

***GLUCOSE-GALACTOSE
SYRUP APPLICATIONS IN
DIFFERENT FOOD
PRODUCTS***



Glucose-Galactose Syrup Applications in Different Food Products

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GLUCOSE-GALACTOSE SYRUP APPLICATIONS IN DIFFERENT FOOD PRODUCTS

Whey disposal represents serious problem from both economical and an environmental point of view and cannot be directly discharged without an adequate treatment. Therefore, the aim of this project was the valorization of whey and utilization of whey by-product, lactose, for producing glucose-galactose syrup (GGS) and applying it in various food products.

GGS is made by removing excess proteins and minerals from the whey with special filtration system processes. Then the obtained lactose solution is hydrolysed into solution containing glucose and galactose which after evaporation gives nice yellow honey-like syrup with sweet, slightly salty and sour taste.

GGS offers a possible alternative to sucrose and glucose-fructose syrup in confectionery and bakery products or preparing ice cream. Different model recipes have been tested, syrup concentrations optimised, and different properties (*e.g.*, rheological, sensorial) of model products evaluated. Depending on the final product and the aimed sweetness level, the sucrose can be replaced fully or partially. The main advantages of using GGS would be higher moisture content which gives softer texture for bakery products. Also, the sweetness in final products is more balanced and additional salt from original recipes can be left out. GGS in ice creams can contribute to caramel taste, viscous and foamy texture.

Following the applicability of GGS in various recipes for cookies, cakes, and bakery products were demonstrated. Additionally, a base recipe for vanilla ice cream is brought out. The recipes are given for 100 – 500 g or up to 2 – 4 kg of final products, which can be easily converted to larger scale.

Nutritional facts of 100 g of GGS:

Calories: 275 kcal

Fat: 0 g

Total carbohydrates: 65-68 g



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Perfect Coconut Macaroons

Final product is golden brown, slightly crunchy on the outside, and soft and chewy on the inside

INGREDIENTS

- 163 g egg whites
- 193 g flaked coconut
- 52 g granulated sugar
- 52 g GGS
- 27 g all-purpose flour



INSTRUCTIONS

1. Mix all ingredients together
2. Use tablespoon or pipe to form mounds onto prepared baking sheets
3. Bake at 180°C for 10 – 12 min or until they start to get colour

Soft Oatmeal Cookies

These oatmeal cookies are not too sweet but super soft, thick, and loaded with oats for great snack

INGREDIENTS

- 50 g softened butter
- 22 g granulated sugar
- 65 g GGS
- 90 g eggs
- 125 g rolled oats
- 33 g all-purpose flour



INSTRUCTIONS

1. Cream together the butter, granulated sugar and GGS until well combined
2. Add eggs one at the time until fully combined
3. Slowly mix in the oats and flour
4. Scoop the cookie dough and drop onto prepared baking sheets, roll into balls and gently press down to flatten
5. Bake at 180°C for 10 – 12 min or until the edges of the cookies are lightly golden brown and the top is set

Generous Chocolate Chunk Cookies

The cookies are crumbly, slightly chewy at the edges, and loaded with generous chocolate chunks

INGREDIENTS

- 85 g softened butter
- 42 g granulated sugar
- 2.5 g vanilla sugar
- 22 g GGS
- 130 g all-purpose flour
- 3.70 g baking powder
- 50 g milk chocolate



INSTRUCTIONS

1. Cream together the butter, granulated sugar, and vanilla sugar until well combined
2. Add GGS and mix more until fully combined
3. Slowly mix in flour-baking powder mixture, and large chocolate chunks
4. Scoop the cookie dough and drop onto prepared baking sheets, roll into balls
5. Bake 175°C for 10 – 15 min or until the cookies are lightly golden brown

Deep Dark Chocolate Cookies

Cooled down cookies are tender biscuits rich in chocolate

INGREDIENTS

- 100 g dark chocolate
- 22 g butter
- 75 g GGS
- 100 g eggs
- 75 g granulated sugar
- 50 g all-purpose flour
- 8 g cocoa powder



INSTRUCTIONS

1. Melt the chopped chocolate with butter over water bath and then mix in the GGS
2. Beat the eggs and granulated sugar until thick and pale
3. Fold in cooled down chocolate-butter-GGS mixture
4. Add flour and cocoa powder and slowly mix until well combined
5. Scoop small mounts onto prepared baking sheets and bake at 175°C for 10 min

Sandwich Cookies with Cream Cheese Filling

*Cookie sandwiches are perfect combination of
flavour and texture – crispy chocolate cookies and
fluffy vanilla cream*

INGREDIENTS

- 200 g Deep Dark Chocolate Cookies
- 100 g cream cheese
- 40 g butter
- 27 g confectioners' sugar
- 1.7 g vanilla sugar



INSTRUCTIONS

1. Beat cream cheese and butter until smooth
2. Add vanilla and slowly add powdered sugar until you reach your desired consistency
3. Pipe cream cheese filling onto the bottom of half the Deep Dark Chocolate Cookie and sandwich it with another cookie

Crunchy Gingerbread Cookies

The gingerbread cookies are nicely spiced with wonderfully buttery crisp texture

INGREDIENTS

- 63 g GGS
- 43 g grounded sugar
- 7.5 g gingerbread spice mix
- 63 g butter
- 30 g eggs
- 150 g all-purpose flour
- 2 g baking soda



INSTRUCTIONS

1. Heat GGS, sugar, and spice mix in a saucepan until boiling
2. Add chopped butter, mix and cool down the mixture
3. Add eggs one by one to the cooled down mixture while beating
4. Add baking soda and flour mix slowly to the wet ingredients
5. Mix and knead the dough and pack it into food film. Keep the dough refrigerated until the next day
6. Roll the dough on lightly floured work surface, cut the shapes, and bake at 200°C for 6 – 9 min

Dark Chocolate Brownies

*This brownie is rich in sweet chocolate cocoa flavour
balanced with crunchy walnuts*

INGREDIENTS

- 100 g butter
- 100 g dark chocolate
- 50 g GGS
- 90 g eggs
- 50 g granulated sugar
- 50 g all-purpose flour
- 50 g walnuts
- 1.25 g vanilla sugar



INSTRUCTIONS

1. Combine butter and chocolate. Heat over water bath until melted and smooth
2. Add GGS and mix
3. Beat the eggs and granulated sugar until thick and pale
4. Add slowly chocolate-butter-GGS mixture to the beaten eggs
5. Add in flour, chopped walnuts, and vanilla sugar and mix until very well combined
6. Pour the batter into prepared baking pan and bake at 170°C for about 30 min or until the wooden pick comes out with moist crumbs still attached. Do not overbake.

Sweet and Crunchy Granola Bars

Ideal portable breakfast or snack – simple, perfectly sweet and crunchy

INGREDIENTS

- 30 g GGS
- 24 g roughly chopped dried cranberries or raisins
- 12 g crushed nuts
- 24 g regular or instant whole-grain oat flakes
- 9 g puffed rice



INSTRUCTIONS

1. Mix all dry ingredients together
2. Add GGS and mix until combined
3. Shape suitable granola bars or spread the granola in the prepared pan and firmly pat down
4. Let it rest for 5 min at room temperature in baking paper
5. Remove the baking paper around the bars and bake at 130°C for 10 min
6. If the mixture was spread on baking tray, then chop it to smaller pieces while still warm
7. Cool down the bars

Incredibly Moist Carrot Cake

This carrot cake is perfectly moist and tender with ultra-creamy cream cheese frosting



INGREDIENTS

Carrot Cake

- 140 g eggs
- 85 g granulated sugar
- 5 g vanilla sugar
- 90 g butter
- 85 g GGS
- 150 g carrot
- 120 all-purpose flour
- 10 g baking powder
- 2.5-5 g cinnamon

Cream Cheese Frosting

- 100 g cream cheese
- 50 g butter
- 100 g confectioners' sugar
- 2.5 g vanilla sugar

INSTRUCTIONS

To make carrot cake

1. Beat the eggs, granulated sugar, and vanilla sugar until thick and pale
2. Add GGS to melted butter and mix
3. Add grated carrots, melted butter and GGS mixture to the beaten eggs and mix until well combined
4. Whisk together the flour, baking powder, and cinnamon. Pour the wet ingredients into the dry ingredients and mix just combined, making sure not to over mix the batter
5. Pour the cake batter to prepared cake pan and bake at 200°C for 20 – 30 min or until the wooden pick comes out clean.
6. Allow to cool down before frosting

To make the cream cheese frosting

7. Beat cream cheese and butter until smooth
8. Add vanilla and slowly add powdered sugar until you reach your desired consistency
9. Frost the top of the cake and add toppings of choice if desired

Raisin Bundt Cake

*Simple, but delicious cake loaded with wonderful
raisin dots*

INGREDIENTS

- 220 g butter
- 110 g granulated sugar
- 110 g GGS
- 180 g eggs
- 4.2 g vanilla sugar
- 150 g raisins
- 370 g all-purpose flour
- 6.3 g baking powder
- 120 g kefir or buttermilk



INSTRUCTIONS

1. Beat softened butter, sugar, and vanilla until light and fluffy
2. Add GGS and mix until well combined
3. Add eggs, one at a time, beating well after each addition
4. Combine flour, raisins, baking powder
5. Add flour mixture and buttermilk alternately to butter mixture
6. Pour batter into a Bundt pan coated with butter
7. Bake at 170°C for 1 hour or until a wooden pick inserted in a centre comes out clean
8. Cool in a pan and then in a wire rack about 20 min

High Fiber Bundt Cake

Delicious and moist cake with “secret” ingredient that boost the nutrition

INGREDIENTS

- 250 g butter
- 90 g granulated sugar
- 80 g GGS
- 150 g eggs
- 6 g vanilla sugar
- 60 g raisins
- 267 g all-purpose flour
- 89 g Elsavie fiber mixture (e.g., feel good inside)
- 7.5 g baking powder



INSTRUCTIONS

1. Beat softened butter, sugar, GGS, and vanilla until light and fluffy
2. Add eggs, one at a time, beating well after each addition
3. Combine flour, fiber mixture, raisins, baking powder
4. Add flour mixture to the butter mixture
5. Pour batter into a Bundt pan coated with butter
6. Bake at 160 °C for 40 – 60 min or until a wooden pick inserted in a centre comes out clean
7. Cool in a pan and then in a wire rack about 20 min



<https://www.elsavie.com/feel-good-inside/>

Orange Pound Cake

This Orange Pound Cake is moist, and tender flavoured with fresh orange juice and zest

INGREDIENTS

- 90 g butter
- 85 g sugar
- 85 g GGS
- 180 eggs
- 50 g of orange juice
- 212 g all-purpose flour
- 4.2 g baking powder
- 100 g kefir or buttermilk
- Zest from 1 orange



INSTRUCTIONS

1. Beat softened butter and sugar until light and fluffy
2. Add GGS and mix until well combined
3. Add eggs, one at a time, beating well after each addition
4. Add orange juice and zest
5. Combine flour and baking powder
6. Add flour mixture and buttermilk alternately to butter mixture
7. Pour batter into a 1.5 L pan coated with butter
8. Bake at 170°C for 1 hour or until a wooden pick inserted in a centre comes out clean
9. Cool in a pan and then in a wire rack about 20 min

Seeded Multigrain Sandwich Bread

This bread is nice and fluffy combined with whole grains and seeds

INGREDIENTS

- 230 g whole wheat flour
- 115 g rye flour
- 400 g wheat flour (type 550)
- 60 g compressed yeast
- 10 g salt
- 20 g GGS
- 1130 g water
- 30 g butter
- 110 g sunflower seeds
- 6 g cumin seeds



INSTRUCTIONS

1. Roast sunflower seeds
2. Whisk all flours together
3. Add warm water to the compressed yeast, salt, and GGS and combine together
4. Add 1/3 of the flour mixture and stir until smooth
5. Add butter and gradually mix enough remaining flour and the seeds to form a smooth, moist dough
6. Cover the bowl and let it rise at 35°C (RH 55 %) for 30 – 40 min
7. Divide the dough ball into 350 g or 600 g of loaves and place into oil-sprayed pans
8. Let all loaves for rise at 35°C (RH 55 %) for 30 min or until double in size
9. Bake at 200°C for 30 – 40 min

Pumpkin Seed Spelt Bread

Pumpkin Seed Spelt Bread is golden brown and crusty on the outsides and perfectly dense and nutty flavoured on the inside

INGREDIENTS

Pre-dough

- 620 g wheat flour (type 550)
- 155 g spelt flour
- 47 g compressed yeast
- 88 g GGS
- 620 g water

Dough

- 543 g wheat flour (type 550)
- 78 g spelt flour
- 30 g salt
- 125 g water
- 46 g butter or margarine
- 155 g chopped pumpkin seeds



INSTRUCTIONS

To make pre-dough

1. Add 250 g of warm (30°C) water to GSS and compressed yeast. Mix together
2. Add all the flours and rest of the water, and combine for 15 min
3. Cover the bowl and let it rise at 35°C (RH 55 %) for 55 min.

To make dough

4. Add rest of the flours from the dough ingredients, melted margarine, salt, pumpkin seeds, and water
5. Mix the dough for 15 min
6. Divide the dough ball into 350 g or 600 g of loaves and place into oil-sprayed pans
7. Let all loaves for rise at 35°C (RH 55 %) for 20 min or until double in size
8. Bake at 200°C for 25 min

Sesame Seed Buns

These are soft and tender dinner buns sprinkled with golden sesame seeds

INGREDIENTS

Pre-dough

- 133 g wheat flour (type 550)
- 142.7 g water
- 23.3 g compressed yeast

Dough

- 267 g wheat flour (type 550)
- 50 g butter or margarine
- 80.7 g GGS
- 35 g eggs
- Beaten egg for brushing
- Sesame seeds to sprinkle



INSTRUCTIONS

To make pre-dough

1. Add warm (30°C) water to compressed yeast. Mix together
2. Add all flour and combine for 5 – 7 min
3. Cover the bowl and let it rise at 35°C (RH 55 %) for 30 min

To make dough

4. Add rest of the flour from the dough ingredients, margarine, GGS, and eggs
5. Mix the dough for 5-7 min and let it rise at 35°C (RH 55 %) for 45 min
6. Divide the dough ball into 38 g of pieces. Shape pieces into rolls and place on a baking sheet
7. Let all buns for rise at 35°C (RH 55 %) for 20 – 25 min
8. Brush the rolls with beaten egg and sprinkle with sesame seeds
9. Bake at 200 – 210°C for 15 min

Poppy Seed Braid

This gorgeous Poppy Seed Braid is simple, but yet stunning

INGREDIENTS

- 900 g wheat flour (type 550)
- 50 g compressed yeast
- 50 g butter
- 70 g GGS
- 10 g salt
- 550 g water
- 30 g poppy seeds



INSTRUCTIONS

1. Add warm (30°C) water to compressed yeast. Mix together
2. Add 450 g flour, salt, GGS and combine
3. Add rest of the flour (450 g) and softened butter, poppy seeds and mix until well combined
4. Let the dough rise at 35°C (RH 55 %) for 35 min
5. Divide dough into 2 and then into 3 roughly equal pieces. Roll each piece into a rope and braid the ropes
6. Place the braids on a baking sheet and let rise at 35°C (RH 55 %) for 20-25 min
7. Brush the rolls with beaten egg and sprinkle with poppy seeds
8. Bake at 200 – 210°C for 20 – 25 min

Rye Bread

Rye Bread made with hemp seeds tastes delicious and is a wonderful, wholesome change for sandwiches and toast, or just served with butter along with a meal

INGREDIENTS

Rye sourdough starter

- 300 g rye flour
- 42 mg starter culture
- 300 g water

Sourdough

- 520 g rye sourdough starter
- 700 g rye flour
- 23 g compressed yeast
- 778 g water
- 86.7 g GGS
- 80 g hemp seeds
- 100 g sunflower seeds



INSTRUCTIONS

To make rye sourdough starter

1. Combine all components and let it rest at 30°C for 24 hours

To make sourdough

2. Add flour, yeast, GGS, seeds, and water to the starter. Mix for 10 min
3. Ferment it for 1 hour at 35°C (RH 55 %)
4. Divide the dough into 600 g of loaves and place into oil-sprayed pans
5. Let all loaves for rise at 35°C (RH 55 %) for 30 min
6. Bake at 220°C for 10 min, 200°C for 10 min, and 180°C for 15 min

Vanilla Ice Cream

Rich, creamy, smooth, and delicious vanilla ice cream with slight caramel notes

INGREDIENTS

- 2375 g water
- 507 g sucrose
- 480 g butter
- 313 g GGS
- 16 g stabilizer
- 309 g skimmed milk powder



INSTRUCTIONS (semi-industrial scale)

1. Weigh dry powders and add a small amount of water. Mix well to avoid clump formation.
2. Add remaining water and GGS
3. Add melted butter to the mix at 40C
4. Heat the mixes to 65C, pre-homogenize for 1 min and homogenize with a two-stage homogenizer at pressures 12 MPa and 18 MPa
5. Pasteurize the mixes at 78°C and left to ripen overnight at 4°C
6. The next day homogenize the mixes quickly, weigh and re-add evaporated water
7. Freeze ice-cream using scraped-surface barrel freezer at a set draw temperature -4.5 ± 0.5 °C.
8. After the ice-cream has been hardened (at -40 °C overnight), held it at -18 °C