, the particles size of <160 µm was 74.02 white color while, 500 µm of particles size is 25 dark color; (6) The hue angle degree and saturation value of flour color were decreased from 14.11 to 0.26 and from 20.71 to 10.95 for particles size of 500 and < 160 µm, respectively. So, < 160 µm particles sizes more white than 500 µm; and (7) Generally, the differences in wheat flour particles size due to different chemical composition, led to change the flour color from dark to white color, according to chemical analysis and color measurements.

INTRODUCTION

Grain crops consider the cheap food and provide a bout 33% calorie energy and protein, for the human

Fondroy *et al.* (1989) observed that as the amount of fluffy cellulose is increased the cake crumb became darker (lower L values), more yellow (higher b values), and less green (lower negative a values) compared with the control. The (a values) were only slightly affected.

Hoshino *et al.* (1994) found that the flour yield improved within creased grain size and that farinograph properties varied with different grain dimensions. The authors showed that by milling larger grains greater flour yield was achieved, although better quality of flour was obtained by milling smaller grains.

Abd El-Kader (1995) mentioned that, there are about 100 types of bread baked today in Egypt. Bread consumption is very high in Egypt, North Africa, West Africa, and south Africa. Wheat is the most important cereal crop in terms of both area cultivated (232 million ha) and the amount of grain produced (595 million t).

Heyland and Werner (1995) mentioned that the purpose of the milling process is to break up the grains of wheat into flour (which comes from the centre of the grain, or endosperm), bran (the skin of the wheat), and pollard (the dusty 14 material created during the grinding process). The aim of the miller is to extract the maximum proportion of flour from the grain with the least possible contamination by bran, pollard and germ, the first two because they discolor the flour, and the last because it reduces the keeping quality.

Schuler *et.al.* (1995) reported that, there is a positive correlation between flour yield and grain width, but a negative one between flour yield and grain length. The smallest flour yield was obtained from cultivar at arka variety (67.6%), which was characterized by the shortest (5.81mm) grain length. These results also pointed out that specific grain dimension of wheat cultivars might have a significant influence on flour yield.

Hazen and Ward (1997) pointed out that wheat milling and baking quality is a function of the physical and chemical traits of grain and flour. Also, these properties were very important in the process of wheat milling.

They are using three methods of image analysis were investigated: morphological opening, constant grey level run lengths and grey level spatial inter dependences to squired images of particle size of milling products. (Novales *et al.* , 1998)

Michael (1999) showed that the first flour streams separated out in the breaking process contain the least bran and germ; they are more “refined.” These are sold as patent flours. Within this class are further grades ranging in refinement (or absence of bran and germ) from fancy to short to medium to long. Subsequent streams of refined middling produce flours known as clear flours. These also have grades from fancy clear to first clear to second clear. Lower grades of flour are usually quite dark and are most frequently used in combination with other flours, particularly in rye bread baking

Takahashi K., and K. Abe (1999) show that the correct differences between colors can be obtained using lab color space . this system expresses the value of a color using L,a,b color space.

During a day, the light color temperature changes from 2000 k during mid day from reddish dawn to bright white noon. Through the human ability for color constancy is a high level phenomenon that sometimes even depends on an understanding of the visual scene (Kelber et al., 2002)

Reberts (2002) said that the human vision system solves the color problem by transforming the initial RGB – like representation into a more useful from the separates out lightness from hue and saturation. Color is coded in two dimensions ranging from green to red, and yellow to blue, while lightness is coded in a separate channel

Hal (2004) mentioned whiteness is a color index by which a samples whiteness is measured and expressed as a single numeric value. Observer ratings of whiteness correspond to consumer preferences for products such as sugar, rice and flour.

Hunter (2005) mentioned that the instrumental method of evaluating flour color, depend on reflectometer using transmission filter which produced a color grad value.

Ministry of Agricultural and Land Reclamation (2005) reported that the total cultivated area of wheat crops in Egypt is about 3 million feddans, producing about 7 million tons, making the country, still un-self sufficient in wheat grains but it is importing about 50% of the total requirements. The total of wheat cultivated about 36% of total area of grains crops. Productivity about 2.5 tons per feddan but it is still import about 5 million tones wheat per year.

The purpose of this study was intended to cover the following main points:

1- Determine the flour color at different particles size of flour,
2- Estimate the protein, ash, and fiber percentages for each stage of extraction,
3- Flour quality according to particles size and its color, and
4- Some color parameters affecting on flour color.

MATERIALS AND METHODS

Experiments of chemical composition analysis of different particles size of wheat flour were carried out in Cookies Department, Food and Technology Institute. While, the color measurements of same samples of wheat flour were executed in Agricultural Engineering Research Institute, Agricultural Research Center, on August, 2007.

Hunter lab color, Different flour samples were evaluated for color using Hunter lab color. (model D25) color according to hunter methods and color scales shown in Figs. 1 and 2. (Abd EL-Kader, 1995). The Hunter color values of produced flours samples from milled wheat grains were measured based on three parameters, the L, a, and b types of scales simulate as:

1) L(Lightness) : is the ranging from 0 for black (darker) color to 100 for white (lightness) color;
2) a (red-green) : is the ranging from (–a) for greens to (+a) for redness, and
3) b (blue-yellow) is the ranging from (– b) for blueness to (+b) for yellowness.

Whiteness index (WIE), whiteness is a color index, which a sample is judged to approach the preferred white. A single number (WIE) is used as a measurement of whiteness according to (Hal, 1996). The WIE can be calculated using equation (1)

$$\mathbf{WIE = L + B} \text{ -------------------------------- } \mathbf{(1)}$$

Where : WIE : is whiteness color index; value

L : is a lightness axis; value and

B : is a yellow – blue axis, value.

Size of the total color difference (ΔE), size of the total color difference (ΔE) is consider the larger value, the larger the color differences. L, a, and b color difference can be expressed a single value according to Hal, (1996). It can be determined from the following equation (2).

$$\Delta E = (\Delta L^2 + \Delta a^2 + \Delta b^2)^{1/2} \text{ ----------- } (2)$$

Where : Δ E : is size of the total color differences, value

Δ L, Δ a, and Δ b are values color difference between sample – standard.

Hue degree (φ), hue angle may be defined as the angle between the hypotenuse and 0º on the a (blue-green/red-yellow) axis, however, positive value use in the first and third and negative values in the second and fourth the quadrants, according to Balkenius *et al.* (2003). Hue angle, can be computed from the following equation (3)

$$\varphi = \arctan (a/b) \quad \text{------------------------------} \quad (3)$$

where: φ : is the hue angle, degree
a: is the (red – green) axis, value and
b : is the (yellow – blue) axis, value.

Fig. (1) : HunterLab device using L, a, b color scale to measure color.

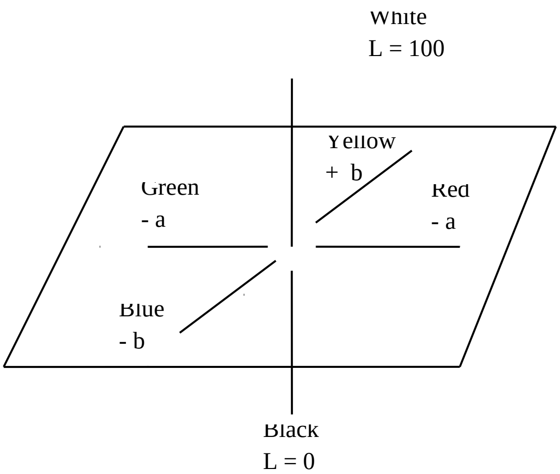

Fig. (2) : Diagram of L, a, b color scale.

Saturation (σ), saturation was referred to color saturation or intensity according to Balkenius *et al.* (2003). This can be calculated from the following equation (4) and represents the hypotenuse of a right triangle created by joining points (0,0), (a, b), and (a,0).

$$\sigma = (a^2 + b^2)^{1/2} \text{ ------------------------------ } (4)$$

Where : σ : is the saturation, value.
a: is the (red – green) axis, value and
b : is the (yellow – blue) axis, value

Grinder (miller) grains, milling process is considered very important to high quality and increase use efficiency of wheat crop. The wheat should produce a high yield of flour with maximum and clean separation from the bran and germ without excessive consumption of power. Specifications of miller were as follows: 1) Balts: three, 2) Speed: 2840 rpm, 3) Power: 1100 Watt (1.1 kW), and Manufacture: Germany.

Sample grains, wheat grains consider food grain crops important which Egyptian people food depend on it. Wheat variety Giza 168 was used in milling process. Prior to milling the wheat is mainly cleaned of impurities by screening to remove different type of impurities.

Physical properties of grain, grain sizes were determined by measuring the major axis as length (L), width (W) and thickness (T) for each grain in the sample by using the digital caliber. The data were measured to determine shape and size of wheat grains (variety Giza 168). Some Physical and mechanical properties of wheat grains were listed in Table (1).

Table (1): Some physical and mechanical properties of wheat grains.

Measurment	Range	Average
Length, mm	5.38 – 6.36	5.87
Width, mm	2.82 – 4.20	3.51
Thickness, mm	2.31 – 2.98	2.65
Weight, gm	0.17 – 0.27	0.22
Moisture content, %	14.0 – 14.4	14.2
Hardiness, N	50.5 – 56.8	53.65
Bulk density, gm/mm3	0.0048 – 0.0034	0.0041

Tempering process, conditioned, a process whereby moisture is added or subtracted as necessary to ensure uniformity in the grain, and to prepare it for the separation of the endosperm from the bran layers. Method of tempering was depended on add water to wheat grain for 18 hrs, according to the following equation:

$$D1\ W1 = D2\ W2 \text{ ------------------------- } (5)$$

$$X = W2 - W1 \text{ ----------------------------- } (6)$$

Where : D1 = 100 – M1 (M1 : Moisture content before tempering, wb %);
D2 = 100 – M2 (M2 : Moisture content after tempering, wb %);
W1 = weight of grains before tempering, gm;
W2 = weight of grains after tempering, gm; and
X = weight of absorbed water, gm.

Chemical composition, chemical composition analysis of flour due to high quality of flours, the ash test fundamentally indicates the purity of the flour. In production of bread flours, the reduction in protein content from wheat to flour should be minimum (not above 1%). Bread making quality of a flour depends on the quality and quantity of the flour proteins. A.O.A.C. (1989) is used for chemical composition analyzing of flour particle at different stages of extraction as follows: a) Ash percentage; b) Protein content; c) Moisture content; and d) Fiber percentage.

Sieving process, the sieve consists of a lightly stretched bolting silk or grits gauze, which be comes progressively coarser from the head to the tail end of the purifier.

The process results in separation of three classes of materials:

1-Coarse fragments, which are fed the next break until only bran remains,

2-Flour, fine particles, which pass through the finest (flour) sieve, and

3-Intermediate particles of granular, which are called middling.

Specifications of sieves were as follows: 1) Model: D-5657 HAAN, 2) Manufacture: Germany, 3) Sieves: 500, 450, 400, 355, 200 and 160 µm, and 4) Power is; 220 – 240 V.

Instruments of measurements:

Moisture content meter of grain, it has the following specifications: 1) The moisture tester model is SP – 1D, 2) Manufactured by Japan, 3) Accuracy is ∓ 0.5 %, 4) The power is 220 V , and 5) The ambient working temperature from 0 to 40 °C.

Digital balance, source of manufacture: Germany; Model: SBA 51; and Accuracy 0.01g. It was used to determine the weight of individual grains.

Digital vernier caliper, it has an accuracy of 0.01 mm. It was used to measure the dimensions of individual grains.

Grain hardness test, hardness of the wheat kernels was tested using hardness tester (model 174886 kiya seisakusho LTD). The hardness value of each sample was recorded in kilogram and calculated in Newten.

RESULTS AND DISCUSSION

Effect of particles size of flour on chemical composition analysis:

Table (2) and Fig. (3) showed that chemical composition analysis for different particles size of flour. The data revealed that particles size of flour was decreased from 500 to 160 µm through sieving process of wheat flour, the ash, protein, and fiber percentages were decreased (from 4.08 to 1.22 %), from (8.24 to 5.47 %), and (from 8.59 to 0.149%), respectively. These results were indicated that it possible to obtain different type of flour according to its chemical composition through sieving process, which can be used to produce different production of cookies.

They also showed that, the purity of flour was increased by decreased particles size of flour from 500 µm to <160 µm because of ash percentage was decreased from 4.08 to 1.22 %. While, increasing both of ash and protein percentages were due to decreasing of flour purity. Therefore, food value of flour was high, then this flour become less valuable to make bread.

As well as, the ash and protein percentages were increased through sieving flour in 500 µm. While, at the sieve < 60 µm has fine particles of flour which, including less percentages of ash and protein. Controlled particle size and chemical composition were production of special flours for specific uses. The fig.1 showed that the correlation factors high (ranged from 0.84 to 0.92) between chemical composition and particles size of flour.

Fig. (3): Chemical composition analysis for different flour particles size.

Table (2): Chemical composition analysis of flour particles size under sieving process

Flour particles size, μ m	Chemical composition of flour		
	Ash , %	Protein, %	Fiber, %
500	4.08	8.32	8.599
450	2.89	8.27	6.270
400	2.24	8.24	5.940
355	1.59	7.67	3.970
200	1.36	6.56	0.470
160	1.25	6.51	0.197
< 160	1.22	5.47	0.149

Relationship between particles size of flour and color analysis:

Table (3) and Fig. (4) indicated that the color of flour at different particles size of wheat flours. They showed that, when the particles sizes of flour were decreased from 500 to >160 μm , the ash percent was decreased from 4.08 to 1.22 % . that mean the color of flour became more white according to the light measurements which pointed to the lightness (L) values that increased from 66.74 to 88.72 by decreasing particles size of flours and its ash percent.

Table (3): Color analysis of flour particles size under sieving process

Flour particles, μ m	Color Analysis						
	L	A	B	Δ E	σ	WIE	H
500	66.74	5.05	20.08	32.06	20.71	25.08	14.12
450	68.12	3.46	18.69	29.85	19.01	29.53	10.49
400	72.71	2.74	18.48	26.18	18.68	36.38	8.43
355	75.91	2.15	17.76	23.38	17.89	42.48	6.90
200	82.60	0.73	16.17	18.02	16.19	56.72	2.58
160	83.15	0.21	14.49	16.20	14.49	61.17	0.83
< 160	88.72	0.05	10.95	11.47	10.95	74.02	0.26

This result indicated that, the flour color become whiter while, increasing ash percentage in flour make the color of flour more dark. Table (3) also revealed that the (b) values were decreased from 20.08 to 10.95, revealed due to increase blue color, nearly white color.

It showed that, the decreased particles size of flour from 500 to < 160 μm, the protein and fiber percentages were decreased from 8.32 to 5.47% and from 8.59 to 0.149%, respectively. This result were supported with color measurements because of (b) values were positive and decreased from 20.08 to 10.95 which decrease yellow color of samples by decreasing protein and fiber percentages.

Therefore, the obtained results indicated that by decreasing particles size of color sieving stages the flour color is changed. At 500 μm particle size of flour, the flour color became more dark color, due to increase ash, protein and fiber percentages. That means lower flour degree and purity of flour. While, at 160 μm particles size of flour gave flour color more white, due to decrease ash, protein and fiber percentages. That means higher flour degree and purity of flour. So, sieving particles size of flour gave different chemical composition of flour which can be used in different cookies during industrial process.

Fig. (4) showed the correlation coefficient of determination which ranged from 0.89 to 0.97 for different particles size of wheat flours.

Fig. (4): Color analysis versus flour particles size.

Relationship between particles size of flour and whiteness index (WIE):

Fig. (5) showed the relationship between particles size of flour and whiteness index (WIE). As the particles size of flour were decreased from 500 to < 160 µm, the whiteness index was increased from 25 to 74.02 which led to increase white color and this results were supported by decreasing protein, and fiber percentages.

So, whiteness index (WIE) was considered pointer to color of flour at 500 µm particles size of flour when the whiteness index was 25 while it was 74.02 at <160 particles size of flour. That mean <160 µm particles size of flour provided more white color than 500 µm particles size of flour due to large number of whiteness index.

Effect size of total color difference (Δ E) on flour color:

The data illustrated in Fig. (5) and table (3) indicated that the decreasing size of total color difference (Δ E) from 32.06 to 11.47, due to decrease the particles size from 500 to < 160 µm which, led to increase whiter color. That mean by decreasing the color difference led to more white (lighter) color while, by increasing color difference more dark color occurred. Therefore, particles size of flour (< 160 µm) were more light (white) than (500 µm) of particles size.

Effect of hue angle of color on flour color:

Fig. (5) and Table (3) showed that the hue angle of color was decreased from 14.11 to 0.26 degree by decreasing particles size of flour from 500 to < 160 µm. These results led to change flour color from dark to light color. That mean by decreasing hue angle of color, the white color of flour was increased. Because of all hue angles degree are positive , it will be the first quadrants. That means the ranging flour color occurred between yellow to white color.

Effect of saturation color on flour color:

Fig. (5) and Table (3) indicated that the value of saturation color was decreased from 20.71 to 10.95 by decreasing particles size of flour. So, the flour color was changed from dark color to light color. That mean by decreasing value of saturation color, the flour color became lighter (white color). Therefore, the saturation value of 20.71 (dark color) occurred with particles size of 500 µm while, it was 10.95 saturation value (more white color) with particles size of < 160 µm.

Fig. (5) also showed that, the correlation coefficient of determination between size of total color difference and particles size of flour was high and ranged from 0.92 to 0.98.

Fig. (5): Size of color difference against particles size.

CONCLUSIONS

The obtained results can be concluded in the following points:-

1- The ash, protein, and fiber percentages were decreased by decreasing particles size of wheat flour,. So, particles size control led to produce different types of flours in chemical composition led to specific uses.

2- The purity of wheat flour was increased by decreasing particles size of flour due to reduce ash percentages.

3- L color value for particles size of 500 μm was 66.74 (dark color) while, it was 88.72 (white color) for particles size of <160 μm according to color measurements.

4- Size of total difference (ΔE) was high difference 32.06 for particles size of 500 μm, while it was 11.47 less difference for particles size of > 160 μm.

5- The large whiteness index, the large white color. So, the particles size of <160 μm has a large number (74.02) of white color while, particles size 500 μm of has a low (25) of dark color.

6- The hue angle degree and saturation value of flour color were decreased from 14.11 to 0.26 and (from 20.71 to 10.95), respectively for particles size of wheat flour of 500 and <160 μm. So, particles sizs of < 160 μm more white than 500 μm.

7- Generally. The differences in wheat flour particles size due to different of chemical composition, led to the change flour color from dark to white color, according to chemical analysis and color measurements.

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الخصائص الضوئية لحبيبات حجم دقيق القمح باستخدام تحليل اللونى

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تهدف هذه الدراسة الى استخدام التحليل اللونى والكيميائى لعينات الدقيق ذات أقطار الحبيبات ونسب الأستخلاص المختلفه لتحديد بعض عوامل جودة دقيق القمح (صنف 168 جيزه) على أساس إختلاف التركيب الكيميائى وتحليل لون مكونات كل مرحلة استخلاص ، ويعتبر التحليل اللونى للعينات مؤشر يعكس مكونات العينه وخصوصا من البروتين والألياف والرماد ، وتقاس درجة اللون لكل مرحلة على اساس المقياس اللونى (مقياس L, a, and b) وتمثل (الأبيض- الأسود) ، (الأحمر- الأخضر) ، (الأصفر- الأزرق) على الترتيب ، حيث تم إجراء التجارب والتحليل الكيميائى للعينات بمعهد تكنولوجيا الأغذية ، بينما تم تحليل القياسات اللونية بمعهد بحوث الهندسة الزراعية ، مركز البحوث الزراعية ، الجيزة ، خلال موسم 2005-2006.

تم اختيار العينات من قسم بحوث الحبوب ، معهد المحاصيل الحقليه من حبوب القمح بمحافظة الجيزة.. حيث تم تجهيز العينات بتنظيفها من الأتربة وتتكيفها (عملية الترطيب) وأجراء بعض القياسات الطبيعية والمكيانيكية على الحبوب (الطول ، والعرض ، والسمك ، والوزن ، والحجم والكثافه ، ودرجة الصلابه) ثم عملية الطحن ، وأخيرا عملية النخل وتم إعداد العينات للمنخوله للتحليل الكيميائى بواسطة طريقة (A.O.C.A.) والتحليل اللونى لهذه النتائج بواسطة (مقياس L, a, and b) لكل عينه ومقارنة مدى ارتباط اللون بالتحليل الكيميائى لكل عينة.

أوضحت النتائج المتحصل عليها الأتى :

1- إنخفاض حجم الحبيبات الدقيق من 500 الى أقل من 160 ميكرون متر يؤدى الى إنخفاض نسب كل من الرماد من 4.08 الى 1.22 % ، والبروتين من 8.24 الى 5.47 % والألياف من 8.59 الى 0.149 % . وبذلك يعتبر حجم الحبيبات مؤشر على التركيب الكيميائى لهذه الحبوب وبالتالى يمكن تصنيف الدقيق حسب حجم الحبيبات مما يؤدى الى انتاج انواع مختلفة من الدقيق تستخدم فى الأغراض المختلفة.

2- درجة نقاوة الدقيق تعتمد على حجم الحبيبات الدقيق (حجم حبيبات 500 ميكرون أقل نقاوة من الدقيق ذو حجم الحبيبات أقل من 160 ميكرون) ، ويستنتج من ذلك ان الدقيق ذو درجة نقاوة أقل يكون عالى فى نسب الرماد والبروتين والألياف، بالعكس تكون هذه النسب منخفضة فى الدقيق ذو درجة النقاوة العاليه0

3- باستخدام المقياس اللونى (L, a, and b) أمكن التعرف على المدى اللونى لحجم الحبيبات الدقيق المختلفة ، حيث وجد ان بزيادة قيمة L (الأضاءة) من 66.74 الى 88.72 يدل ذلك على زيادة كمية الأضاءة اللونية ويكون ذلك بانخفاض حجم الحبيبات الدقيق من 500 الى أقل 160 ميكرون ، وبالتالى يصبح الدقيق ذو حجم الحبيبات أقل من 160 ميكرون أكثر بياضا (ذو اضاءة عالية) ، بينما يكون لون الدقيق ذو حجم حبيبات 500 ميكرون داكنا (ذو اضاءة منخفضه) وبالتالى يعتبر المقياس L مؤشر للتركيب الكيميائى حيث انه بزيادة القيمة L تكون عينة الدقيق ذو نسبة منخفضة فى كل من الرماد والبروتين والألياف، بينما تكون هذه النسب منخفضه عند قيمة L المنخفضة.

4- تتناسب قيم المقياس b تناسبا طرديا مع حجم الحبيبات الدقيق حيث يقل اللون الأصفر ويزداد اللون الأبيض وذلك بإنخفاض قيم b وحجم حبيبات الدقيق والعكس صحيح.

5- بزيادة قيمة المقياس اللونى (WIE) تزداد درجة اللون الأبيض للدقيق وذلك بانخفاض حجم حبيبات الدقيق ، ولذلك فان حجم الحبيبات اقل من 160 ميكرون ذو المقياس (74.02) تكون اكثر بياضا من لون الدقيق ذو حجم حبيبات 500 ميكرون ذو المقياس (25) اقل بياضا (اكثر داكنا).

6- بزيادة قيمة الأختلاف اللونى الكلى للون الدقيق يدعم زيادة مدى التشتت اللونى كما فى الدقيق ذو الحبيبات الكبيرة تون ذات لون داكن (قريب من اللون الأصفر) ، ولكن بانخفاض قيمته فى الدقيق ذو حجم الحبيبات صغيره يجعل اللون اقل تشتت وبالتالى يكون اللون أكثر تمسكا ووضوحا (اللون الأبيض).

7- ان انخفاض زاوية اللون من 14.11 الى 0.26^{o} والتى تقع فى المربع الأول من دائرة اللون (360^{o}) والتى تشير الى اتجاه اللون من الأصفر الى الأبيض ، وبالتالى فان أنخفاض زاوية اللون تدل على زيادة اللون الأبيض ونقص حجم الحبيبات.

8- إن انخفاض درجة تشبع اللون من 20.71 الى 10.95 يؤدى ذلك الى زيادة اللون بياضا ويصبح اكثر وضوحا ، اى كلما أنخفضت حجم حبيبات الدقيق ، حيث تتناسب درجة تشبع اللون تناسبا طرديا مع حجم حبيبات الدقيق.