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Formulation of a low fat fresh cream based on gums from Beilschmiedia obscura seeds

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***Abstract*— *The purpose of this work is to improve the conditions for extracting and using gums from Beilschmiedia obscura (BO) seeds, with a view to formulating a light fat-reduced cream. To this end, the study of the effect of the extraction time on the extraction yield and on the expression of some functional properties of these gums has been carried out. The extraction time was varied from 15 to 120 minutes (min); the yield, the apparent water absorption capacity (AWAC), the solubility index (SI) and the emulsifying activity (EA) were measured. A centered composite plan has been developed to optimize the solubility of these hydrocolloids. Then, a substitution plan was implemented to lighten the fat-free creams. The proportions of 5%, 10%, 15%, 20%, 25%, 30% and 35% of substitutes have been formulated and the fat content, consistency and color of the mixtures have been determined. A sensory analysis was also done. From this work, it emerges that the extraction time has an influence on the properties of the gums studied. Indeed, the yield of Beilschmiedia obscura gums (BOGs) is optimum at 30 min of extraction. AWAC increases with extraction time while SI and EA are inversely proportional to extraction time. BOGs dissolve most between 70 and 80 ° C for speeds greater than or equal to 200 rpm and between 40 ° C and 80 ° C, for stirring speeds greater than 500 rpm. However, to avoid molecular damage to the water-soluble gums, it is preferable to dissolve them at 70 ° C and at 200 rpm. With regard to the formulation of fresh creams, the reduction made it possible to move from a fresh cream of 33.91% fat, to a cream of 20.1% of fat with BOGs, a reduction of 124.29 Kcal.*

Keywords*— *Beilschmiedia obscura, Extraction, fat, gums, low-fat fresh cream , obesity and overweight.

I. INTRODUCTION

Obesity is a widespread disease that rages on all continents. It predisposes to chronic diseases like diabetes, cardiovascular diseases and cancer. Obesity is responsible for the deaths of 2.8 million people each year, or 6,850 deaths per day and the 5th leading cause of death worldwide [1]. In Africa, the number of overweight and obese children has increased by almost 50% since 2000. In Cameroon, 9.6% of the population over the age of 18 was overweight in 2014, or around 4,400 deaths [2]. This surge is justified by the change in eating habits and the sedentary lifestyle of the populations. To this end, the WHO recommends the practice of sports exercises and the limitation of a high-calorie food consumption. Among the rich foods, there is milk.

In Cameroon, milk production is estimated at 172,000 tonnes [3], and results in the production of a wide range of dairy products made mostly from whole milk, the nutritional value of which is well established. Indeed, milk is a complete food, containing proteins (3.2%), carbohydrates (5%), minerals (0.9%) and lipids (3.6%) [4]. However, the consumption of whole milk given its high content of animal fat and saturated fatty acids, can lead to overweight leading to obesity and cardiovascular and

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metabolic diseases [5] [6]. In order to avoid these health problems while benefiting from the advantages of milk and dairy products, the lipid load of milk is often reduced by the skimming process, this justifies the development of low-fat dairy products.

Furthermore, the cream eliminated during this process being rich in fat-soluble vitamins and essential fatty acids, must be valued for human consumption, hence the need to reduce only its energy value, while retaining its beneficial nutritional value. Indeed, the whole cream contains about 60% water, 2% protein, 3% lactose and between 30 and 40% fat [7]. The reduction in the latter consists of a reduction in fat between 12 and 29% [6]. However, this operation generally causes organoleptic defects on the finished product. To this end, the technology of low-fat dairy products generally uses food improvers (modified starches, water-soluble gums), to correct these defects. Anything that creates an extra cost for the low-fat industry. This situation is accentuated in Cameroon because, most of the food improvers are imported although the country abounds with significant potential. Indeed, the hydrocolloids were extracted from the seeds of *Beilschmiedia sp*, a Cameroon forest plant, but not yet valued on an industrial scale [8]. In addition, with a view to promoting the use of Cameroonian potential in the manufacture of low-cost food improvers at the local level, the work of Edima [9] made it possible to develop methods for extracting *Beilschmiedia obscura's* gums (BOGs). However, the study of the effect of extraction time on the yield and properties of gums has not been carried out. As is the use of BOGs in a food matrix. In order to develop the Cameroonian potential, this study aims to improve the process of extracting BOGs for the manufacture of a low-fat fresh cream from fresh milk and BOGs.

II. MATERIALS AND METHODS

A. Materiel

The material used consists of *Beilschmiedia obscura* (BO) seeds and fresh milk.

The dry BO seeds were purchased in Meiganga, a town 160 km from Ngaoundéré (Adamaoua Region in Cameroon), during the month of March. Then, packed in polyethylene bags, and sent to the Physico-chemical laboratory of the National advanced School of Agro-Industrial Sciences of the University of Ngaoundéré. Once in the laboratory, the seeds are cleaned and washed with potable water, then dried for 48 hours at 40 ° C using a drier (P. Dominioni Lurate caccivio como, Italy). After drying, the seeds are ground using a grain mill (SAMAP). Then, the powder obtained is sieved with a 400 µm sieve of Prufsieb brand mesh. The powder thus obtained is stored in airtight containers at room temperature.

Fresh milk was collected from the "Dalang" farm located 7 km from Bini Dang. After collection in previously washed and disinfected bottles, the milk is sent to the cheese workshop of the National advanced School of Agro-Industrial Sciences, in a cooler. Then, it was pasteurized at 80 ° C for 15 min; this using a hot plate (Heidolph, Germany). After cooling (room temperature), it is conditioned in a stainless steel pot and stored at 4 ° C in a refrigerator until it is used for the formulation of the light cream.

B. Study of the effect of the extraction time

The method used in this work is that of Edima [9]. 10 g of BO powder are mixed with 250 mL of distilled water. The solution is buffered to pH 7 with citric acid and Na_2CO_3, then brought to 68 ° C for extraction. The extraction is carried out at this temperature with stirring, varying the extraction time from 15 min to 2 hours (h) with a step of 15 min. Thereafter, the solution is centrifuged at 3600 rpm for 20 min. The gums contained in the supernatant are precipitated with ethanol for an alcohol / water ratio of 3: 1. Then, the whole is filtered and the wet gums dried at 38 ° C for 15 h. For each extraction time, the yield (Y), the apparent water absorption capacity (AWAC), the solubility index (SI), the emulsifying properties were evaluated.

B.1. Determination of extraction yield

The extraction yield is calculated from the following formula:

$$Y\ (\%) = M_2 \times 100/M_1$$

With: M_1: the sample mass; M_2: the mass of gum; R: yield.

B.2. Apparent water absorption capacity

Apparent water absorption capacity (AWAC) is determined by the method of Philips [10]. 0.4 g of corn flour is mixed with 0.1 g of gum. This mixture of mass M_1= 0.5 g is associated with 10 ml of distilled water and the whole is subjected to stirring for 30 min using a stirrer (Heidoph, Germany) and centrifuged at 5600 rpm for 30 min (a Biofuge primoR Hereas centrifuge, Germany). The recovered M_2 pellet is weighed and the apparent water absorption capacity (AWAC) is calculated by the following formula:

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AWAC (g of water / g of sample) = $[(M_2 - M_1) / M_1] \times 100$

B.3.Solubility index

Solubility index (SI) determined according to the method of Anderson [11]. 0.1 g of gum is associated with 0.4 g of corn flour, the whole is mixed with 10 ml of distilled water and stirred using a brand magnetic stirrer (Heidolph, Germany) for 30min; then the mixture is centrifuged at 5600 rpm for 30 min (centrifuge Biofuge primoR Hereas, Germany). The M_2 pellet is collected, weighed, and brought to the oven at 105 ° C for 24 h. The weight of the dry pellet M_3 is determined and the following formula of the Solubility Index (SI) is applied:

SI (%) = MSe- $[(M_3 - M_0) \times 100) / (M_2 - M_0)]$

With MSe: dry matter of the sample.

B.4.Determination of the emulsifying properties of gums

0.1 g of gum is dissolved in 5 ml of distilled water. The whole is mixed with 5ml of cotton seed oil (Azur, Cameroon), and stirred for 30 min using a magnetic stirrer (Heidolph, Germany).

The emulsifying activity (EA) is evaluated by the modified method of Muschiolok [12]. 10 ml of the emulsion solution are introduced into a graduated tube and left to stand for 30 min at room temperature. The height of the emulsified phase is measured and makes it possible to determine the emulsifying activity (EA) of the gums in%. The formula is as follows:

EA (%) = (He / Hw) x 100

With, He: height of the emulsified layer; Hw: total height of the liquid in the tube.

C. Solubility optimization

C.1. Experimental design

A centered composite plan has been developed for this purpose. The factors considered being the temperature varying from 40 to 80 ° C and the stirring speed varying from 200 to 600 rpm. The experimental matrix used is represented by table I. For each test, the solubility index was evaluated as described above.

Table I. Experimental matrix for the optimization of solubility

N° Essays	**Coded variables**		**Actual variables**	
	X_1 (temperature)	**X_2 (Speed)**	**X_1 (temperature in °C)**	**X_2 (Speed rpm)**
1	-1	-1	40	200
2	+1	-1	80	200
3	-1	+1	40	600
4	+1	+1	80	600
5	0	0	60	400
6	0	0	60	400
7	0	0	60	400
8	$-\sqrt{2}$	0	32	400
9	$\sqrt{2}$	0	88	400
10	0	$-\sqrt{2}$	60	120
11	0	$\sqrt{2}$	60	700

C.1. Statistical analysis

Analysis of variance (ANOVA) was used to determine the influence of each factor as well as the degree of significance of each of these effects. The significance of each factor is determined by the Fisher test which is defined as the ratio of the mean square of the regression (CMR) to the experimental error (EE) (F = CMR / EE), representation of the meaning of each variable ordered on the model examined. The regression equation was also subjected to the Fisher test to determine the regression coefficient R^2. The calculations were made with STATISTICA 5.0 software. The confidence level considered is $(1 - \alpha) \geq 0.9$.

The validation of the model was made via the regression coefficient R^2 and the Absolute Average Deviation Analysis (AADA). The AADA must be substantially equal to 0 and less than 2 for the model to be validated. It is determined according to the following formula:

$$AADA = \frac{\sum_{i=1}^{p}\left(\frac{|Y_{i\,exp} - Y_{ical}|}{Y_{i\,exp}}\right)}{p}$$

With, $Y_{i\,exp}$ the experimental response and Y_{ical} the response calculated from the model for an experiment i; p being the total number of experiments.

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D. Development of a low fat fresh cream

D.1. Process for the production of low fat fresh cream

Fresh milk is filtered to remove impurities and then skimmed. The cream obtained is standardized via the introduction of the gum extract. The whole is homogenized and pasteurized at 80 ° C for 15 min, then cooled to 25 ° C. The lactic ferment is added and the whole is matured at 15 ° C for 15h, then conditioned.

D.2. Formulation of a light cream reduced in fat

A substitution plan has been implemented with the BOGs. The proportions of 0%, 5%, 10%, 15%, 20%, 25%, 30% and 35% of substitutes or BOGs were added to the cream. The different formulations are listed in Table II.

Table II. Different cream formulations produced

No. Essays	Cream proportions (%)	Proportions of substitutes (%)
1	100	0
2	95	5
3	90	10
4	85	15
5	80	20
6	75	25
7	70	30
8	65	35

D.3. Determination of the fat content of creams

The fat contents of the cream used and of the various formulations, were determined according to the method of Folch [13]. 100 ml of sample are added to a mixture of the extraction solvent Chloroform / methanol: 2/1, V / V, 200ml / 100ml. The whole is mixed using a mixer for 20 min. The homogenate must constitute a single phase. If this is not the case, add the mixture [$CHCl_3$ / CH_3OH 2: 1 (v / v)] in sufficient quantity to obtain a phase. The mixture is filtered under suction through a No. 3 sintered glass, in order to remove the denatured proteins. Then, 0.88% KCl (w / v) at a rate of 1/4 of the total volume of the supernatant is added and the mixture is homogenized. The whole is transferred to a separatory funnel. After separation of the two phases, the lower phase is recovered in a flask and the solvent is evaporated using a rotary evaporator at 50 ° C. The volume of lipids is measured, and the difference with the initial volume makes it possible to calculate the lipid content of the different formulations. The results obtained were expressed as a percentage.

D.3. Determination of the penetration force

The penetration force is determined using a texturometer of the texture analyzer type (Brookfield, United States, 2011). The principle of measurement consists in applying a compressive force to a sample using a probe. As part of this work, a normal test using a rear extrusion probe was carried out. This analysis made it possible to compare the texture of light fresh creams formulated, with that of a light reference fresh cream with 14% fat (Bridelice brand, France). The penetration distance used was 6 mm, the mass of the probe 2 g and the descent speed 0.5 mm / s. The resistance of the sample is measured by a calibrated load cell expressed in grams. The values obtained in grams have been brought back to Newton by the following formula:

1g = 0.102N

D.4. Color determination

The effect of adding gums on the color of fresh creams was evaluated using a Lovibond RT 100 colorimeter. The L parameter (luminance) of each sample of cream is compared to the sample of fresh cream lightened to 14% fat (Bridélice, France).

D.5. Sensory analyzes

The sensory analysis was carried out by a hedonic test. The panel consisted of 10 people previously trained for 4 days in the tasting of thick fresh cream, using the reference sample. The descriptors considered during this analysis were texture, color, taste and odour. A general score was also assigned to each sample. During the sensory analysis, the different samples (20 g) of cream are presented in plastic bowls of white color, all identical, bearing codes with random 3-digit numbers. The samples were accompanied by bread and served in two sets. It was a question for the taster to assign a score ranging from 1 for the least appreciated sample, to 6 for the most appreciated sample. The evaluation of the general grades was done in the same logic. The results obtained were subjected to analysis of variance (ANOVA), to determine if there is a significant difference between the tasters and the treatments. Then, Duncan's multiple comparison test was done to determine which sample differed significantly from the other.

III. RESULTS AND DISCUSSION

A. BOGs performance

The results of the study of the effect of extraction time

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on the yield and some properties of BOGs are presented in the following figures.

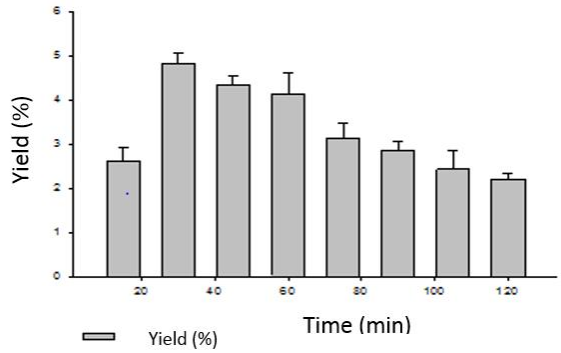

Fig. 1. BOGs extraction yield as a function of time

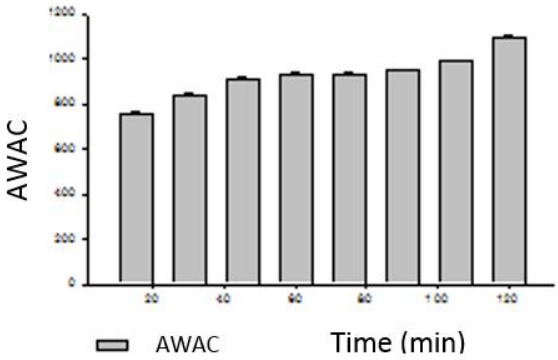

Fig. 2. AWAC of BOGs as a function of time

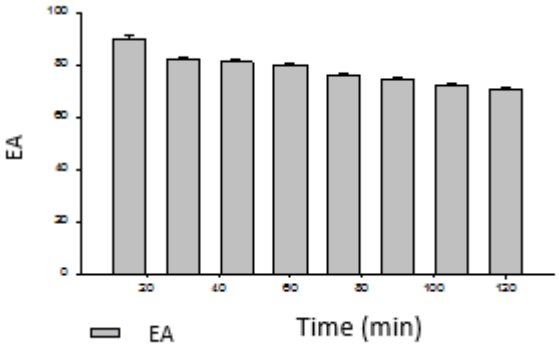

Fig. 3. EA of BOGs as a function of time

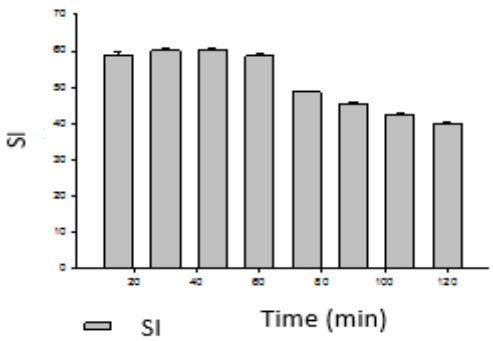

Fig. 4. BOGs IS as a function of time

From the results above it appears that, the yields obtained during this work increase with the extraction time in the interval 15-30 min, and beyond this interval, decrease with the extraction time. These results are different from the results of Panyoo [14] on *Grewia mollis* gums, in which the extraction time has no effect on the extraction yield. This can be justified by the difference between the samples (rigid shrub bark). However, these results are close to those of Wu [15] on sterculia seeds and those of Singthong [16] on Yanang leaves, which confirms that, the extraction time influences the yield of the gums. However, in these works the optimum yields are reached after 30 min. This can be justified by the difference in the extraction conditions and the raw material. The decrease in yield beyond 30 min may be due to the fact that over time, the gums extracted tend to bind to other macromolecules, for example the proteins present in the medium; this would decrease their ability to precipitate in the presence of ethanol during purification. The highest yield is 4.81%. This value is lower than that found by Ndjouenkeu [8]; This can be justified for various reasons. In particular, the difference of the samples used. Indeed, the studies of Ndjouenkeu [8] have focused on the seeds of *Beilschmiedia sp* while this work has focused on the seeds of *Beilschmiedia obscura*. In addition, in this work, the purification was done with ethanol while in the work of Ndjouenkeu [8], it was carried out by dialysis, with papain and TCA. The methods for determining extraction yields are also different. Ndjouenkeu [8] compared the percentage of gums to the total percentage of polysaccharides. While in this work, the percentage of gum is determined by making a ratio between the mass of the raw material and the mass of dry gum obtained.

The highest AWAC is 1100.01 g of water / g of gum and is obtained after 2 hours of extraction. It is higher than that found by Ndjouenkeu [8] which is 1053.6 g of water / g of gum. This difference may be due to the diversity of the raw materials used. In addition, in its work, AWAC was

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measured using raw material powders, which is not the case in our context. AWAC increases with extraction time; This can be justified by the formation of intermolecular interactions between the gum molecules, forming aggregates which can trap the water molecules.

The highest EA is 90.01% and corresponds to a duration of 15 min of extraction. This value is higher than that of Ndjouenkeu [8] which is 60%. These results show that, the EA decreases very little with the extraction time. This phenomenon is justified by the formation of aggregates with the consequence, the reduction of the dispersion of gums in the environment [17]. This directly impacts the emulsifying activity so expression is conditioned by the dispersion of the gums in the solution. Indeed, [18] have shown that the emulsifying properties of locust bean gums are due to their ability to form films of liquids around the droplets. Knowing that, BOGs can be assimilated to hydrophilic chain arabinose and galactose polymers [8], the decrease in EA is therefore strongly linked to the formation of aggregates over time of extraction.

The results of the solubility index show that the solubility of BOGs varies little with the extraction time. The EA increase between 15 and 45 min. Beyond this range, it decreases. This decrease in solubility can be explained by the formation of aggregates over the extraction time. Dakia [17] state that the solubility of galactomannans is limited by the formation of aggregates. Furthermore, it should be noted that, the highest value of solubility is 60.01 %, which proves that these gums have difficulty in dissolving. This may be due to the extraction conditions. Indeed, the work of Richardson [19] demonstrate that, the solubility of galactomannans is a function of their origins, extraction and measurement methods. The hydrocoillods studied in this work have interesting properties whose expression is reduced by limited solubility.

B. Optimization results of BOGs solubility

The results of this analysis are collated in Table III.

Table II. Presentation of the BOGs SI results

No. Essays	**Temperature (°C)**	**Speed (rpm)**	**IS obtained (%)**
1	40	200	51,01
2	80	200	70,00
3	40	600	75,82
4	80	600	83,64
5	60	400	67,30
6	60	400	67,80
7	60	400	66,90
8	32	400	50,50
9	88	400	81,95
10	60	120	48,10
11	60	700	85,45

From the above table, it follows that, the highest SI of 85.45% is obtained at 60 ° C and at 700 rpm. While the lowest SI of 48.1% corresponds to 60 ° C and 120 rpm.

B.1. Model equation

The equation mathematically describing the BOGs SI is as follows

$Y = 67.33 + 17.82\ X_1 + 22.81X_2 + 0.70\ X_1\ X_1 - 5.58\ X_1\ X_2 + 1.25\ X_2\ X_2$

With, Y = IS; X_1 = temperature; X_2 = stirring speed

From this equation it appears that, only the interaction temperature - agitation speed has a negative effect on the SI. Among all these factors and interactions, the speed of agitation is that which has the most effect on the SI because its coefficient is the highest (22.81); it is followed by the temperature factor which has a coefficient of 17.82. Then comes the temperature-speed interaction with a coefficient of -5.58. The quadratic interactions speed - speed and temperature - temperature come in last positions with respectively 1.25 and 0.70.

B.2. Model validation

The SI model was validated by the analysis of the R^2 and the AADA. The values obtained are presented in Table IV.

Table III. Probability table for the effects of BOGs SI

Validation element	Abbreviation	Value obtained	Standard value
Correlation coefficient	R^2	93,04 %	100%
Absolute Average Deviation Analysis	AADA	-0,003	0

The value of R^2 is fairly close to the standard value; the difference between the value found and the standard is due to the different handling errors. The calculated AADA is

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very close to 0. Using these two tools, the model describing the BOGs SI is validated.

B.3. Determination of the significance of the factors

Table V. Probability table for the effects of BOGs SI

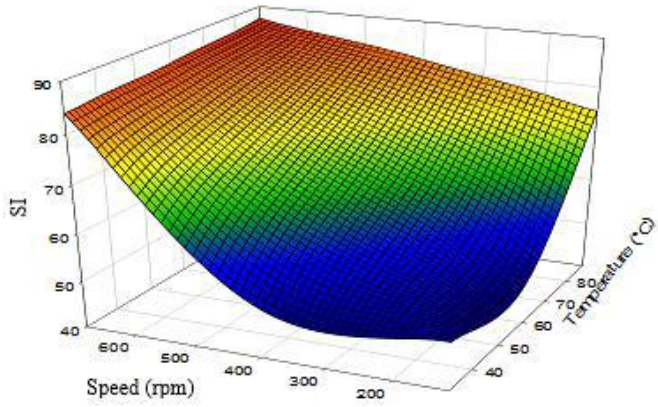
Source	Sum of squares	DDL	Quadratic mean	Report F	Proba
A:temperature	686,48	1	686,48	25,87	0,0038
B:vitesse	977,94	1	977,94	36,85	0,0018
AA	4,58	1	4,58	0,17	0,6948
AB	99,90	1	99,90	3,76	0,1101
BB	7,81	1	7,81	0,29	0,6107
Total error	132,70	5	26,54		
Total (corr.)	1906,75	10			

For a 95.0% confidence level, only the temperature and agitation speed factors have significant effects on the BOGs SI. In fact, their probabilities are respectively 0.0038 and 0.0018, all less than 0.05.

B.4. Response area

In order to better visualize the relationships between the different factors and the BOGs SI, response surfaces have been drawn; Figure 5 below shows this result.

From this figure it can be seen that, the BOGs SI increases with temperature and the speed of agitation. Optimal values are obtained between 70 ° C and 80°C at stirring speeds above 200 rpm, and between 40 ° and 80 ° C for speeds above 500 rpm. These results are close to those of Singthong [16] who showed that guar gums had a maximum solubility at 40 ° C and those of locust bean at 80 ° C. However, the high temperatures coupled with high agitation rates lead to destruction of the macromolecules. The work of Mao [20] reveals that, when the shear rates increase, the macromolecules of galactomannans quickly become entangled. This has the consequence of reducing the viscosity. To avoid this, it is preferable that the BOGs are solubilized at 70 ° C and at 200rpm.



SI of BOGs : ■ :40% ; ■ : 50%; ■ : 60% ; ■ : 70% ; ■ : 80% ; ■ : 90%.

Fig. 4. Response surfaces of SI of BOGs

C. Results of the formulation of light creams with reduced fat content

C.1. Lipid content of the different formulations

The results of this manipulation are shown in Table VI.

From this table it emerges that, the fresh cream obtained from the skimming of whole milk contains 33.91% fat. This value complies with the standard which recommends a minimum fat content of 30% [7]. Formulations made with BOGs reveal that only mixtures containing 10, 15, 20, 25 and 30% of BOGs extracts comply with the standard for light products, which means that the proportion of fat in a fresh cream is between 12 and 29 %. Adding 5% fat is not enough to have a light cream. While, the addition of 35 % gum extract is outside the regulation. To this end, the rest of the results will only concern formulations conforming to the standard.

TABLE VI. Lipid content of the different formulations

No. Essays	**Proportions of fresh cream (%)**	**Proportions of substitutes (%)**	**MG content of creams BOGS (%)**
1	100	0	33,91
2	95	5	30,15 (G_1)
3	90	10	26,8 (G_2)
4	85	15	23,45 (G_3)
5	80	20	20,1 (G_4)
6	75	25	16,75 (G_5)

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7	70	30	13,4 (G_6)
8	65	35	10,05 (G_7)

C.2. Determination of the consistency of the creams formulated

The results obtained are presented in Table VII. The data in this table reveal that, the highest consistency in BOGs is 8.26 N and corresponds to the formulation of 26.80% fat. The lowest consistency is 2.75 N and corresponds to the formulation of 13.40 % fat. That of the reference is 5.61 N with 14% fat. The value closest to the reference is 5.23 N obtained at G_4 (20.10%). This difference between the formulations and the reference may be due to the fact that, the reference has been reduced with a combination of modified starches and pectins, which have given more consistency to the cream, so that the relief has been greater. The addition of BOGs in fresh creams allows the absorption of excess water and balances the texture of the product. Note that, the reduction in consistency is proportional to the reduction in the fat content. This is explained by the fact that, the reduction in fat causes a reduction in the total solids of the product, thus generating a significant reduction in the firmness of the gel [21].

Table VII. Consistencies of the different formulations

No. Essays	**Lipid proportions (%)**	**Consistency** (N)
G_2	26,80	8,26±0,65
G_3	23,45	7,08±0,17
G_4	20,11	5,23±0,23
G_5	16,75	3,27±0,41
G_6	13,41	2,75±0,15
R	14	5,61±0,34

C.3. Color determination

The results of this analysis are collated in Table VIII. The L parameter decreases with the addition of gums. This is in line with the work of Kumar [22] who demonstrated that, the addition of pectin and sodium alginate in a yogurt made from soy milk and mango reduced the L indices. It is the G_2 sample that comes closest to the reference.

Table VIII: Presentation of parameters L, a and b of the formulated creams

Samples	**L**	**a**	**B**
G_2	69,36	0,28	9,95
G_3	68,96	0,96	10,61
G_4	63,02	1,01	11,52
G_5	55,21	1,39	11,57
G_6	50,37	1,72	11,62

C.4. Sensory analysis

The data obtained from the analysis of BOGs creams are presented in the following figure. This figure reveals that, in general, the G_4 sample is the most appreciated; it is followed by G_3 and G_2. For the texture descriptor, the G_4 sample is the most popular followed by G_3 and G_2.The taste assessment shows that G_2 is the most liked followed by G_3 and G_4; but there is no significant difference between these samples. For the odour and color descriptors, G_2 is the most popular followed by G_3 and G_4.

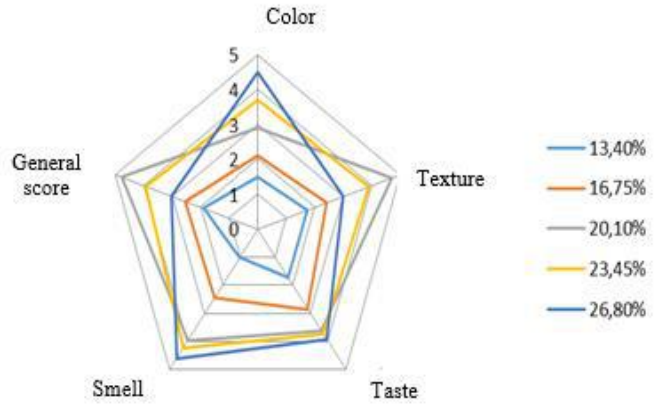

Fig. 4. Results of sensory analysis of fresh BOGs creams

IV. CONCLUSION

The extraction time has an influence on the gums studied. Indeed, the yield of BOGs is optimum at 30 min of extraction, the AWAC increases with the extraction time while the IS and the EA are inversely proportional to the extraction time. For this purpose, the BOGs must be extracted at 30 minutes to have a high yield combined with good functional properties. BOGs dissolve most between 70 and 80 ° C for speeds greater than or equal to 200 rpm and between 40 ° C and 80 ° C for stirring speeds greater than 500 rpm. However, to avoid molecular alterations, it is preferable to dissolve them at 70 ° C and at 200 rpm.

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Regarding the formulation of light fat cream, the lightening of the creams made it possible to start from a cream with 33.91% fat to creams of 20.1% with BOGS. A reduction of 124.29 Kcal.

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