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Research Article

Investigation of Factors Affecting Textural Properties of Chewing Gum and Bubble Gum and Changes during Storage

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ABSTRACT

Textural properties of chewing gum and bubble gum are undoubtedly a key product attributes for consumption. However know about number of the various ingredients in these gums alter the textural properties. Consequently, defining the textural properties & understanding the importance for maintaining the product quality and shelf life of the finished products are investigated. The standard operating procedure for important textural parameters in different types of products like hardness and stickiness for bubble gum, crunchiness for coated pellets, hardness for centre filled gums & chewing gum sticks and tensile strength for lollipops are standardized. The changes in above textural parameters in all the products are measured during the stability studies performed at refrigerated, ambient& stressed conditions. Under stressed conditions, hardness of the product was decreased due to moisture increase for bubble gum &chewing gum stick. At the same conditions, hardness of centre filled gum increased due to moisture loss. The results obtained from moisture & texture analysis, sensory evaluation, the expected shelf life given to the products from 9 months to 12 months for coated pellets, other products shelf life unchanged during the studies.

Keywords: *Texture, Bubble Gum, Chewing Gum, Natural, Flavours*

INTRODUCTION

Texture received little attention until the second half of this century. The first attempts to list components of texture started with Smith (1947) and Kramer (1955. The first important textural term was 'hardness'. Changes in thickness are usually associated by changes in viscous behavior of food materials (Malcolm C. Bourne). Chewing gum is defined as "product made from natural or synthetic gum base containing flavours, sweeteners (nutritive or non-nutritive) aroma compounds & other additives" (FSSAI, 2006). Chewing gum is a "A sweet made by using gum chicle or modern synthetic chewing gum base which could be chewed indefinitely" IS (Indian standard).

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confection made from natural or synthetic gum base containing flavours sweeteners (nutritive or non-nutritive), aroma compounds and any other appropriate additivesCodex (2014). Chewing gum with the gum base being strong, elastic enough to stretch and form a bubble when filled with air (Codex).

Objectives

1. To study the textural properties of the different types of the gum products manufactured by Wrigley India pvt. Ltd.
2. Standardize the operating procedure of texture analyzer for the different products like Pellets, Bubble gum, Chewing gum stick, Centre filled gum, Lollipop.
3. To evaluate the textural changes in the products during storage period under the following storage conditions

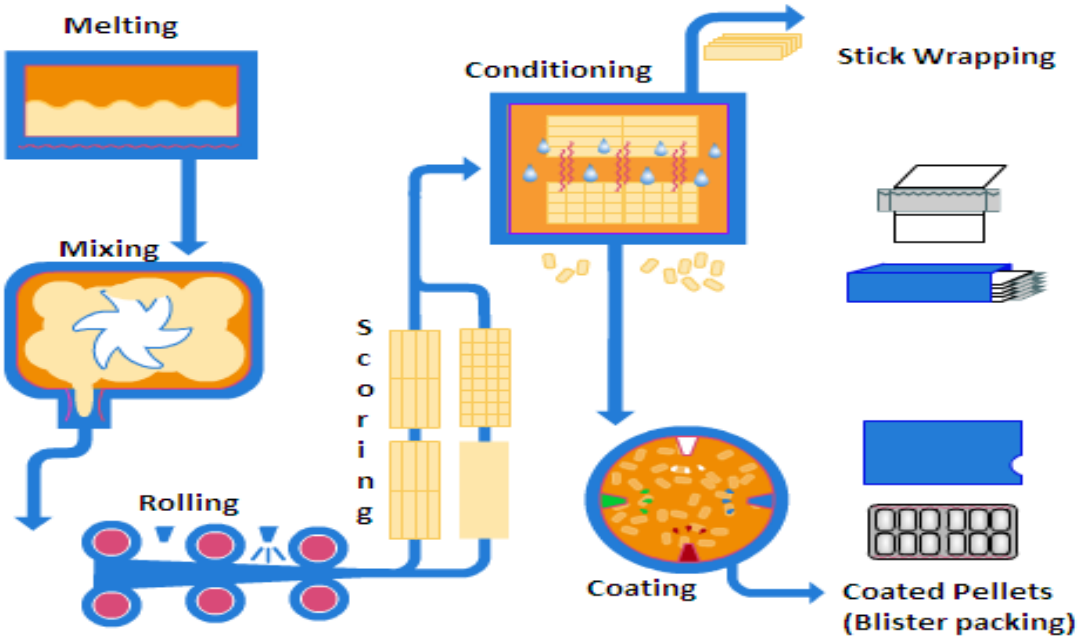
- Control condition,
- Ambient temperature,
- Stressed conditions (under 45^0c & 85% RH).

4. To predict the expected shelf life for all the products by evaluating the sensory parameters during above mentioned storage periods.

MATERIALS AND METHODS

Manufacturing of Chewing gum

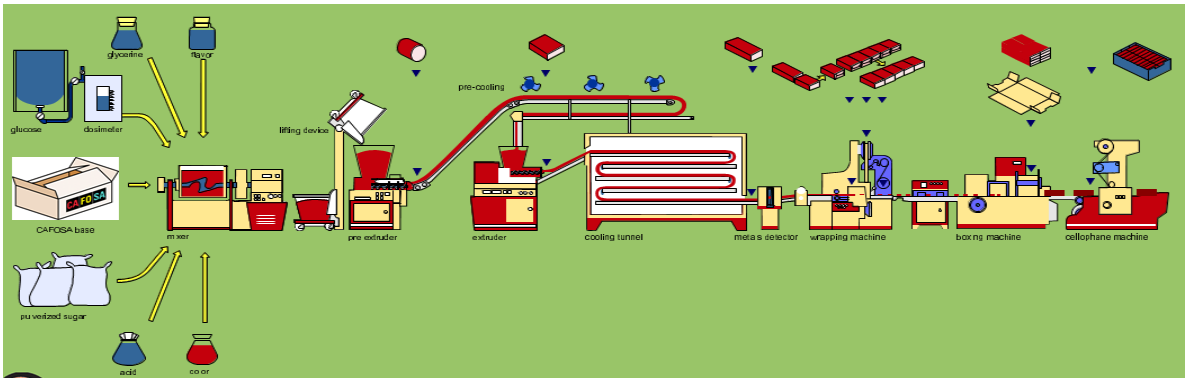
Chewing gum is made by melting the gum base at a temperature ranging between 70ºC - 120ºC.The molten gum base is mixed with a liquid plasticizer with or without an emulsifier for a targeted amount of time (2 to 8 minutes). Mixing the gum base with sweeteners, flavours, colour & other ingredients. After complete mixing of the ingredients, pass the gum through rollers to gradually reduce the thickness of gum by adding the powdered sugar, followed by roller, gum passes through a scorer to cut gum into desired shape & size. Conditioning of the gum should done to get right consistency of gum. If the product coated pellets then gum sent for coating **(**sugar/ sugar free coating). If the product is chewing gum stick after conditioning it will directly sent to wrapping section (stick packing). (Gwendolyn Graff).



Bubble gum processing

The molten bubble gum base is mixed with a liquid plasticizer with or without an emulsifier for a targeted amount of time (2 to 8 minutes). About 2/3rd of the sugars along with coloring agents are then added to the mix and stirred for

another 1 to 4 minutes. A slow mixing process is subsequently continued with the addition of the remaining sugar ingredients followed by addition of flavoring agents for 1 to 4 minutes. The final step consists of addition of fillers, humectants as well as antioxidants with further mixing for 1 to 4 minutes. The resultant gum mixture is then typically rolled to form thin ribbons which are coated with finely ground sugar powder to enhance the flavor as well as to keep the gum from sticking to the rollers cut into pieces& wrap it.



Measurement of Textural properties for the different products

Table 1. Texture measurement properties for different products

S. No	Product type	Probe	Principle of the test	Property measured
1	Bubble gum	P/4 P/0.5	Penetration Stickiness	Hardness Stickiness
2	Coated pellets(Sugar/ Sugar free)	P/4	Penetration	Crunchiness, Hardness
3	Bubble gum with jelly (JOT)	P/4 P/0.5	Penetration Stickiness	Hardness Stickiness of the jelly
4	Centre filled gum	P/4	Penetration	Hardness
5	Chewing gum Stick	P/4 3 point bend rig	Penetration Bending	Hardness Strength & flexibility
6	Compressed tablets	P/50	Compression	Hardness

RESULTS AND DISCUSSION

Chewing gum (Stick)

The moisture contentis analysed for chewing gum stick at stressed conditions during storage. The moisture content was increased, while as hardness was gradually decreased from 0^{th} day to 19^{th} day.

Table 2. Moisture content & hardness for the chewing gum stick during storage at stressed conditions

	Date	M.C%	Hardness (g)
1	**Zero day**	**2.0458**	**709.472**
2	3^{rd} day	2.8175	598.717
3	5^{th} day	2.7802	595.374
4	**7^{th} day**	**2.5189**	**690.403**
5	9^{th} day	2.4296	603.124
6	11^{th} day	2.9445	576.253
7	**13^{th} day**	**2.602**	**486.399**
8	15^{th} day	2.9935	483.309
9	17^{th} day	2.9554	443.615
10	**19^{th} day**	**3.3021**	**335.63**

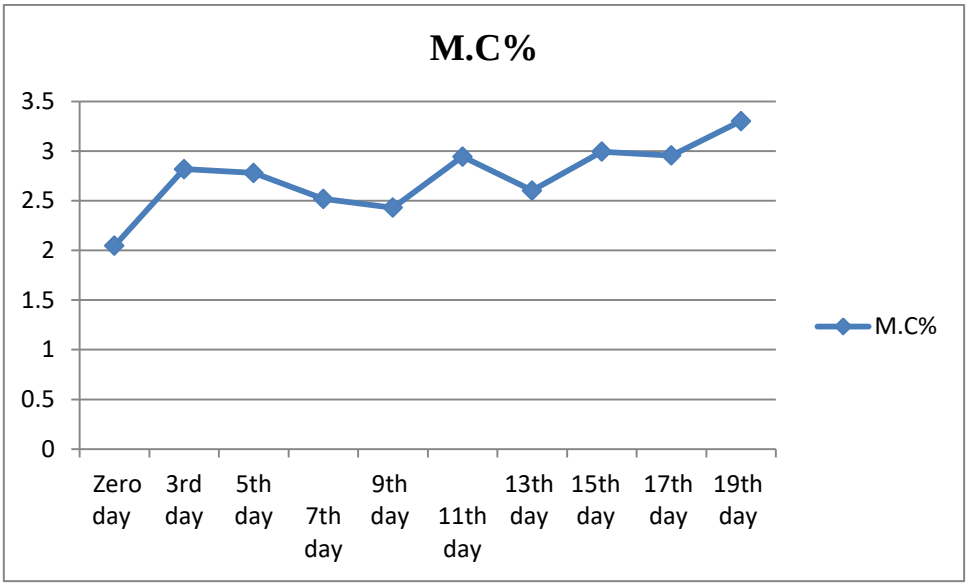


Fig 1. Graph of chewing gum stick for moisture stressed conditions

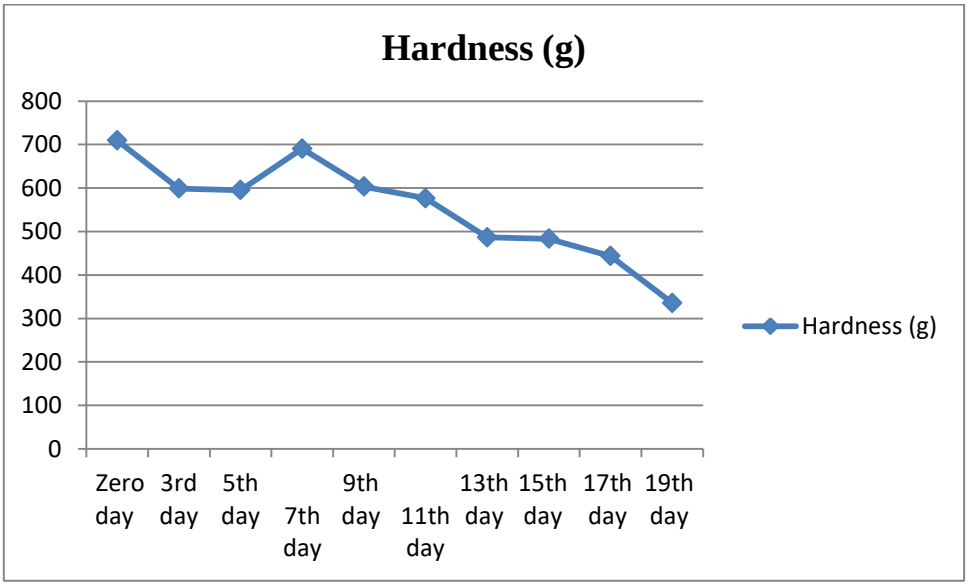


Fig 2. Graph of chewing gum stick for hardness stressed conditions

Sensory observations of the chewing gum stick at stressed conditions

The sensory analysis was evaluated for the chewing stick from 0th day to 19th day. The texture & overall acceptability was good up to 13th day.

Table 3. Observations of the chewing gum stick atstressed conditions

Parameters	0 day	7th day	13th day	19th day
Colour	Good	Acceptable	Acceptable	Not Acceptable
Flavour	Good	Acceptable	Acceptable	Not Acceptable
Taste	Good	Acceptable	Acceptable	Not Acceptable
Texture	Good	Acceptable	Acceptable	Not Acceptable
OverallAppearance	Good	Acceptable	Acceptable	Not Acceptable

Bubble gum (Chunk)

The moisture content is analysed for bubble gum at stressed conditions during storage. The moisture content was increased, while as hardness was gradually decreased from 0th day to 19th day.

Table 4. Moisture content, hardness & stickiness for the bubble gum during storage at stressed conditions

S.NO	Days	M.C (%)	Hardness (g)	Stickiness (g)
1	**Zero day**	**3.41**	**543**	**781**
2	3rd day	3.47	745.63	713
3	5th day	3.75	727	791
4	**7th day**	**4.08**	**729**	**761**
5	9th day	4.09	698	732
6	11th day	3.97	711	646
7	**13th day**	**4.18**	**697**	**732**
8	15th day	4.40	667	698
9	17th day	4.24	686	663
10	**19th day**	**4.35**	**630**	**771**

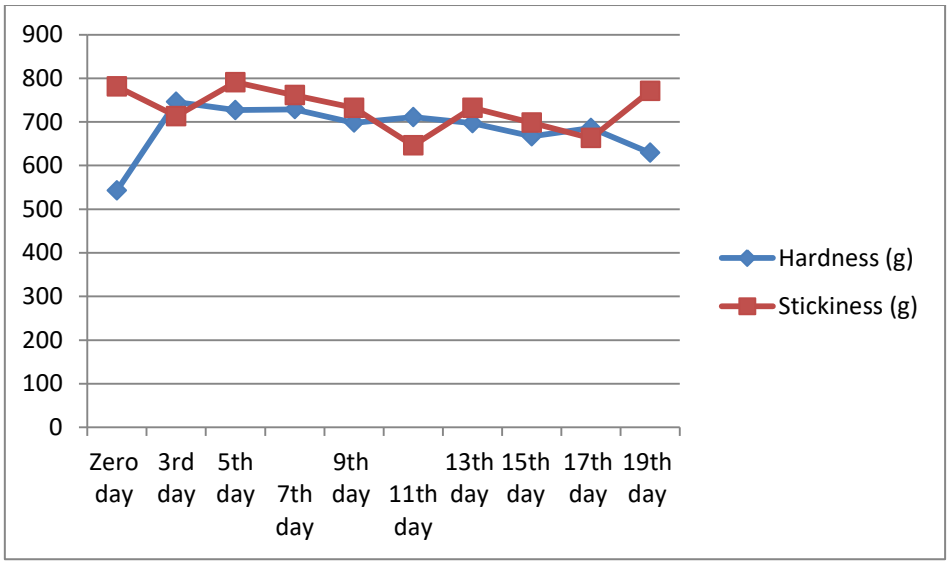


Fig 3. Graph of bubble gum for hardness & stickiness stressed conditions

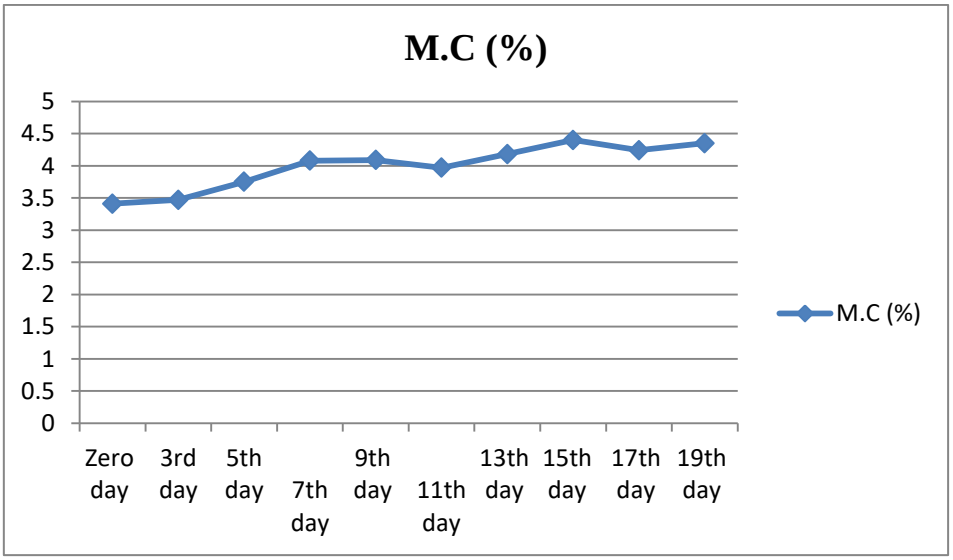


Fig 4. Graph of bubble gum for moisture stressed conditions

Sensory observations of the bubble gum at stressed conditions

The sensory analysis was evaluated for the bubble gum from 0th day to 19th day. The texture & overall acceptability was good up to 19th day.

Table 5. Observations of the bubble gum at stressed conditions

Parameters	0 day	7th day	13th day	19th day
Colour	Good	Acceptable	Acceptable	Colour changed (light to dark colour) but Acceptable
Flavour	Good	Acceptable	Acceptable	Acceptable
Taste	Good	Acceptable	Acceptable	Acceptable
Texture	Good	Acceptable	Acceptable	Acceptable
OverallAppearance	Good	Acceptable	Acceptable	Not Acceptable

Bubble gum readings kept at refrigerated conditions

Table 6. Readings of the bubble gum at refrigerated temperature

Days	M.C (%)	Hardness (g)	Stickiness (g)
Zero day	3.41	543	781
7th day	3.58	462	857
13th day	4.31	403	891
19th day	4.28	418	881

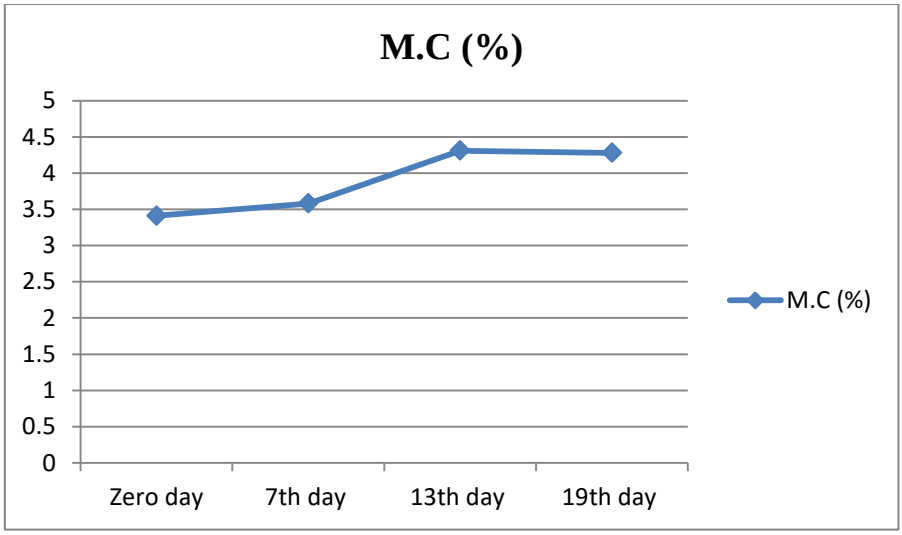


Fig 5. Graph of bubble gum for moisture at refrigerated temperature

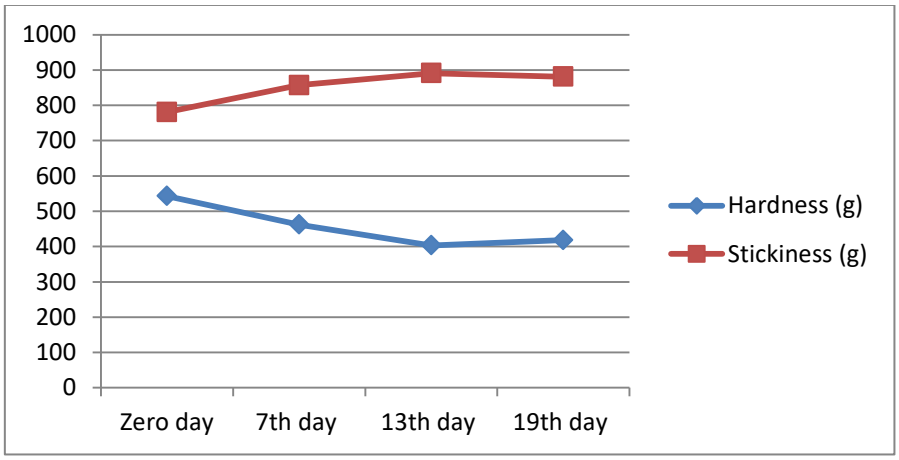


Fig 6. Graph of bubble gum for hardness & stickiness at refrigerated temperature

Bubble gum readings kept at room temperature

Table 7. Readings of the bubble gum at Room temperatures

Days	M.C (%)	Hardness (g)	Stickiness (g)
Zero day	3.41	543	781
7th day	3.58	464	785
13th day	4.2	420	817
19th day	4.29	412	859

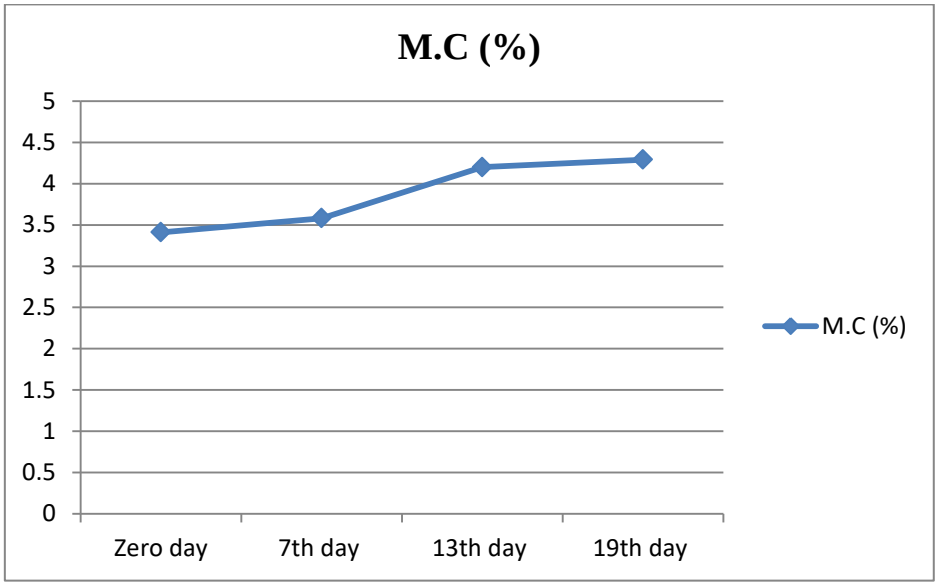


Fig 7.Graph of bubble gum for moisture at room temperature

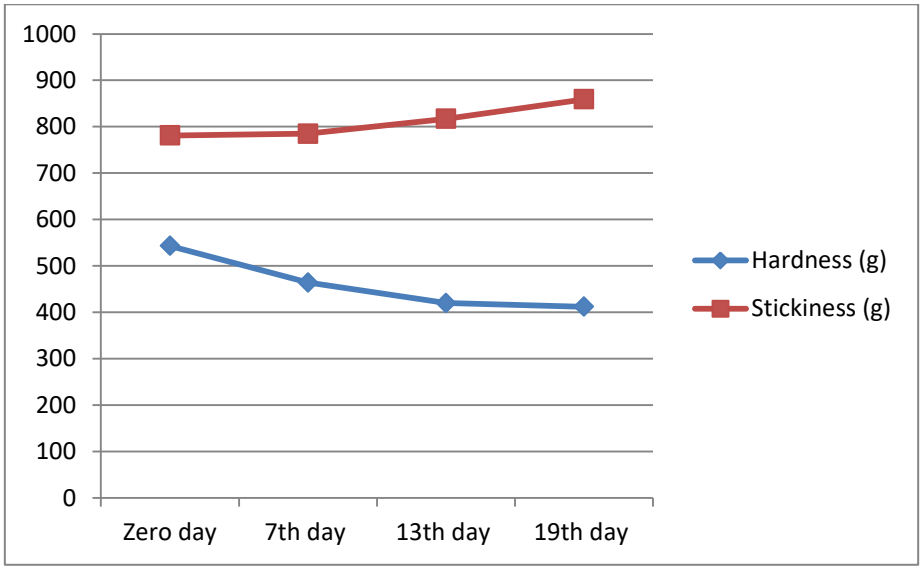


Fig 8. Graph of bubble gum for hardness & stickiness at room temperature Zero day

Observations

- Samples are analysed at stressed conditions and found not good after 25th day as compared to the control samples.
- Up to 19th day sample sensory & textural properties of the product was found good, after 19th day colour became very dark, flavour changes observed.
- Product absorbed more moisture, it became sticky & sticking to the wrapper, as well as sweetness also decreased.
- So, shelf life of the bubble gum cannot be extended further.

- **Product textural parameters**

According to the above study got the standard textural parameters for the different products are-

- For bubble gum hardness - 5mm
- For chewing gum Stick hardness - 5mm

CONCLUSIONS

Texture analysis is a well-established technique for evaluating the mechanical & physical properties of raw ingredients, structure of food, and pre & post quality control checks. Texture can be measured easily by mechanical methods in units such as force. In texture testing, standard tests such as compression, tension, hardness, crispiness, softness, springiness, tackiness, and other properties of the foods. Texture analysis is used for the measurement & control of process variations such as temperature, humidity & processing time. (Glycerine: an overview, 1990).

The standard operating procedure for important textural parameters in different types of products like hardness and stickiness for bubble gum, crunchiness for coated pellets, hardness for centre filled gums & chewing gum sticks and tensile strength for lollipops are standardized. The changes in above textural parameters in all the products are measured during the stability studies performed at refrigerated, ambient & stressed conditions. (JH Hotchkiss).

Gum products show less textural changes at low temperatures (controlled conditions & ambient conditions) it is almost negligible, at higher temperatures (at stressed conditions etc.) products texture changes from week to week. Products like bubble gums lose its soft texture at higher temperatures; chewing gums like coated pellets lost its crunchiness & colour. Hard boiled confections like candy, lollipop became like graininess & surface bloom.

The results of moisture & texture analysis, sensory evaluation for all the products are studied. With the few modifications in formulation, monitoring of textural changes & with keen observations in shelf life studies, 2 varietiesof coated pellets (i.e. Spearmint & mixed fruit flavored) are approved for the shelf life extension from 9 months to 12 months. It is going to be implemented in future.

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Conflict of Interest

The author(s) declares no conflict of interest.

Author Contribution

All authors contributed equally to establishing the topic of the research and design experiment.

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