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Study on the Physicochemical Properties and Sensory Evaluation of Salad Creams Made from Locally Available Raw Materials

[1]Oli,C.C., [2]Ezeudu, E.C. and [3]Okoye, O.N.N.

[1]Department of Pure and Industrial Chemistry, NnamdiAzikiwe University, Awka, Nigeria.
[2]Department of Chemistry, Paul University, Awka, Nigeria.
[3]Chemical Sciences Department, Evangel University, Akaeze, Nigeria.

*Corresponding Author: Oli, C.C. Email: oli4lord@yahoo.com,

ABSTRACT

Salad creams were formulated from Nigerian raw materials such as refined bleached deodourized palm kernel oil (RBDPKO), bleached palm oil, whole egg, ginger, garlic, white onions, salt, sugar, ethanoic acid, and yellow corn flour. The physicochemical analysis as well as the sensory evaluation of these salad cream formulations were determined, and result compared with that of a commercial salad cream. Commercial salad cream and the different formulations of salad cream were evaluated for chemical properties (titratable acidity, pH, total solids, protein, carbohydrate, fat, ash, moisture content and dry matter), physical properties (colour), and rheological properties (viscosity). The chemical analysis showed that the moisture content of the four formulations (S01,S02,S03,S04) were 49.00%, 40.10%, 51.80%, 58.70%, 48.10%, 43.70% and 50.40% respectively, and that of the commercial salad cream was 50.20%. There was no significant difference between the moisture content of all the salad cream formulations and that of the commercial ($p>0.05$). Ash contents for samples (S01-S04) were 0.50%, 6.80%, 1.20%, 1.50% respectively and commercial (4.10%), which showed that both formulated and commercial salad creams had high mineral content. The crude fibre content of formulations and commercial showed 9.05%, 4.45%, 2.75%, 5.95% and 8.50% respectively. The protein contents were recorded as 6.30%, 4.55%, 2.63%, 1.40%, and 8.75% for samples S01- S04 and commercial respectively. The result for carbohydrate both for formulations, S01-S04 and commercial were 9.69%, 8.34%, 35.50%, 14.07%, and 27.57% respectively. The pH for S01-S04 were 4.0, 5.0, 5.5, 4.5, and for commercial was 5.5. The result of the viscosity of the commercial salad cream (20.50Pa.s) showed that the formulated salad creams, S01-S04, which had viscosity of 2.79, 3.47, 2.85, 3.1 5 Pa.s respectively flowed more than the commercial. The result of the colours of S01–S04 (2.4, 2.0, 2.0, 2.6) showed no significant difference from that of the commercial at $p>0.05$. Titratable acidity for S01-S04 were 1.35%, 1.42%, 2.11%, 2.50% while that of commercial is 1.55%. Sensory evaluation showed that salad cream made from locally available raw materials were acceptable to the panelists especially formulation S04. Acceptable and nutritious salad cream can be processed from these raw materials.

Keywords: Salad cream, Formulation, Physicochemical properties, Sensory Evaluation, Rheological.

INTRODUCTION

Salad cream was defined as an emulsified semi-solid food consisting of sweetened oil-in-water emulsion, with egg yolk as emulsifying agent and containing edible vegetable oil, salt, vinegar, spices, flavourings, thickener and colouring Devey, 1959;[1] Pearson, 1976[2]. Another definition, based on rheological and compositional properties is that salad cream is a readymade creamy white dressing with a flowing consistency for eating with salad (mixture of vegetables), and is prepared with various ingredients of which modified maize flour serves as the base raw material [3]. In yet another definition, cassava starch is the base raw material [4].

The main definition mentions four compulsory raw materials namely vegetable oil, water, whole egg or egg yolk, and an acidifying agent. Oil is the major ingredient contributing to the viscosity and body of salad creams. The rigidity of the emulsion depends on the size of the oil droplets and how tightly packed they are in the emulsion. The oil also provide base for the rest of the ingredients. Highly flavoured oil such as olive oil and nut oil lend distinctive characteristics to the flavour of the finished product [2].

Many natural and processed foods contain small droplets of oil dispersed in an aqueous medium (e.g., milk, cream, fruit beverages, soups, cake batters, mayonnaise, cream liqueurs, sauces, deserts, salad cream, and ice cream) or small droplets of water dispersed in a lipid medium (e.g., butter and margarine). Despite the considerable diversity of physicochemical and sensory characteristics exhibited by these foods, they can all be considered to fall into a class of material called ‘‘emulsions’’ and their properties can be understood using the concepts and techniques of ‘‘emulsion science’’ [5] [6]. [7] indicated that salad cream being considered as semi-permanent emulsion may contain stabilizing or thickening agents for preventing separation of the emulsions or improving homogeneity, since the increased viscosity retards the separation of semi-permanent. Several polysaccharide gums or cellulose derivatives could be incorporated in the preparation of salad cream and mayonnaise, especially xanthan gum was proved to be an excellent stabilizer [8]. The presence of starch in salad dressing serves as a gelling agent, binding agent, thickening agent, emulsifying agent and a stabilizer.

The wide diversity of physicochemical and organoleptic characteristics exhibited by food emulsions is the result of product formulation and processing conditions used to create them. The manufacture of an emulsion-based food product with specific desirable quality attributes depends on the selection of the suitable raw materials (e.g., water, oil, emulsifiers, thickening agents, minerals, acids, bases, vitamins, flavours, colourants, etc.) and optimization of processing conditions (e.g., mixing, homogenization, pasteurization, sterilization, etc.). The product must be transported and stored under appropriate conditions to maintain its desirable quality attributes prior to consumption (e.g., exposure to temperature variations, light, and mechanical agitation). [9], [10]. The modified food starch develops viscosity and protective colloid characteristics that help to prevent the breakdown of the blend during various processing steps. A recent study has shown the use of starch extracted from one of the root and tuber crop – cassava, as one of the ingredients of salad [3].

MATERIALS AND METHODS

MATERIALS

The materials used include yellow corn flour, salt, sugar, water, oil (ground nut oil, soya bean oil, palm kernel oil, bleached palm oil), ethanoic acid as the acidifier, emulsifier (whole egg), antioxidant (garlic, onion and ginger).Yellow corn was bought; ground and

sieved, sugar, ground nut oil, palm oil, salt and bottle were bought from Abakpa Market, Enugu State while the palm kernel oil (PKO) was purchased at Bridge head market, Onitsha, Anambra State, Nigeria.

METHOD

SALAD CREAM PRODUCTION

STEP I

The dry yellow corn flour (50.00g) was dispersed in about 200ml of water. This was mixture was cooked until paste was obtained, and allowed to cool. The salt, sugar, flavourings, whole egg and ethanoic acid were blended with about 100ml of water, and the mixture was passed through a fine sieve and heated a little with stirring in a steam-heated pan.

Disperse yellow corn flour in water

↓

Cook in a pot until a paste is obtained

↓

Stir vigorously to avoid lumps

↓

Remove from fire and allow to cool

Fig. 1: Flow Chart of the Salad Cream Production

STEP II

The corn flour paste was then added to the blend with stirring and the whole mixture was heated to a temperature of about 82°C in a steam-heated pan with stirring. This was allowed to cool to 43°C, and thereafter fresh vegetable oil was added in a fine stream with vigorous stirring maintained all through. The mixture was finally blended for about 5 minutes in an electric blender after which it was bottled and stored in a cool place before further studies. Below is the flow chart of the salad cream production.

Blend the egg, flavouring, water and ethanoic acid

↓

Add paste obtained in stage

↓

Stir continuously and cool to 43°C

↓

Add fresh vegetable oil in a fine stream
(Stir vigorously)

↓

Blend for 5 minutes

↓

Bottling

Fig. 2: Flow chart of the Salad Cream Production

Table-1.0: Recipe for formulation I		
Composition		
Materials/Ingredients	weight	percentage (%)
Vegetable oil (RBDPKO)*	300.00	30.03
Corn flour	50.00	5.00
Sugar	170.00	17.02
Salt	15.00	1.50
Ethanoic acid	14.80	1.40
Whole egg	62.30	6.24
Water (ml)	387.70	38.81
Flavouring (ginger)	---	---
	999.00	100.00
*RBDPKO = Refined BleachedDeodorised Palm Kernel Oil		

Table -2.0: Recipe for formulation II			
Composition			
Materials/Ingredients		weight	percentage (%)
Vegetable oil (RBDPKO)*	300.00	29.95	
Corn flour	50.00	4.99	
Sugar		170.00	16.97
Salt		15.00	1.50
Ethanoic acid		14.80	1.40
Whole egg		64.90	6.48
Water (ml)		387.70	38.71
Flavouring (garlic)		---	---
		1001.60	100.00
*PKO = Refined Bleached Deodorised Palm Kernel Oil			

Table-3.0: Recipe for formulation III		
Composition		
Materials/Ingredients	weight	percentage (%)
Vegetable oil (RBDBPKO)*	300.00	29.95
Corn flour	50.00	4.99
Sugar	170.00	16.97
Salt	15.00	1.50
Ethanoic acid	14.80	1.40
Whole egg	59.2	6.48
Water (ml)	387.70	38.71
Flavouring (onion)	---	---
	987.70	100.00
*RBDPKO = Refined Bleached Deodorised Palm Kernel Oil		

Table-4.0: Recipe for formulation IV		
Composition		
Materials/Ingredients	weight	percentage (%)
Vegetable oil (RBDPO)*	300.00	29.95
Corn flour	50.00	4.99
Sugar	170.00	16.97
Salt	15.00	1.50
Ethanoic acid	14.80	1.40
Whole egg	59.20	6.48
Water (ml)	387.70	38.71
Flavouring (ginger)	---	---
	985.60	100.00
*RBBPO = Refined Bleached Deodorised Palm Olien		

CHEMICAL ANALYSIS

CALORIFIC VALUE DETERMINATION

The Calorific value for the sample was determined by determining the carbohydrate content. Protein content, fat content, all multiplied with appropriate factors and adding up to get the energy content as shown in the relation below.

Calorific Value = (% protein x 4) + (% fat x 9) + (% carbohydrate x 4)

CARBOHYDRATE CONSTANT BY DIFFERENCE

In the determination, the carbohydrate content of a sample was regarded as the nitrogen free extract and this was determined by adding up the percentage of moisture, Ash, protein, Fat and subtracting the sum from 100.

% carbohydrate = 100- (% Protein + % Ash+ Moisture + % Fat)

pH DETERMINATION

The full range indicator paper was dipped into the sample whose pH was to be determined for a few seconds. The colour development was noted. The pH was read by comparing the colour developed with the colour scale (pH 1-14).

SENSORY EVALUATION

The sensory evaluation of the food products were carried out with the taste panel drawn from consumers of salad cream. Four coded samples of salad creams were presented to the panellists with one of the samples, which was a regularly consumed salad cream as the reference, R. A multiple comparison test was conducted to compare the attributes such appearance (colour), aroma, taste (sourness), texture and flavour of the formulations with the reference sample. A 9 point Hedonic test (where 1 represented extremely better than R and 9 represented extremely inferior to R) was used to determine the overall acceptability of the locally made salad creams. [11].

STATISTICAL ANALYSIS

The Table of values below was analyzed statistically using the 'Analysis of Variance' or ANOVA method to determine whether there was significant difference among the samples or not.

III. RESULTS AND DISCUSSION

Chemical Analysis of Salad Cream

The chemical analysis of the salad creams were carried out to determine their nutritional value and the results were shown in the Table 5.0.

Table 5.0: **Result of Chemical Analysis of Salad Cream.**

		Samples				
S/N	**Parameters**	**S01**	**S02**	**S03**	**S04**	***R**
1	Moisture content (%)	58.70	48.10	43.70	51.20	50.20
2	Dry matter (%)	41.30	51.90	56.30	48.80	49.80
3	Ash content (%)	0.50	6.80	1.20	1.50	4.10
4	Crude fibre (%)	9.05	4.45	2.75	5.95	8.50
5	Fats (%)	15.76	27.76	14.22	25.88	0.68
6	Protein Content (%)	6.30	4.55	2.63	1.40	8.75
7	Carbohydrate (%)	9.69	8.34	35.50	14.07	27.57
8	Titratable acidity	1.35	1.42	2.11	2.50	1.55
9	Calorific Value(Kcal/g)	205.8	301.4	280.5	294.8	151.4

***R** = Commercial Salad Cream

Table 5.0 showed the results of the chemical properties of salad creams made from locally available raw materials compared with commercial product. The result of the moisture content of both the formulations and the commercial product ranged from 43.70 - 58.70%.

There was no significant (p>0.05) differences between the moisture contents of all the formulated salad creams compared to that of Heinz salad cream, which has moisture content of 50.20%. The high moisture content of the formulations and the commercial product is as a result of large amount of water used in the preparation of the salad creams. This showed that they cannot be kept for a very long time. Use of carbohydrate-based substitutes, which were prepared by incorporating water into gel-type structure, results in the high quantity of water content associated with products and may reduce product shelf life [12]. The trend of moisture in the eight samples was S01>S04>R>S02>S03.For % ash contents, the value ranged from 0.5 – 6.8%. This showed high mineral content of these salad creams except for S01, which has low ash content 0.5%. The trend was S02>R>S04>S03>S01. The fibre content of the salad creams ranged from 2.75 – 9.05%. This meant that the body does not digest it all. The trend of the fibre contents of the salad creams was S01>R>S04>S02>S03. The protein content of these salad dressings ranged from 1.40 – 8.75%. This showed that the salad creams contained protein, but cannot be relied on as a major source of protein since the values are low. The calorific value for samples S01 and S04 are high, which indicated that they contain reasonable amount of energy and would give energy when consumed. The result represented in the bar chart Fig. 3:

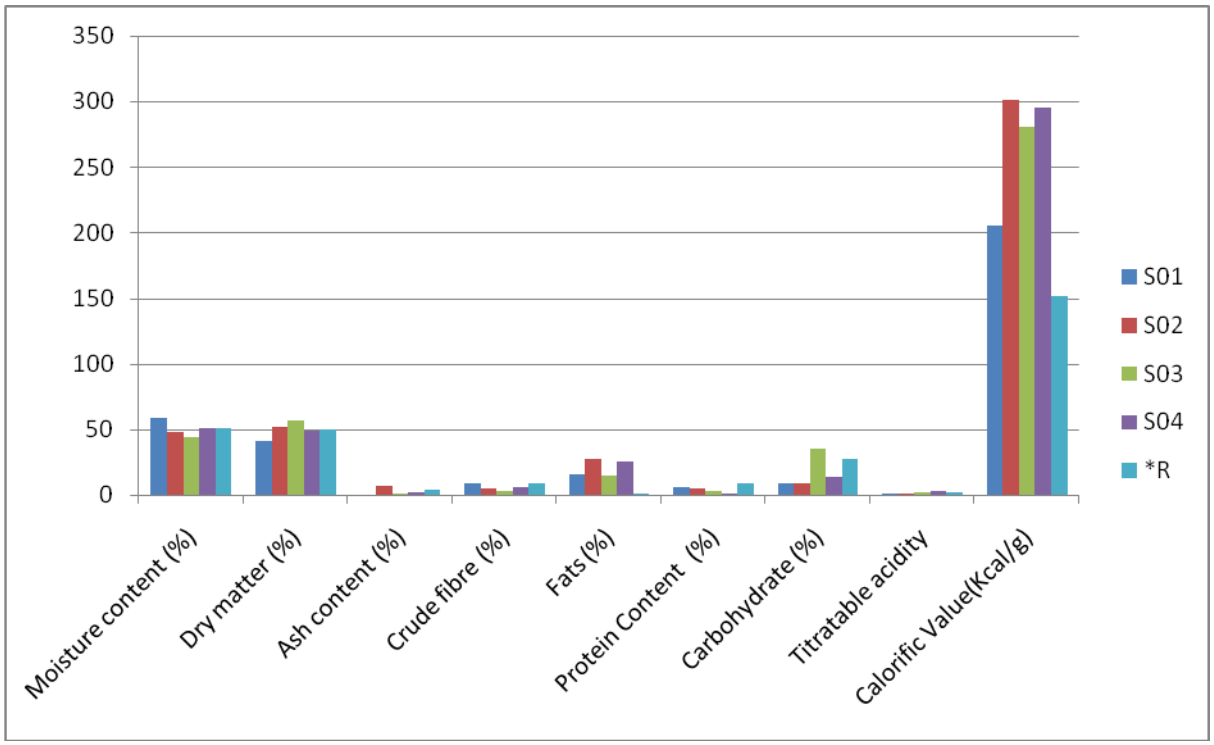

Fig-3: The result of the chemical analysis of the salad creams

Rheological Properties, Colour and pH of Salad Creams

The salad creams were analysed for rheological properties, Colour and pH, which were shown inTable-6.0 below:

Table-6.0: Rheological Properties, Colours and pH of Salad Creams

		Samples				
S/N	**Parameters**	**S01**	**S02**	**S03**	**S04**	***R**
1	Ph	4.0	5.0	5.5	4.5	5.5
2	Colour (Hazen)	2.6	2.2	2.0	2.4	2.6
3	Viscosity (Pa.s)	2.79	3.47	2.85	3.15	20.50

*R = Commercial salad cream

According to the Thai Industrial Standards concerning mayonnaise and salad cream, acidity of less than 4.1 is one of the qualifications needed [13]. Therefore, salad creams can be defined as acid foods. In Table-5.0, sample S01 exhibited that high acidity while the rest including the commercial salad cream are slightly above. These acidic conditions might destroy or inhibit the growth of micro-organisms during the shelf life periods, which would ensure the safety for consumption when kept at room temperature for about six months.

The result shows that there is no significant difference between the colour of the various formulations and that of the commercial product. S01 has exactly the same value (2.6) as the commercial salad cream. The lower value of the other formulations was an indication of the salad cream tending towards white colouration more than the commercial product. A highest viscosity was observed in the commercial product. This shows that the salad creams made from locally available raw materials flowed more than the commercial product. This observation could be due to the modified corn flour and gum additives used in its preparation [14]. S01 showed the least viscosity.

The result of the Rheological Properties, Colours and pH of the Salad Creams are represented in the in Fig. 4:

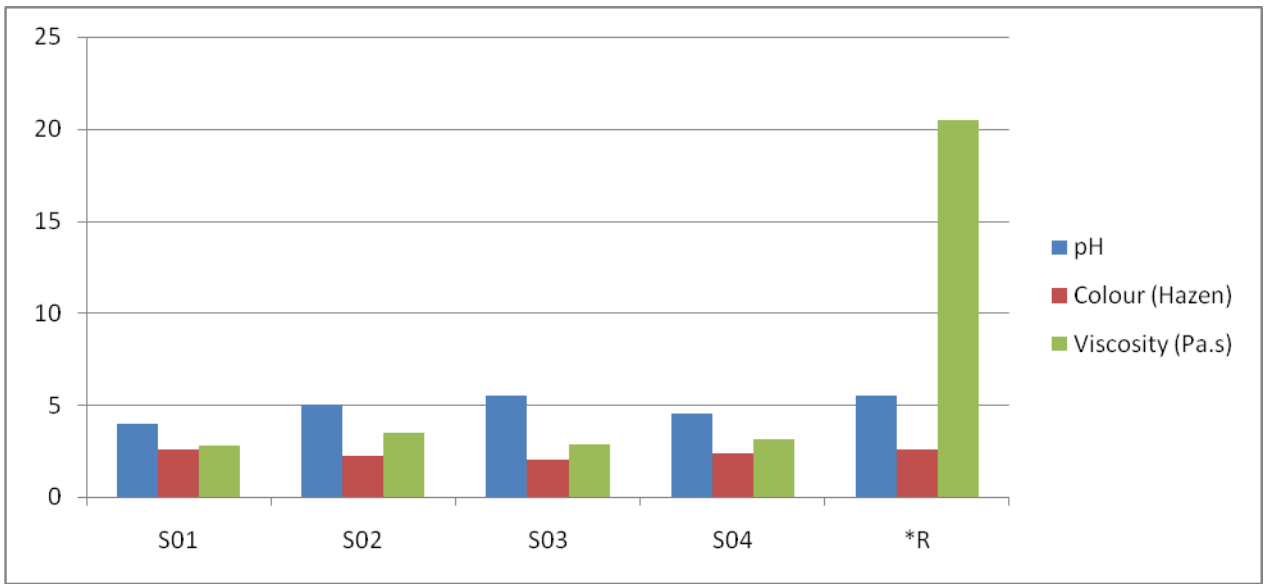

Fig-4: Rheological Properties, Colours and pH of Salad Creams

Table-7.0: Mean Scores of Sensory Evaluation of the Salad Cream Formulations

	Samples			
Panelist	**S01**	**S02**	**S03**	**S04**
Flavour	4.6	6.6	6.4	6.6
Taste	4.2	6.8	6.8	6.6
Aroma	4.4	7.2	6.8	6.6
Texture	6.2	4.6	6.8	4.2
Colour	4.3	4.5	5.0	5.0
Overall Acceptance	4.7	5.9	6.0	5.8

There was no significant difference among the samples at 5% (0.05) Significance level. From Table 7.0, the overall acceptance showed that sample S01, which has mean score 4.7, was the best of the seven salad creams produced while samples S02 (5.9) and S07 (5.8) were the inferior. Arranging the samples in decreasing order of preference gave:S01 (4.7), S04(5.8), S02,(5.6), S03 (6.0). This result is depicted in a Bar Chart in Fig. 5.

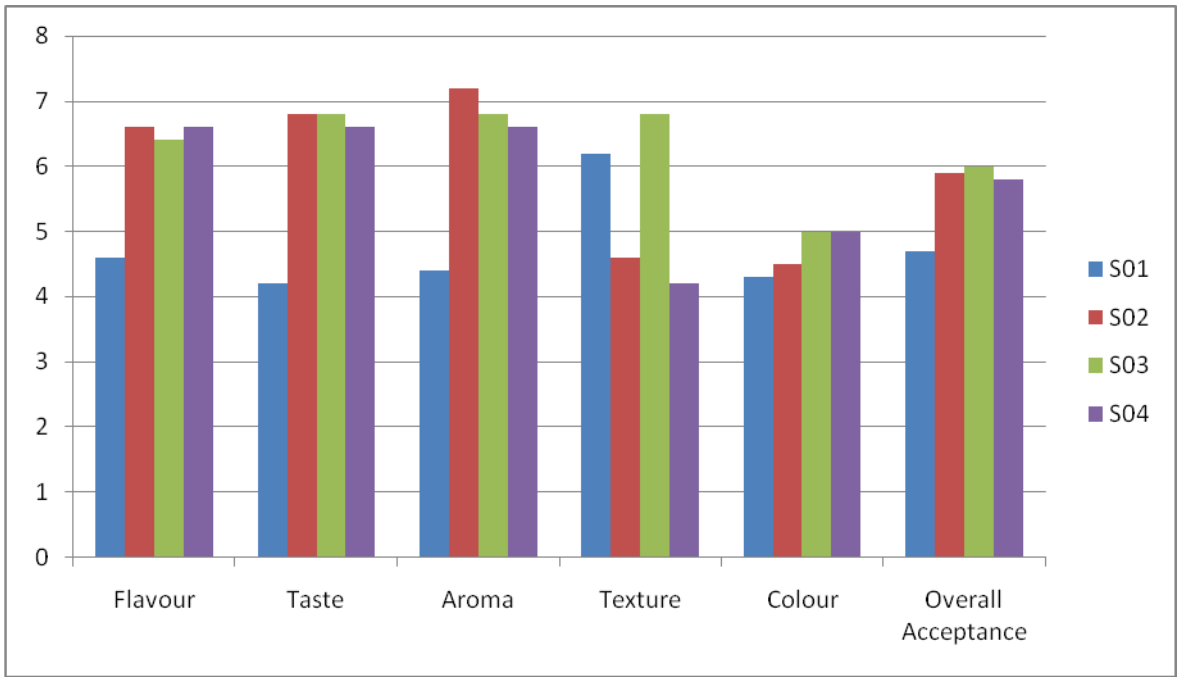

Fig-5: Mean Scores of Sensory Evaluation of the Salad Cream Formulations

CONCLUSION

From the discussion above, the chemical analysis of the four formulated salad creams showed that a nutritious salad cream could be produced from Refined Bleached Deodorised Palm Kernel oil (RBDPKO), Refined Bleached Deodorised Palm oil (RBDPO), garlic, ginger, white onions, salt, sugar, whole egg and ethanoic acid. The data presented in the sensory evaluation showed that an acceptable salad cream can be made from these locally available

raw materials. Preservation of this food condiment under an unfavourable temperature condition can lead to break down or separation of emulsion, which will in turn reduce its shelf life and makes it unpalatable. Therefore, formulation of this widely consumed food condiment from the locally available raw materials will make it readily available and at an affordable rate.

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