Note-by-Note Dish

Orange cocktail

	Zeting Qin

1 Materials and Method

1.1 Equipment

The following equipment was used in procedure:

Equipment	Specification	Pictures

Digital precision scale	Weighing ingredients to 0.01g accuracy	
Gas stove	Controlled heating of gel solutions	
Silicone moulds	Setting gel into dessert shapes	 
Silicone mat	Spreading methylcellulose solution for crisps	
Offset spatula	Spreading thin layers uniformly	
Convection oven	Baking methylcellulose crisps at 180 ℃	
Refrigerator	Setting gels at 4 ℃	
Hand whisk	Dispersing hydrocolloid powders	
Saucepan (500 ml)	Heating gel solutions	

Table 1 Equipment used in procedure

1.2 Final Dish overview

The final dish consists of two components: 1) a moulded citrus gel and 2) methylcellulose crisps. Both are constructed from pure compounds. No whole-ingredient extracts are used except as noted in the aroma compound specifications below.

Component 1—Moulded citrus gel

The citrus gel is an agar-kappa carrageenan system flavoured with a citrus-floral aroma compound blend dissolved in vodka as an ethanol carrier. The formulation was refined across four experimental sessions (see more details in logbooks in Appendices). Batch 300g. Serves 3 (100g per portion).

Compound	% w/w	g	Role	Description
Water (H_2O)	84%	252 g	Solvent	Tape water
Vodka 38% v/v (700 ml Vodka has 266 ml Ethanol)	10%	30 g	Aroma carrier / co-solvent	Istil 
Agar-agar (E406)	2%	6 g	Gelling agent	SpecialIngredients 
Kappa Carrageenan (E407)	0.2%	0.6 g	Gelling agent	Texturas 
Sucrose	3%	9 g	Sweetness /mouthfeel	gem 
Sodium Chloride (NaCl)	0.3%	0.9 g	Flavour enhancement	gem 

Citric acid (E330)	0.3%	0.9 g	Primary acidity	Louis Francois 
Malic acid (E296)	0.2%	0.6 g	Secondary acidity	msk 
Lemon natural flavouring: invert sugar, emulsifier: glycerin (E422), lemon natural extract	0.03%	30 mg	Aroma	Sosa 
Orange blossom natural flavouring: invert sugar, emulsifier: glycerin (E422), natural orange blossom extract	0.03%	30 mg	Aroma	Sosa 
Orange essential oil flavouring	0.02%	20 mg	Aroma	msk 
Yellow fat-soluble powder colour: E102 tartrazine	0.02%	20mg	Colouring	msk 
TOTAL	**100.0%**	**300.0 g**		

Table 2 Ingredients used for citrus gel

Procedure—Moulded citrus gel

Step 1 Dissolve aroma in vodka

Combine Lemon natural flavouring, Orange blossom natural flavouring and orange essential oil flavouring into the vodka. Stir until fully dissolved. These compounds are lipophilic — ethanol is the only effective solvent.

Step 2 Prepare aqueous base

Combine water, citric acid, malic acid, NaCl, and sucrose. Stir at room temperature until fully dissolved.

Step 3 Dissolve agar

Whisk agar and carrageenan into aqueous base. Heat to 90–95 °C over medium heat, stirring constantly for 5 mins. Do not boil aggressively.

Step 4 Add vodka-aroma fraction

Remove from heat. Cool to 70 °C then stir in the vodka mixture. Critical: above 78 °C ethanol and aroma compounds evaporate.

Step 5 Shape

Transfer to mould. Work quickly before agar sets (~40 °C).

Step 6 Set
Put in the blast chiller let it cool down.

Component 2—Methylcellulose crisps

The Methylcellulose crisps exploit the unique thermos-gelling property of methylcellulose that gels on heating and dissolve on cooling to produce crispy, zero-calorie wafer. Batch size: 100g. Yields around 8-10 crisps depending on shaping that serves 2 portions.

Compound	% w/w	g	Role	Description
Water (H_2O)	91.9%	91.9 g	Solvent	Tap water
Methycellulose (E461)	6%	6 g	Thermo-gelling agent	Sosa 
Sucrose	1.5%	1.5 g	Sweetness/ mouthfeel	gem 
Sodium Chloride (NaCl)	0.5%	0.5 g	Flavour enhancement	gem

				
Lemon natural flavouring: invert sugar, emulsifier: glycerin (E422), lemon natural extract	0.03%	30 mg	Aroma	Sosa 
Orange blossom natural flavouring: invert sugar, emulsifier: glycerin (E422), natural orange blossom extract	0.03%	30 mg	Aroma	Sosa 
Orange essential oil flavouring	0.02%	2 ml	Aroma	msk 
Bronze metallic powder colour	0.02%	20 mg	Colouring	msk 
TOTAL	**100.0%**	**100.0 g**		

Table 3 Ingredients used for methylcellulose crisp

Procedure—Methylcellulose crisps

Step 1 Dissolve aroma compounds

Combine Lemon natural flavouring, Orange blossom natural flavouring and orange essential oil flavouring into water.

Step 2 Prepare cold water base

Combine cold water, NaCl, sucrose. Stir until dissolved. Add the aroma mixture and stir well.

Step 3 Hydrate methylcellulose cold

Whisk methylcellulose powder into the mixture. Stir vigorously until fully dispersed. Refrigerate for 10 minutes to fully hydrate. Critical: do not add methylcellulose to warm water or it will clump immediately.

Step 4 Spread thin
Remove from fridge. Using spatula quickly spread the cold solution onto a silicone mat with baking tray in a very thin, even layer — 1–2 mm.

Step 5 Bake
Place in oven at 180 °C. Bake for 15 minutes. The methylcellulose will gel and set on heating, then dry into a crispy sheet.
Step 6 Cool and break
Remove from oven and allow to cool completely at room temperature — about 5 minutes. The sheet will be crispy and brittle. Break into shards.

1.3 Sensory evaluation method

During the development, a observation table was used to record sensory

descriptors with off-notes that indicated formulation problems requiring correction. A hedonic test is conducted with a panel of assessors who rated the dish across five sensory attributes — appearance, aroma, flavour, texture, and overall acceptability — on a five-point scale, where 1 represents extremely dislike and 5 represents extremely like.

Nutritional calculation method

Nutrition values calculated per 100g of each component using the standard compositional approach by multiplying the quantity of each ingredients by its known energy density using the Atwater conversion factors: protein 4kcal/g, carbohydrate 4 kcal/g, fat 9 kcal/g, alcohol 7 kcal/g, and dietary fibre 2 kcal/g (FAO, 2003). Reference values for ingredient composition were sourced from EU regulation 1169/2011 Annex XIV.

Costing method

Ingredient costs are calculated per batch based on Irish retail and food-grade supplier pricing as of April 2026. Unit prices are converted to a per-gram cost, then multiplied by the quantity used in each batch. Total batch cost was divided by the number of serving to produce a per-portion cost.

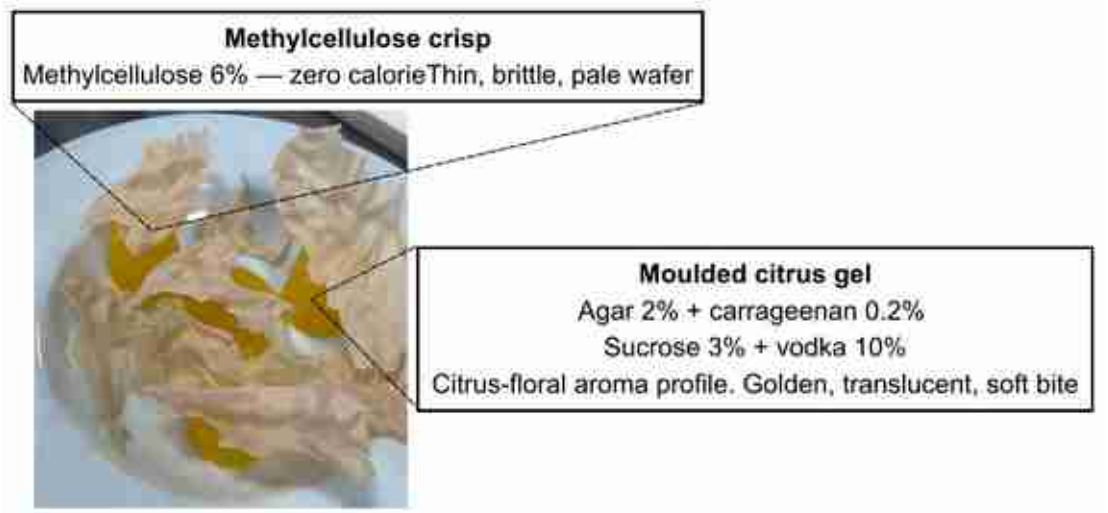

Figure 1 Final NbN dish: Citrus cocktail with word explanation

The dish consists of two components produced from pure compounds. The moulded citrus gel (yellow part) is an agar-carrageenan gel system (agar 2%, carrageenan 0.2%) flavoured with a citrus-floral aroma bleand—lemon natural flavouring, orange blossom natural flavouring and orange essential oil flavouring dissolved in vodka (10%) as an ethanol-based aroma carrier. The methylcellulose crisps (on the top—light orange part) are produced by spreading at 6% methylcellulose solution in a thin layer and baking at 180 ℃, the reverse thermal gelation property of methylcellulose to produce a brittle, zero-calorie wafer. Both components share the same aroma compound profile, providing sensory coherence across the contrasting textures. The primary eating experience of the combined dish is the simultaneous contrast between the cold, soft, juicy gel and the brittle, aromatic crisp.

Flavour scored 4/5, reflecting that the citrus-floral aroma compound blend successfully delivered a palatable flavour profile. Aroma received the lowest score at 3.83/5, which is still positive, may reflect the relatively unfamiliar aromatic character of the compound-based aroma system compared to conventional whole-ingredient cooking, plus the aroma of the dish is too weak to detect.

Nutritional analysis

Step 1 Identify which ingredients contribute calories

Citrus Gel (300g batch):		
Ingredient	**Mass**	**Contributes**
Water	253.5g	0 kcal
Vodka 38% v/v	30g	Ethanol only
Agar-agar	4.5g	Non-digestible fibre — 0 kcal
Kappa carrageenan	0.6g	Non-digestible — 0 kcal
Sucrose	9.0g	Carbohydrate
NaCl	0.9g	0 kcal
Citric acid	0.9g	Negligible at trace levels
Malic acid	0.6g	Negligible at trace levels
Aroma compounds	~100mg	Negligible

Table 4 Ingredients contribute calories identify for citrus gel

Methylcellulose Crisp (100g solution batch):		
Ingredient	**Mass**	**Contributes**
Water	91.9g	0 kcal (evaporates on baking)
Methylcellulose	6.0g	Non-digestible fibre — 0 kcal
Sucrose	1.5g	Carbohydrate
NaCl	0.5g	0 kcal
Aroma compounds	~100mg	Negligible

Table 5 Ingredients contribute calories identify for methylcellulose crisp

Step 2 Calculate Ethanol from Vodka

Vodka is sold as 38% v/v (Volume of ethanol per volume of vodka). The density of 38% vodka is 0.94 g/ml. So 30g vodka has 12.1 ml ethanol. The ethanol density is 0.789g/ml.

Overall, 30g vodka has 9.6g ethanol.

Step 3 Calculate Calories

According to the Atwater factors (FAO, 2003), Calculate the calories for citrus gel and methylcellulose crisps separately:

Citrus Gel — 300g batch:		
Source	**Calculation**	**kcal**
Sucrose	9.0g × 4 kcal/g	36.0 kcal

Ethanol	9.6g × 7 kcal/g	67.2 kcal
Total batch (300g)		**103.2 kcal**

Table 6 Calories calculation for citrus gel

Methylcellulose Crisp — 100g solution:		
Source	**Calculation**	**kcal**
Sucrose	1.5g × 4 kcal/g	6.0 kcal
Total batch (100g)		**6.0 kcal**

Table 7 Calories calculation for methylcellulose crisp

Step 4 Convert to per 100g and per portion

Per 100g is 34.4 kcal for citrus gel, same for per portion.

Per 100g is 6 kcal for methylcellulose crisp, 3 kcal for per portion.

Additionally, agar is classified as a non-digestible soluble dietary fibre (Lahaye, 1991). It passes through the digestive system without being broken down by human digestive enzymes. Kappa-carrageenan is classified as a non-digestible polysaccharide and contributes to the fibre count (Joint FAO/WHO Expert Committee on Food Additives, 2015). Methylcellulose is the non-fermentable dietary fibre that passes through the digestive tract without contributing digestible energy (Dikeman and Fahey, 2006)

Overall, here is the overall nutrition information for whole dish.

Nutrition Information			
	Citrus Gel per 100g	**Crisp per 100g**	**Per full serving***
Energy	144kJ 34.4kcal	25kJ 6.0kcal	156.5kJ 37.4kcal
Fat **of which saturates**	0g 0g	0g 0g	0g 0g
Carbohydrate **of which sugars**	3.0g 3.0g	1.5g 1.5g	3.75g 3.75g
Fibre	1.7g	6.0g	4.7g
Protein	0g	0g	0g
Salt	0.08g	0.13g	0.15g

**per serving includes 100g citrus gel and 50g crisp*

**Gel contains alcohol—approximately 3.8% alcohol by weight.*

Table 8 Nutrition information for NbN dish—Citrus cocktail

Costing

Based on the European food-grade pricing, msk, Sosa, and price sheet provided by TU Dublin in-store manage. Here is the final costing for two components and total costing per serves:

For Citrus gel:

Ingredients	Unit price	Qty Used	Cost

Water	€ 0	252 g	€ 0
Vodka 38% v/v	€ 35/700ml	31.9ml	€ 1.60
Agar-agar (E406)	€ 26.9/300g	6 g	€ 0.54
Kappa Carrageenan (E407)	€ 1.71/10g	0.6 g	€ 0.10
Sucrose	€ 0.23/100g	9 g	€ 0.02
Sodium Chloride (NaCl)	€ 1.41/1000g	0.9 g	€ 0
Citric acid (E330)	€ 0.8/40g	0.9 g	€ 0.02
Malic acid (E296)	€ 0.23/5g	0.6 g	€ 0.03
Lemon natural flavouring	€ 18/50g	0.03g	€ 0.01
Orange blossom natural flavouring	€ 20/50g	0.03g	€ 0.01
Orange essential oil flavouring	€ 15/30ml	1 ml	€ 0.50
Yellow fat-soluble powder colour	€ 13/25g	0.02g	€ 0.01
TOTAL		300.0 g	€ 2.84

Table 9 Raw ingredients cost per batch for citrus gel

For Methylcellulose crisp:

Ingredients	Unit price	g	Cost
Water	€ 0	91.9 g	€ 0
Methycellulose (E461)	€ 37.41/302g	6 g	€ 0.74
Sucrose	€ 0.23/100g	1.5 g	€ 0
Sodium Chloride (NaCl)	€ 1.41/1000g	0.5 g	€ 0
Lemon natural flavouring	€ 18/50g	0.03g	€ 0.01
Orange blossom natural flavouring	€ 20/50g	0.03g	€ 0.01
Orange essential oil flavouring	€ 15/30ml	1 ml	€ 0.50
Bronze metallic powder colour	€ 14.77/20g	0.02g	€ 0.01
TOTAL		100.0g	€ 1.27

Table 10 Raw ingredients cost per batch for methylcellulose crisp

In total, per serve costs € 1.58 (100g citrus gel + 50g methylcellulose crisp)

2 Conclusion

This project successfully developed a two-component NbN dish: orange cocktail consists of moulded citrus gel and methylcellulose crisps that constructed entirely from isolated chemical compounds with no whole-

ingredient derivatives. The key conclusions are:

- The final citrus gel formulation (agar 1.5%, carrageenan 0.2%, vodka 10%, sucrose 3%) delivers a fresh, balanced sensory profile with acceptable texture for a moulded dessert format and is fully compliant with EU food additive regulations.
- Ethanol at concentrations above 10–15% in agar gel systems causes significant gel weakening, and calcium chloride above 0.1% causes unacceptable bitterness — both of which are quantifiable formulation limits confirmed through iterative experimentation.
- Methylcellulose at 6.0%, baked at 180 °C, produces a crispy, zero-calorie wafer that satisfies all three project constraints (low cost, low time, low calorie) and provides a strong textural contrast to the soft gel.
- All additives are within EU maximum permitted levels under Regulation (EC) No 1333/2008, and the dish meets low-calorie criteria with approximately 34.4 kcal/100 g (gel) and 6 kcal/100 g (crisp).
- The combined dish cost is approximately € 1.58 per serving (gel + crisps), confirming the low-cost objective is met using standard food-grade ingredients.

3 References

Armisén, R. and Galatas, F. (2009) 'Agar', in Phillips, G.O. and Williams, P.A. (eds.) *Handbook of Hydrocolloids.* 2nd edn. Cambridge: Woodhead Publishing, pp. 82–107.

Bulone, D., Newman, J. and San Biagio, P.L. (1997) 'Mesoscopic gels at low agarose concentration: perturbation effects of ethanol', *Biophysical Journal,* 72(1), pp. 388–394. Available at: https://doi.org/10.1016/S0006-3495(97)78678-8.

Burke, R.M., Danaher, P. and Hurley, D. (2020) 'Creating bespoke note by note dishes and drinks inspired by traditional foods', *Journal of Ethnic Foods,* 7(1), 33. Available at: https://doi.org/10.1186/s42779-020-00071-3.

Burke, R.M., Kelly, A.L., Lavelle, C. and This vo Kientza, H. (eds.) (2021) *Handbook of Molecular Gastronomy: Scientific Foundations, Educational Practices, and Culinary Applications.* Boca Raton: CRC Press. Available at: https://doi.org/10.1201/9780429168703.

Dikeman, C.L. and Fahey, G.C. (2006) 'Viscosity as related to dietary fiber: a review', *Critical Reviews in Food Science and Nutrition,* 46(8), pp. 649–663. Available at: https://doi.org/10.1080/10408390500511862.

European Food Safety Authority (EFSA) Panel on Food Additives and Nutrient Sources added to Food (ANS) (2009) 'Scientific Opinion on the re-

evaluation of Tartrazine (E 102)', *EFSA Journal,* 7(11), 1331. Available at: https://doi.org/10.2903/j.efsa.2009.1331.

European Parliament and Council of the European Union (2011) *Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers.* Available at: https://eur-lex.europa.eu/eli/reg/2011/1169/oj (Accessed: 5 May 2026).

European Parliament and Council of the European Union (2008) *Regulation (EC) No 1333/2008 of the European Parliament and of the Council of 16 December 2008 on food additives.* Available at: https://eur-lex.europa.eu/eli/reg/2008/1333/oj (Accessed: 5 May 2026).

European Commission (2012) *Commission Regulation (EU) No 380/2012 of 3 May 2012 amending Annex II to Regulation (EC) No 1333/2008 of the European Parliament and of the Council as regards the conditions of use and the use levels for aluminium-containing food additives.* Available at: https://eur-lex.europa.eu/eli/reg/2012/380/oj (Accessed: 5 May 2026).

Food and Agriculture Organization of the United Nations (FAO) (2003) *Food energy — methods of analysis and conversion factors.* FAO Food and Nutrition Paper 77. Rome: FAO. Available at: https://www.fao.org/4/y5022e/y5022e00.htm (Accessed: 5 May 2026).

Food and Agriculture Organization of the United Nations (FAO) (2026) *FAO Food Price Index — March 2026 update.* Rome: FAO. Available at: https://www.fao.org/worldfoodsituation/foodpricesindex/en/ (Accessed: April 2026).

Fortune Business Insights (2026) *Convenience food market size, share & industry analysis, 2026–2034.* Available at: https://www.fortunebusinessinsights.com/convenience-food-market-115415 (Accessed: April 2026).

Food Standards Agency (FSA) (2025) *FSA reminds consumers that slush ice drinks containing glycerol are not recommended for young children.* London: FSA. Available at: https://www.food.gov.uk/news-alerts/news/fsa-reminds-consumers-that-slush-ice-drinks-containing-glycerol-are-not-recommended-for-young-children (Accessed: April 2026).

González-Mas, M.C., Rambla, J.L., López-Gresa, M.P., Blázquez, M.A. and Granell, A. (2019) 'Volatile compounds in *Citrus* essential oils: a comprehensive review', *Frontiers in Plant Science,* 10, 12. Available at: https://doi.org/10.3389/fpls.2019.00012.

IWSR (2026) *Six key drivers shaping beverage alcohol in 2026 and beyond.* London: IWSR. Available at: https://www.theiwsr.com/insight/six-key-drivers-shaping-beverage-alcohol-in-2026-and-beyond/ (Accessed: April 2026).

Joint FAO/WHO Expert Committee on Food Additives (JECFA) (2015) *Compendium of food additive specifications: carrageenan (INS 407).* JECFA Monograph 17. Rome: Food and Agriculture Organization of the United Nations.

Lahaye, M. (1991) 'Marine algae as sources of fibres: determination of soluble and insoluble dietary fibre contents in some "sea vegetables"', *Journal of the Science of Food and Agriculture,* 54(4), pp. 587–594. Available at: https://doi.org/10.1002/jsfa.2740540410.

Lawless, H.T., Rapacki, F., Horne, J. and Hayes, A. (2003) 'The taste of calcium and magnesium salts and anionic modifications', *Food Quality and Preference,* 14(4), pp. 319–325. Available at: https://doi.org/10.1016/S0950-3293(02)00128-3.

Lee, W.K., Lim, Y.Y., Leow, A.T.C., Namasivayam, P., Ong Abdullah, J. and Ho, C.L. (2017) 'Factors affecting yield and gelling properties of agar', *Journal of Applied Phycology,* 29(3), pp. 1527–1540. Available at: https://doi.org/10.1007/s10811-016-1009-y.

MSK Ingredients (2026) *MSK: helping chefs from vision to plate.* Available at: https://msk-ingredients.com/ (Accessed: April 2026).

Panier des Chefs (2026) *Panier des Chefs.* Available at: https://panierdeschefs.eu/en/ (Accessed: April 2026).

Pipart, P., Bresson, B., Marcellan, A., Merland, T., Tran, Y., Gorges, J.-C., Carion, O. and Hourdet, D. (2025) 'Formulation of sustainable materials from agar/glycerol/water gels: an alternative to polyurethane foams in single-use applications', *Gels,* 11(10), 842. Available at: https://doi.org/10.3390/gels11100842.

Roux, D.C.D., Jeacomine, I., Maîtrejean, G., Caton, F. and Rinaudo, M. (2023) 'Characterization of agarose gels in solvent and non-solvent media', *Polymers,* 15(9), 2162. Available at: https://doi.org/10.3390/polym15092162.

Sarkar, N. (1979) 'Thermal gelation properties of methyl and hydroxypropyl methylcellulose', *Journal of Applied Polymer Science,* 24(4), pp. 1073–1087. Available at: https://doi.org/10.1002/app.1979.070240420.

This, H. (2013) 'Molecular gastronomy is a scientific discipline, and note by note

cuisine is the next culinary trend', *Flavour,* 2(1), 1. Available at: https://doi.org/10.1186/2044-7248-2-1.

This, H. (2014) *Note-by-note cooking: the future of food.* Translated by M. DeBevoise. New York: Columbia University Press. Available at: https://doi.org/10.7312/columbia/9780231164863.001.0001.

World Health Organization (WHO) (2025) *Obesity and overweight: fact sheet.* Geneva: WHO. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (Accessed: April 2026).