

EVALUATION OF PECTIN TYPES FOR TEXTURE DEVELOPMENT AND GELATION PERFORMANCE IN FRUIT-BASED CONFECTIONERY APPLICATIONS

Derya ARSLAN 1,*, Şevval ŞEN 2

1 R&D Developer, derya.arslan@dohler.com.tr, Döhler Gıda Sanayi A.Ş., Balıkesir, Türkiye

2 R&D Teamlead, seval.sen@dohler.com.tr, Döhler Gıda Sanayi A.Ş., Balıkesir, Türkiye

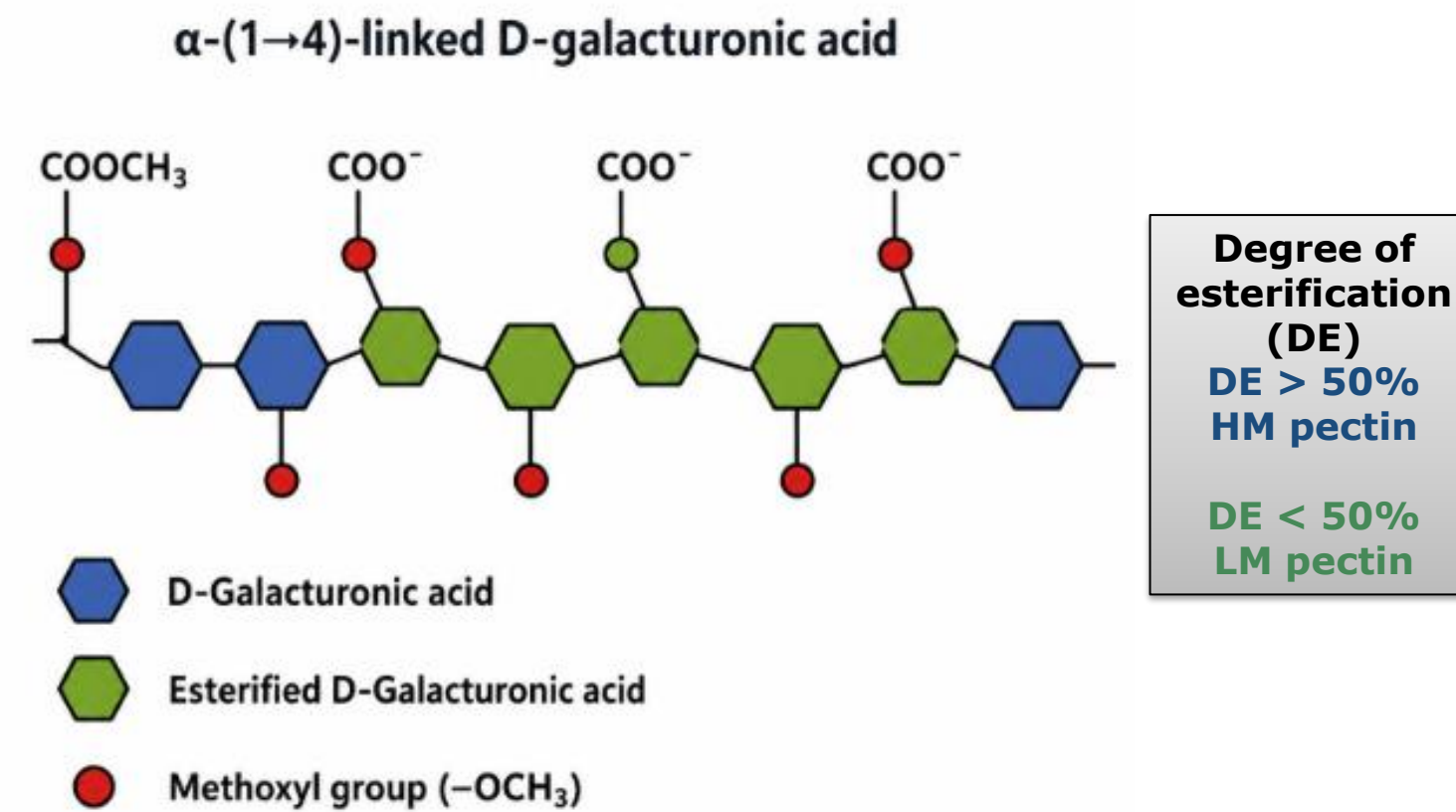
FROM MOLECULAR STRUCTURE TO TEXTURE: UNDERSTANDING PECTIN FOR BETTER CONFECTIONERY

1. INTRODUCTION

Pectin is a natural polysaccharide widely used in fruit-based confectionery products to create desirable texture, stability and mouthfeel.

Functionality depends on structural characteristics and interaction with formulation and processing parameters.

2. PECTIN STRUCTURE

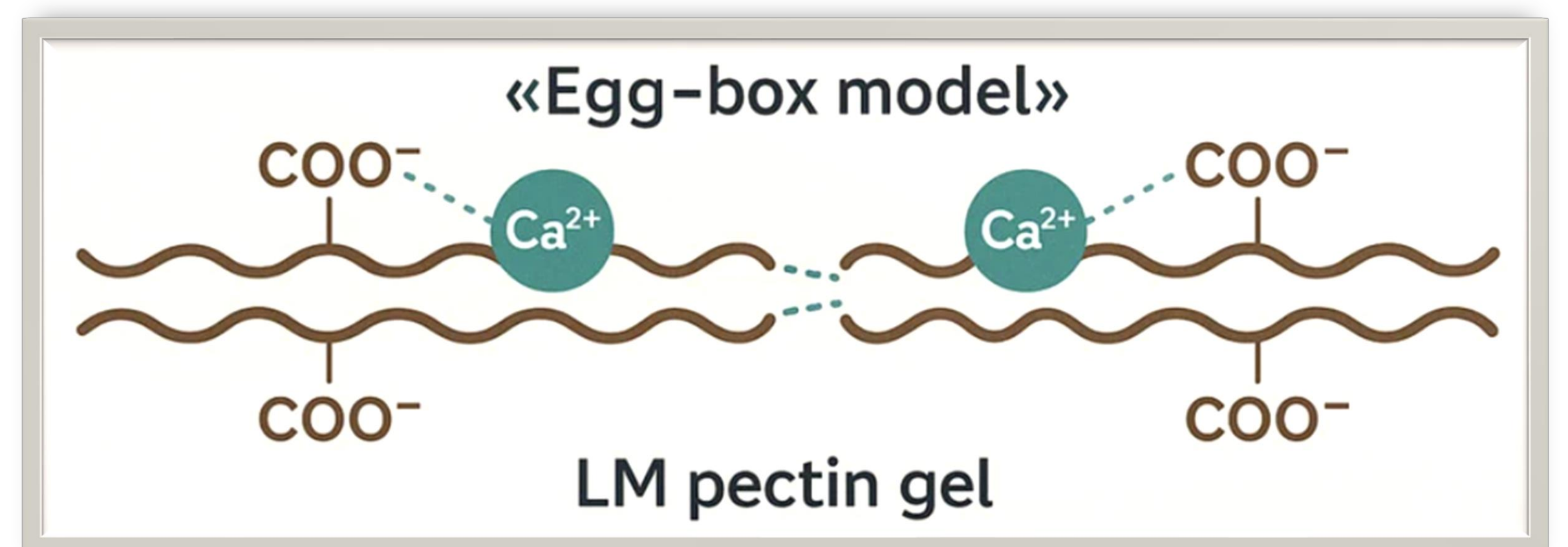
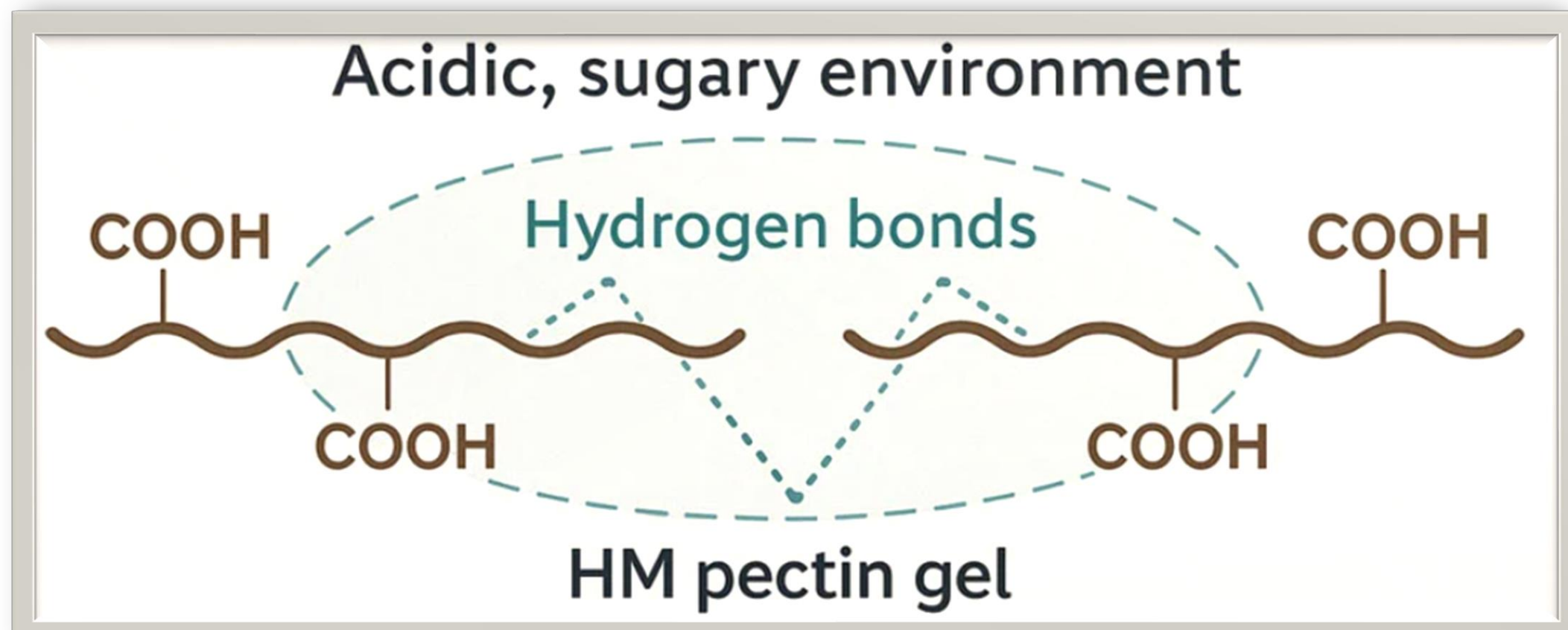


DE determines the gelation mechanism and strongly influences texture.

3. HM vs. LM PECTIN

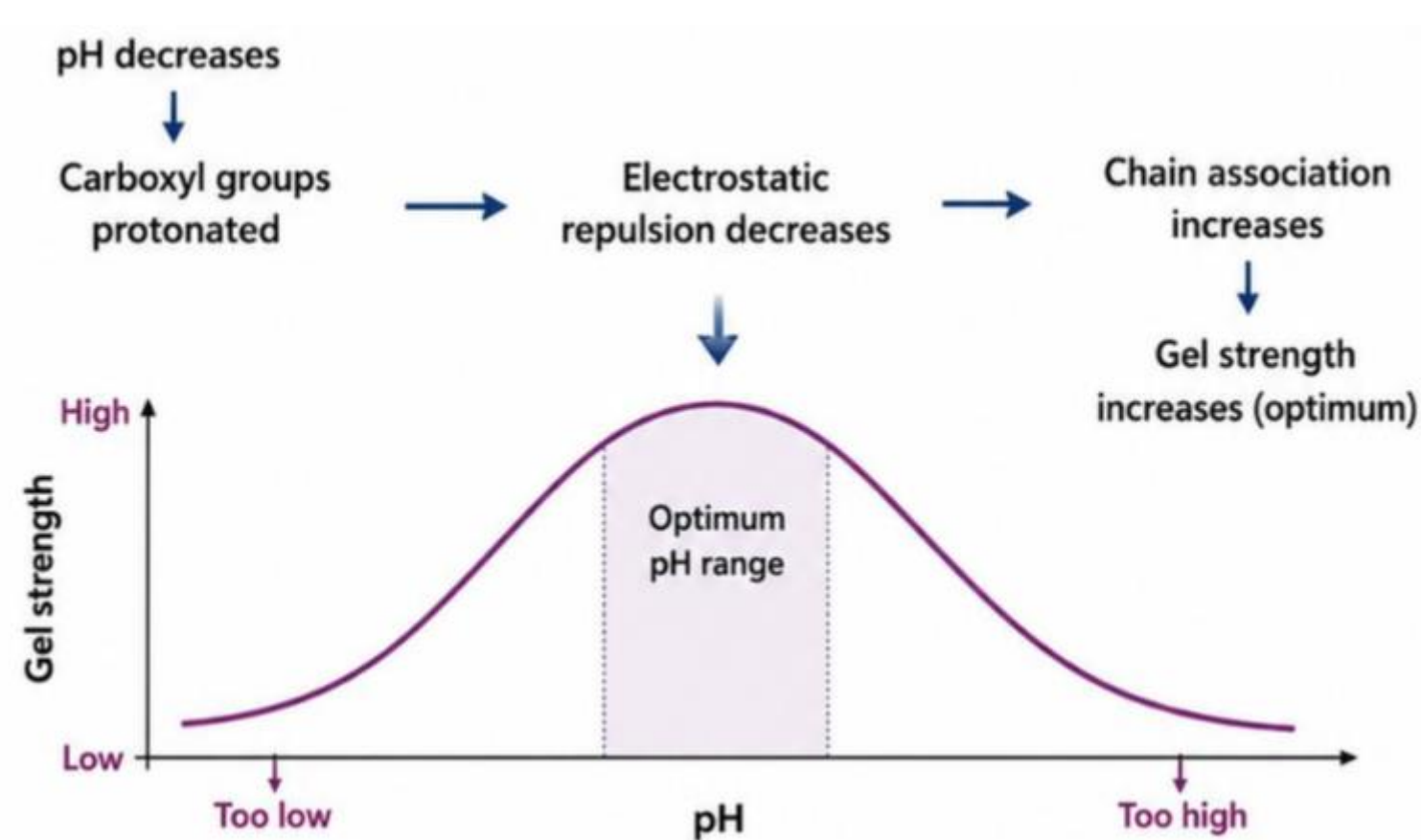
Property	High Methoxyl Pectin (HM)	Low Methoxyl Pectin (LM)
Degree of esterification	> 50%	< 50%
Gelation	Sugar + Acid	Calcium ions
Sugar requirement	High	Low
Ph dependency	High	Moderate to high
Typical applications	Jams, jellies, marmalades	Reduced-sugar products, fruit preparations, dairy systems
Texture	Firm, brittle	Soft, elastic

4. GELATION MECHANISM



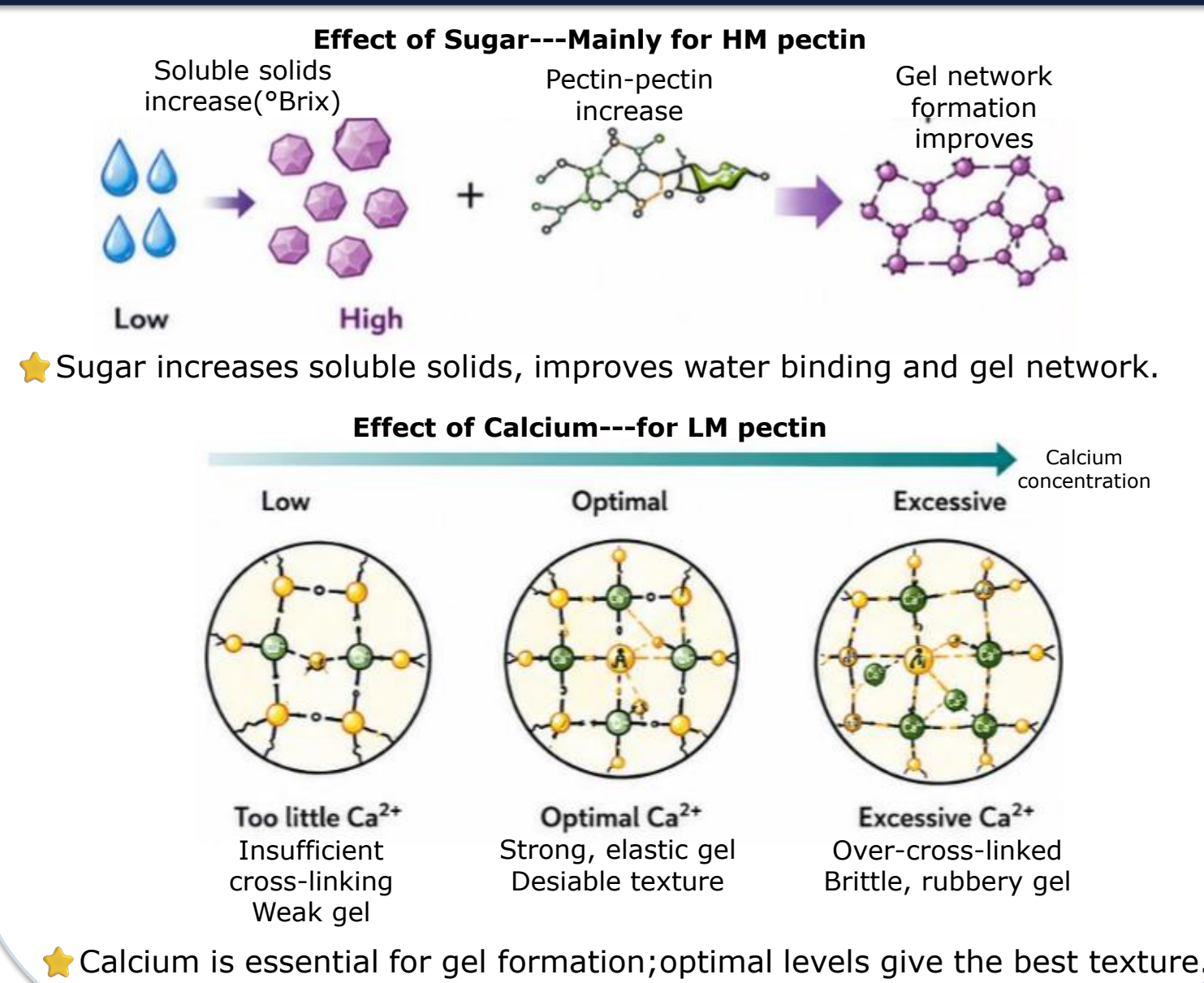
Schematic Representation of Gelation Mechanisms for HM and LM Pectin. The top panel shows HM pectin gelation in an acidic, high-sugar environment. The bottom panel illustrates the LM pectin “egg-box” model, where calcium ions bridge adjacent pectin chains through ionic interactions with free carboxylate groups.

5. EFFECT OF pH

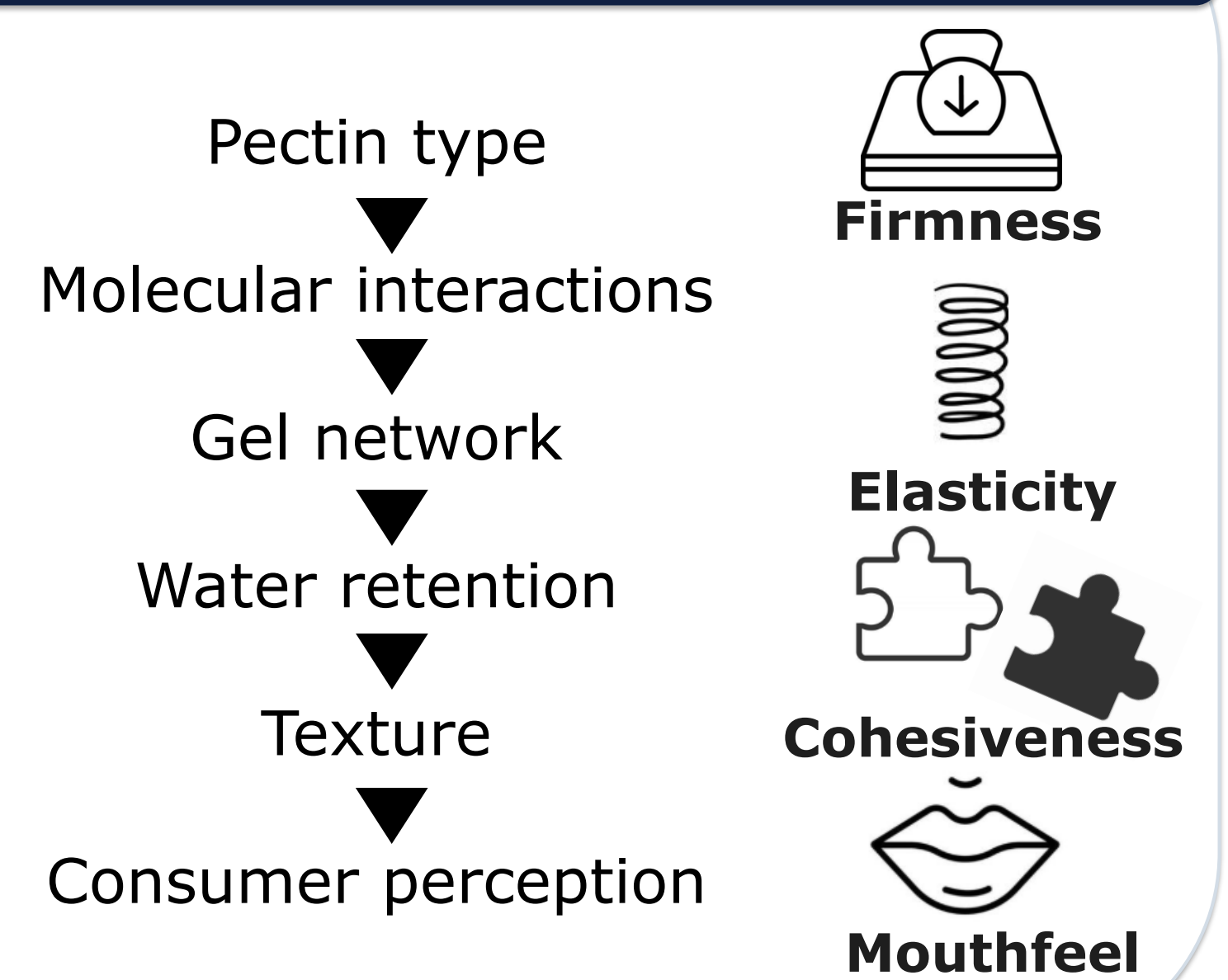


Too low pH---pectin degradation, weak, less stable gel
Too high pH---repulsion remains high, weak gel

6. EFFECT OF SUGAR & CALCIUM



7. FROM FORMULATION TO TEXTURE



8. INDUSTRIAL APPLICATIONS IN FRUIT-BASED CONFECTIONERY



- ✓ Provides desirable texture and stability
- ✓ Works in wide range of pH and Brix value
- ✓ Compatible with clean label concepts
- ✓ Enables sugar reduction strategies
- ✓ Improves process efficiency and product quantity

9. KEY TAKEAWAYS

- ★ Pectin functionality is strongly dependent on its degree of esterification.
- ★ HM and LM pectins rely on different gelation mechanisms.
- ★ Sugar, pH and Calcium play critical roles in gel formation and texture.
- ★ Hydration and processing conditions can significantly influence pectin performance.
- ★ The optimum pectin system is application and process-dependent.

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1. INTRODUCTION

Physical stability of dried foods is governed by interrelated physicochemical properties.

Water Activity (a_w): Controls available water for reactions and microbial growth.

Glass Transition Temperature (T_g): Marks boundary between glassy and rubbery states.

Hygroscopicity: Determines moisture sorption behavior from the environment.

A clear understanding of these parameters is essential for designing stable, high-quality dried foods.

2. KEY PHYSICAL PROPERTIES

Water Activity (a_w)

- Ratio of vapor pressure of water in food to pure water (0-1).
- Indicates unbound water available for chemical & microbial reactions.

Glass transition Temperature (T_g)

- Temp at which amorphous materials change from hard glassy state to soft rubbery state.
- Below T_g : Low molecular mobility (Glassy).
- Above T_g : High molecular mobility (Rubbery).

Hygroscopicity

- Tendency to absorb moisture from environment.

3. INTERACTIONS (T_g , a_w , HYGROSCOPICITY)



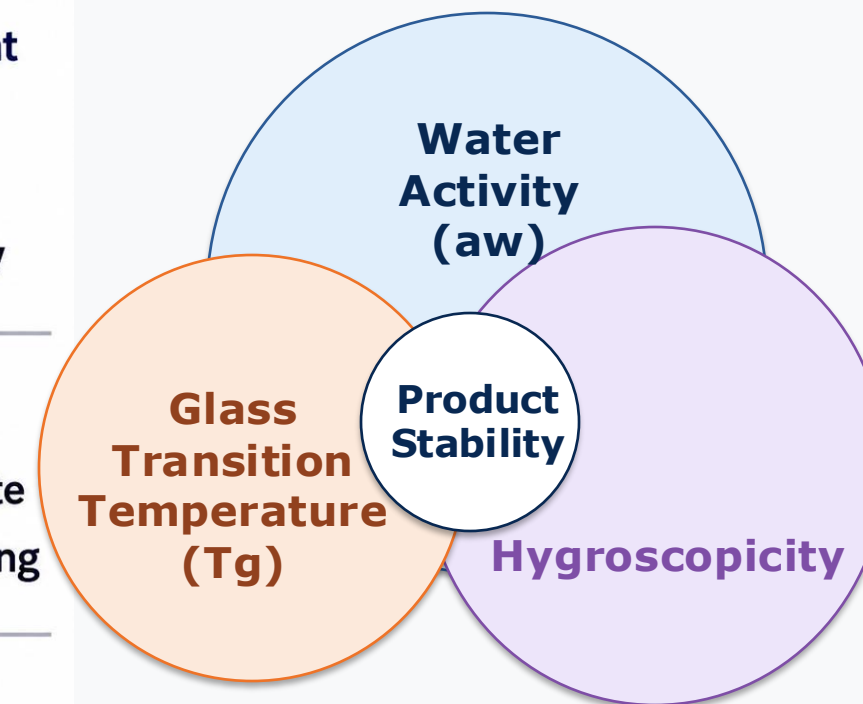
Increase in moisture content
→ $a_w \uparrow$
→ $T_g \downarrow$
→ Higher molecular mobility



When $T > T_g$
→ Transition to rubbery state
→ Stickiness, collapse, caking

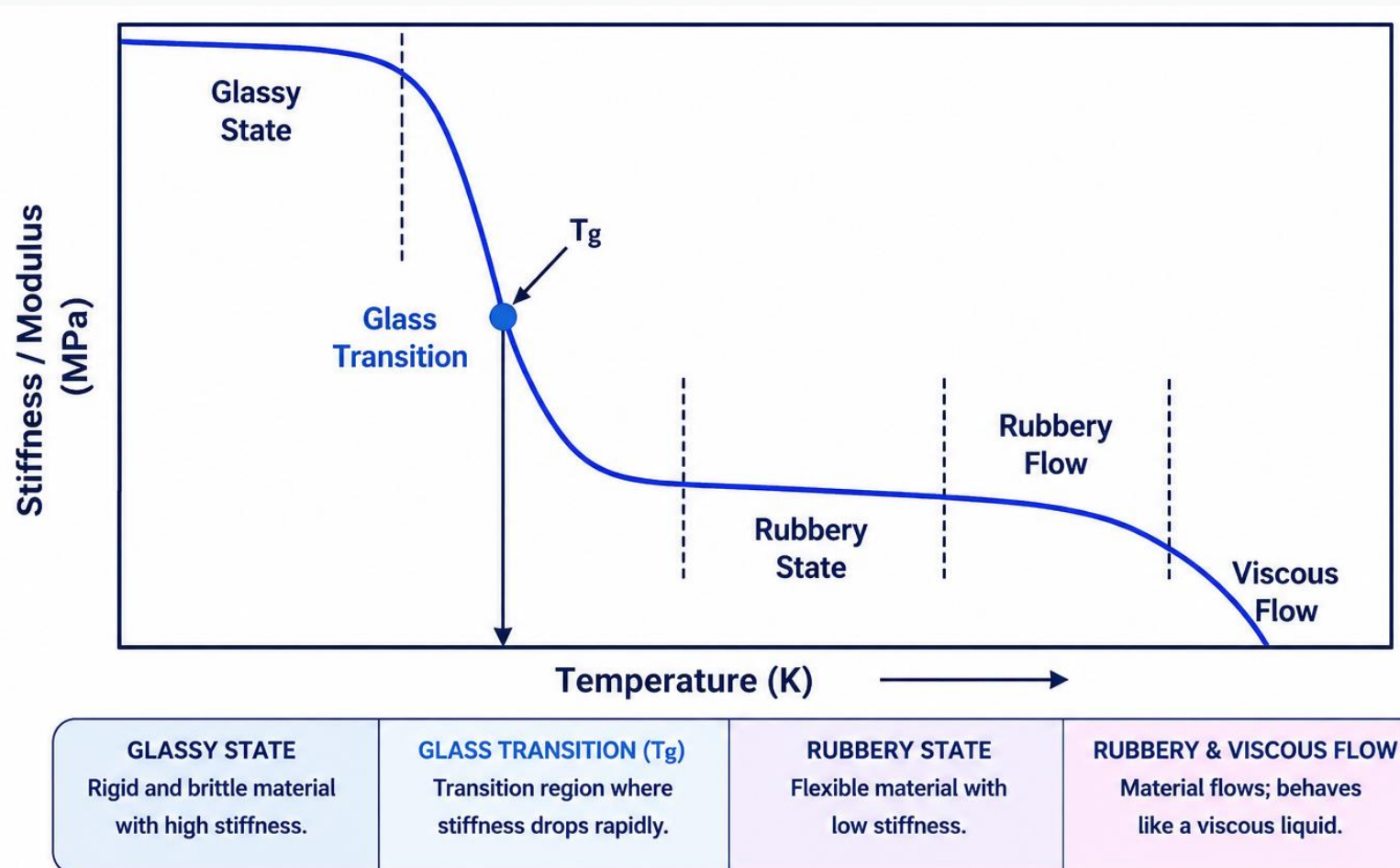


High hygroscopicity
→ More moisture sorption
→ $a_w \uparrow$ and $T_g \downarrow$
→ Reduced stability

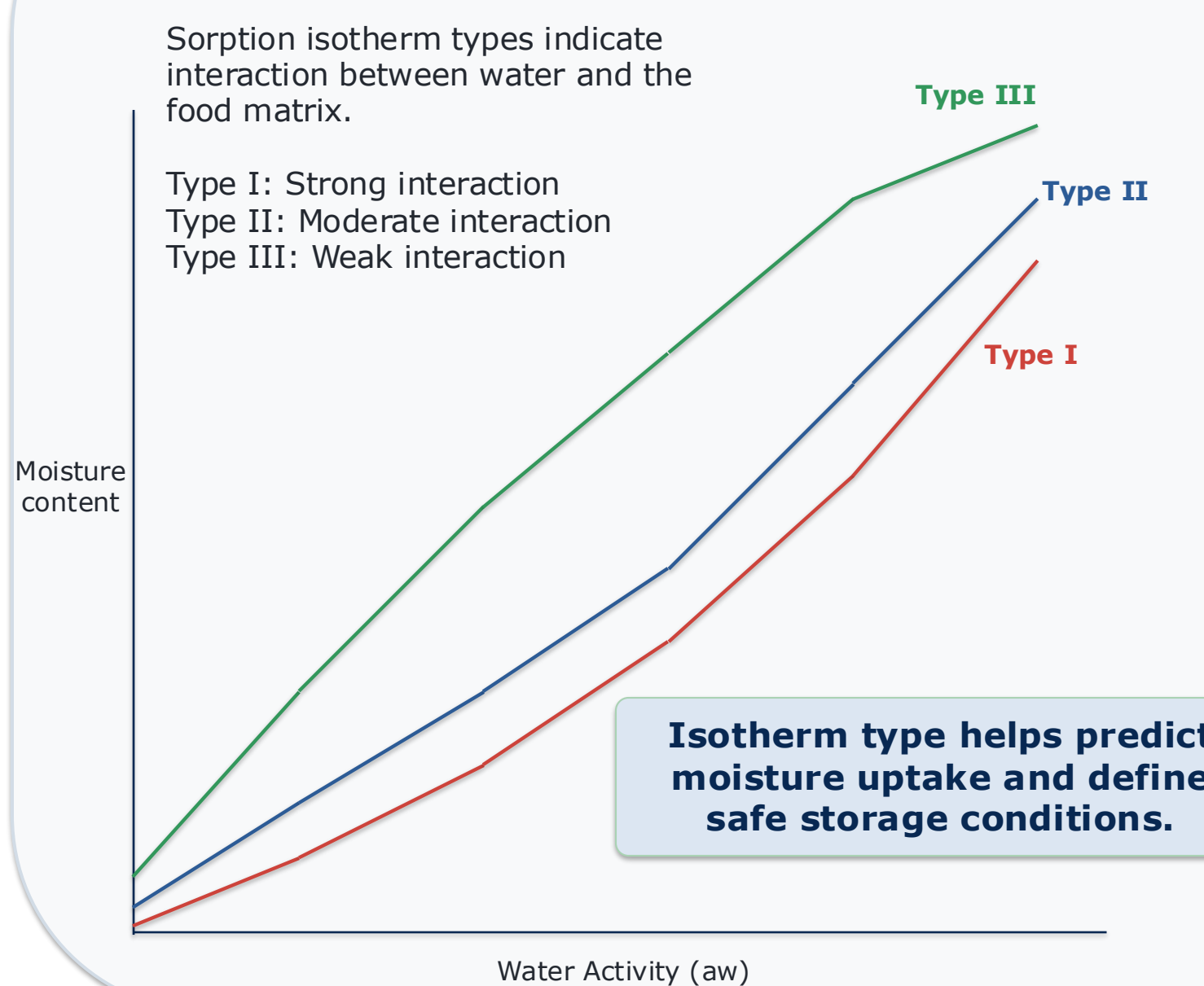


Maintaining $T < T_g$ and a_w in a safe range is critical to preserve the glassy state and product stability.

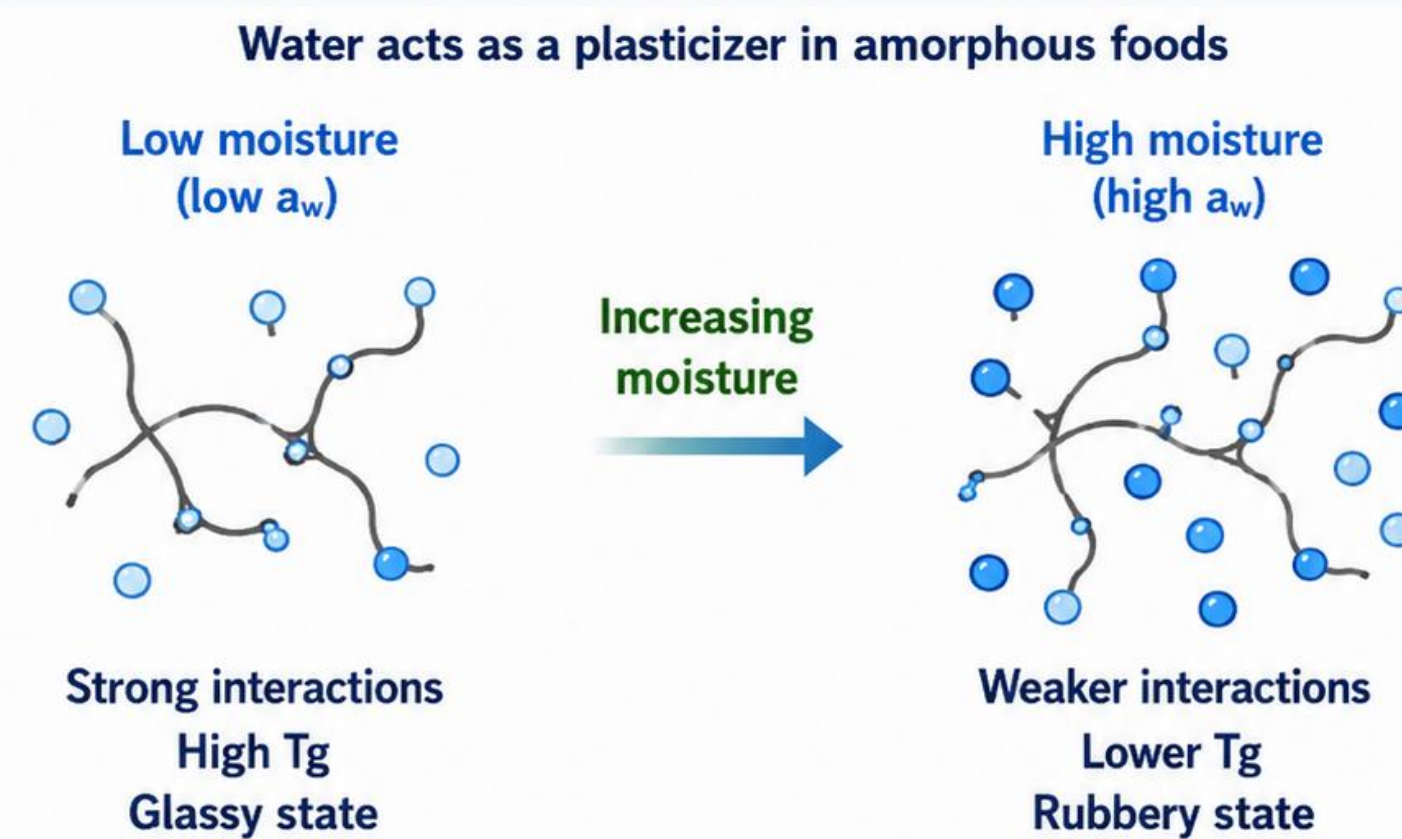
4. EFFECTS ON PHYSICAL STATE & QUALITY



5. MOISTURE SORPTION BEHAVIOR

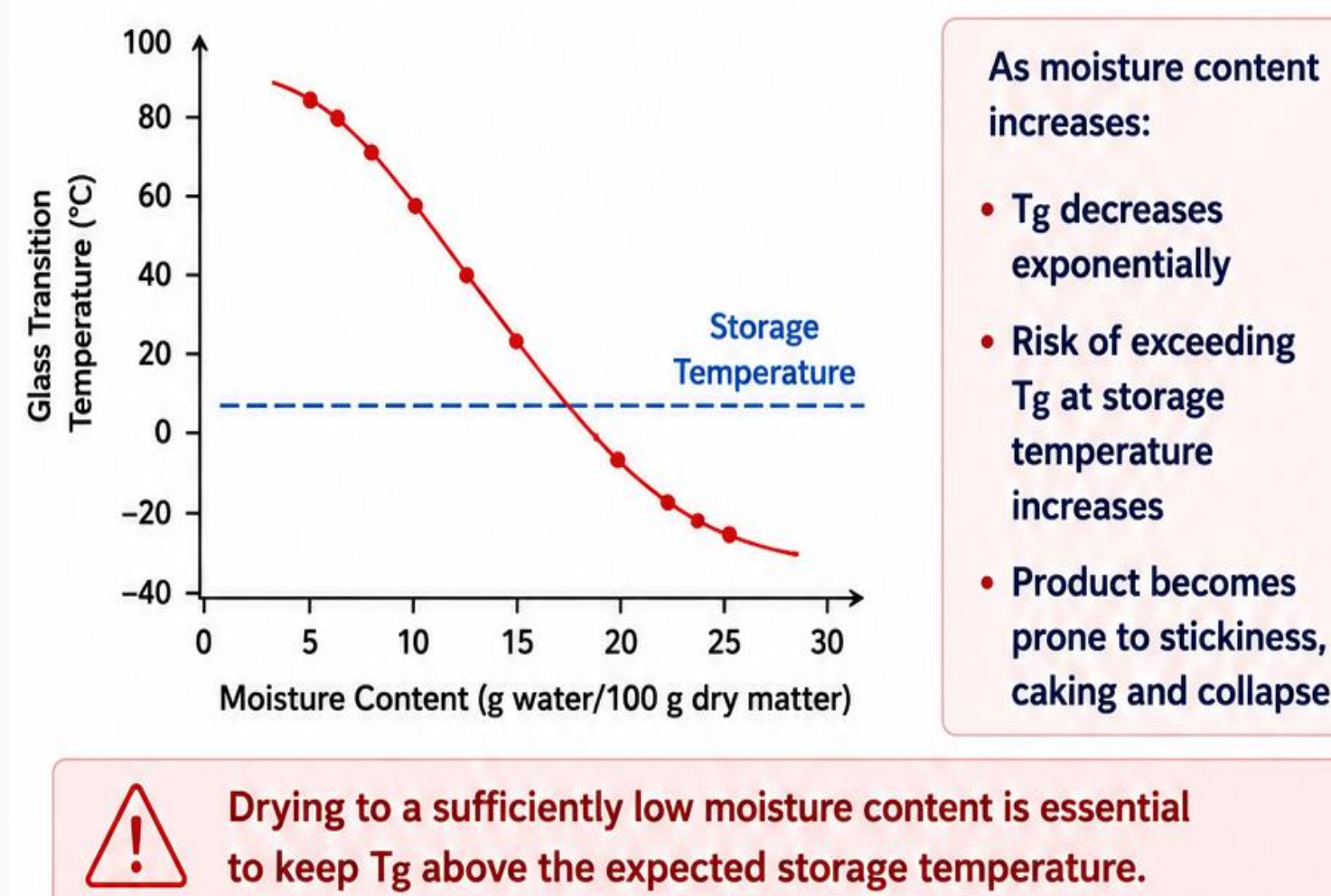


6. PLASTICIZING EFFECT OF WATER

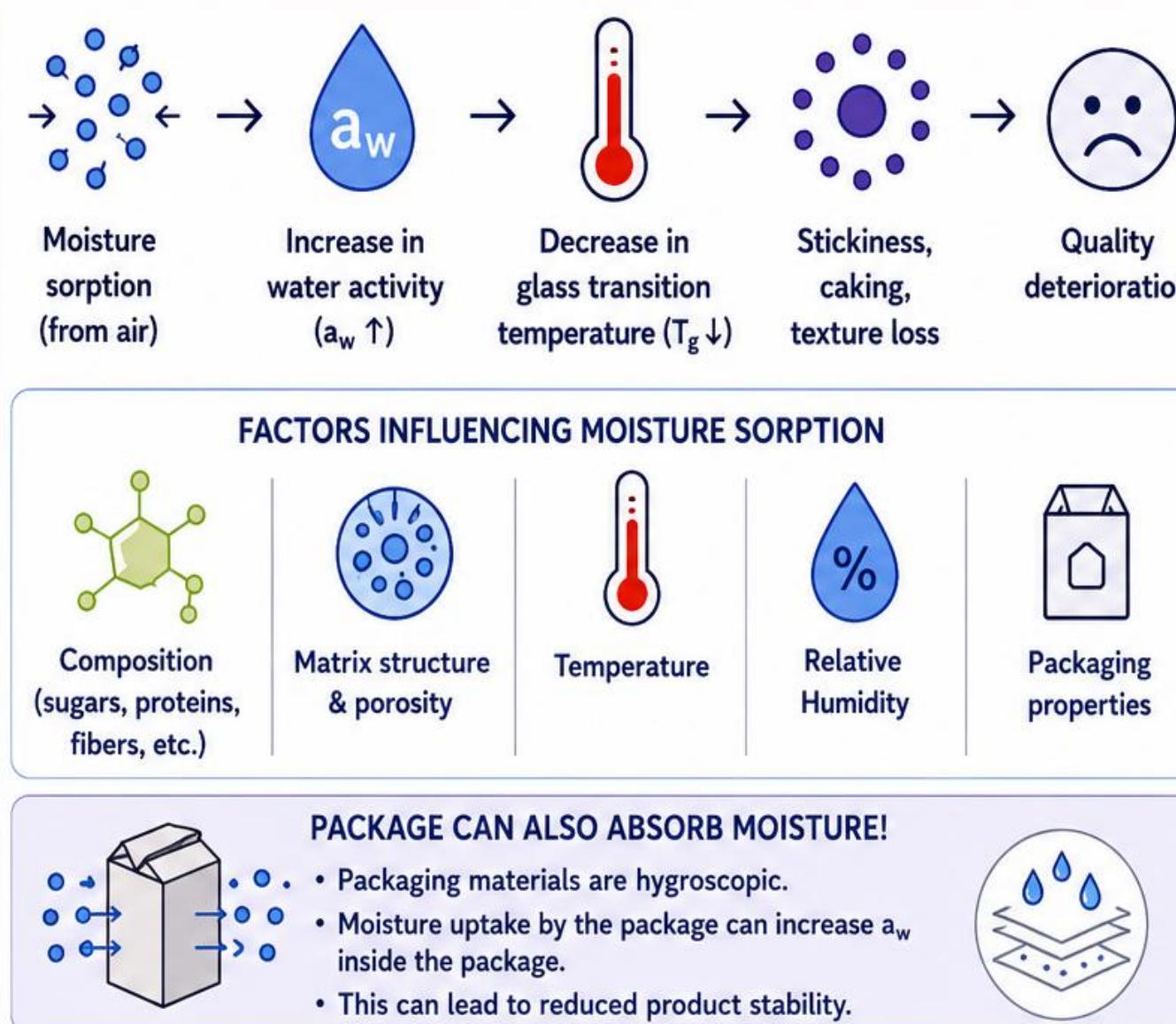


Even small increases in moisture can significantly lower T_g and increase molecular mobility.

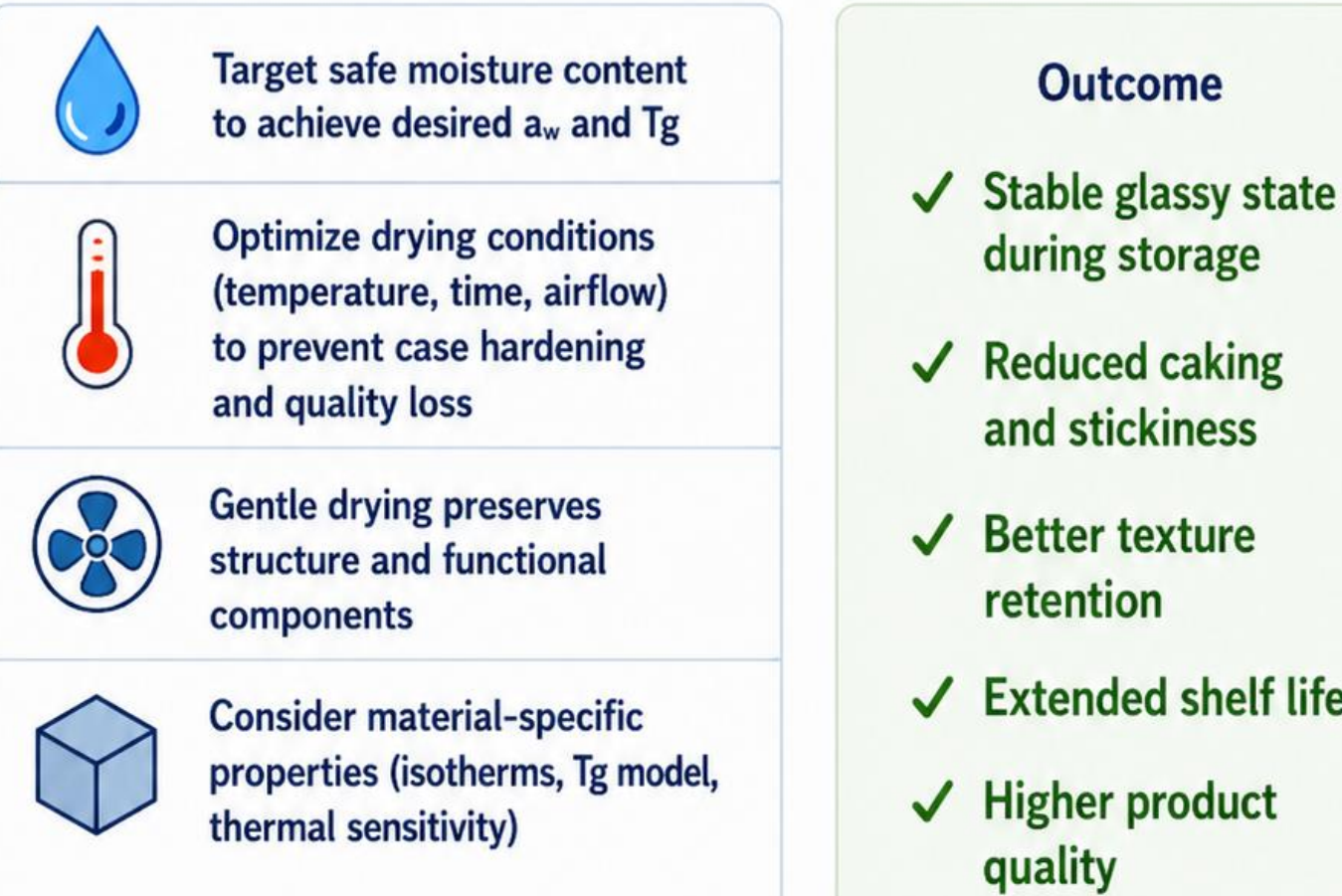
7. T_g DEPENDENCE ON MOISTURE CONTENT



8. HYGROSCOPIC MATERIALS: STORAGE RISKS



9. IMPLICATIONS FOR PROCESS DESIGN



10. TOOLS FOR PREDICTION AND DESIGN

State Diagram	Sorption Isotherm	T_g Prediction Models
Defines safe storage region ($T < T_g$)	Predicts moisture uptake at given RH	Estimate T_g as a function of moisture content

11. APPLICATIONS IN DRIED FOOD SYSTEMS



12. KEY TAKEAWAYS

T_g , a_w , and hygroscopicity are interdependent and govern product stability.

Water acts as a plasticizer, lowering T_g and increasing molecular mobility.

Storing dried foods below T_g and at an appropriate a_w prevents stickiness and caking.

Sorption isotherms and T_g prediction models are essential tools for process design.

Combining these parameters enables high-quality dried food production.

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8TH INTERNATIONAL CONFERENCE ON NATURAL SCIENCES AND TECHNOLOGIES

Sep 03-05, 2026

Fethiye, Türkiye

Ultrasound-Assisted Extraction and Its Effects on Apple Juice Concentrate

Ebru Bozkurt Abdik

DÖHLER GIDA SANAYİ AŞ. Bahçelievler Mahallesi, Recep Tayyip Erdoğan Bulvarı, No:136,70100 Karaman, Türkiye

Introduction

Apple juice is widely consumed due to its pleasant taste and nutritional value. It contains various bioactive compounds, particularly phenolic compounds and antioxidants, which contribute to its potential health benefits. However, conventional extraction and juice-processing methods may cause the loss or degradation of these valuable compounds.

Ultrasound-assisted extraction (UAE) is an emerging technique that uses ultrasonic waves to enhance mass transfer and improve the extraction of bioactive compounds. This method can reduce extraction time and increase extraction efficiency compared with conventional techniques. Therefore, ultrasound treatment has the potential to improve the quality and functional properties of apple juice concentrate.

This study focuses on the use of ultrasound-assisted extraction and evaluates its effects on the physicochemical properties, antioxidant activity, phenolic content, and overall quality of apple juice concentrate.



Methodology

Preparation of apple juice

Fresh apples were purchased from the local market. Apples were washed with water, dried with paper towels, and then were cut into four pieces with a stainless steel knife, while seeds and stems were separated from the apples. Apple juice was extracted using a domestic juicer and was smoothed using a cleaning cloth. Control samples were tested in order to the pasteurization at 71°C for 6 s and stored in the refrigerator (Abid et al., 2013).

Total solids (Brix)

The total solid content was measured at 20 ± 0.5°C using a refract meter (Abid et al., 2013).

pH

pH was measured at 20 ± 0.5°C. pH meter was calibrated with a solution of a commercial buffer 4 and 7 (Abid et al., 2013).

Titrateable acidity

Ten milliliter of the sample was poured into 250 ml of the beaker, and 90 ml of distilled water was added. The solution was titrated with a profit of 1/N to the endpoint of pH = 2.8 ± 0.1. Titrateable acidity was obtained from the following equation (AOAC, 1999):

Total polyphenol content

The total content of phenolic was carried out using two methods of spectrophotometry and Folin-Ciocalteu. Gallic acid was used as a standard (Boyer & Liu, 2004).

Total antioxidant capacity

Apple juice total antioxidant capacity was measured in accordance with a procedure done by Oboh and Ademosun (2012). Ascorbic acid was used as standard, and the antioxidant capacity was measured compared to it.

Statistical analysis

Statistical analysis of treatments was carried out by the analysis of variance (ANOVA) using SPSS16 software. A significant difference between means was determined at 0.05 by Duncan test.

Results and Discussion

1. Determination of pH, acidity, and total solids changes

The effect of ultrasound on pH, acidity, and total solids (Brix) of apple juice samples. There was no difference between the pH and acidity of ultrasound treatments (bath and probe) and controls ($p > 0.05$). These results are consistent with the findings of Walkling-Ribeiro, Noci, Cronin, Lyng, and Morgan (2009) that observed no significant effect of combined treatment of electric pulses and ultrasound on pH, acidity, and total solid contents of orange juice. The findings of Abid et al. (2013) also showed that ultrasound does not cause significant changes in pH, acidity, and total solid content in apple juice.

2. Assessment of total polyphenol and total antioxidant capacity changes

The results of the ultrasound on total polyphenols and total antioxidant capacity of apple juice samples is shown in Figures 1 and 2. According to data obtained, there was no significant difference between ultrasound treatments and control samples ($p < 0.05$). Total polyphenols of ultrasound treatment were higher than at 40°C. Total polyphenols of apple juice samples treated by ultrasonic probe were higher than an ultrasonic bath ($p < 0.05$). Abid et al. (2014) studied the effects of ultrasound on the total polyphenol content in apple juice and observed significant difference between ultrasound and control samples ($p < 0.05$), and ultrasound treatments had higher total polyphenols. Also, increasing temperature from 40 to 60°C had a significant effect on these compounds and ultrasound probe is more effective than an ultrasonic bath at 60°C. The findings of Abid et al. (2013) showed a significant increase in total phenols of fruit juices treated with ultrasound for 30, 60, and 90 min compared with the control. The probable reason for the increasing significance of such phenolic compounds is probably due to escalating certain inappropriate cell wall conditions caused by cavitations and rapidly changing fluid pressure due to shear forces applied during ultrasound that may release some polyphenol compounds and ultimately increase its availability in the juice. Hydroxyl radical's connection to aromatic ring of phenolic compounds during ultrasound through bubble blast may increase them in the apple juice. It was also reported that the increase in the antioxidant capacity of phenolic compounds is attributed to addition of the second group of hydroxyl to ortho and para positions. Increasing polyphenol oxidase activity in the ultrasound treatment may be another reason for the increase of these compounds. All these results suggest that ultrasound of apple juice is beneficial for consumers from a commercial standpoint and from the standpoint of nutrition.

3. Determination of cloud point and color changes

According to the results, there is a significant difference between the cloud point of control samples and Chitosan ($p < 0.05$). The cloud point in ultrasonic probe has increased compared to an ultrasonic bath ($p < 0.05$). In accordance with the findings of Abid et al. (2013), ultrasound treatment significantly increased the cloud point in apple juice ($p < 0.05$). Increase in cloud point of ultrasound treatments compared with control samples and Chitosan + ultrasound treatments is probably due to the high-pressure gradient caused by cavitation during ultrasound treatment. That deplete colloids, dispersion and decomposition of macromolecules into smaller units, and juices are well homogeneous and more stable. Some studies suggest that ultrasound reduced molecular weight of pectin by breaking the linear molecule and therefore form a weak network. Increases in temperature and time do not have a significant effect on the cloud point ($p < 0.05$). According to research carried out by Fatih Ertugay and Baslar (2014) on a microscopic scale, ultrasound increases cloud level and stabilize fruit juice by crushing coarse particles in the juice and creates a stable suspension so it will improve physical appearance of apple juice.



Figure 1.

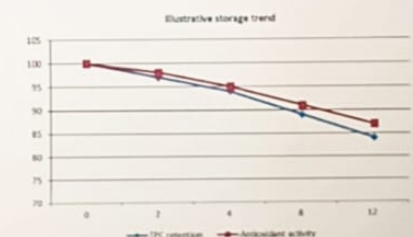


Figure 2.

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8TH INTERNATIONAL CONFERENCE ON NATURAL SCIENCES AND TECHNOLOGIES

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Production of Protein-Rich Product Fractions From Oily Seeds and Nuts by Supercritical CO₂ Extraction: A Sustainable Approach for Multi-Component Valorization

Zeynep Asiltürk

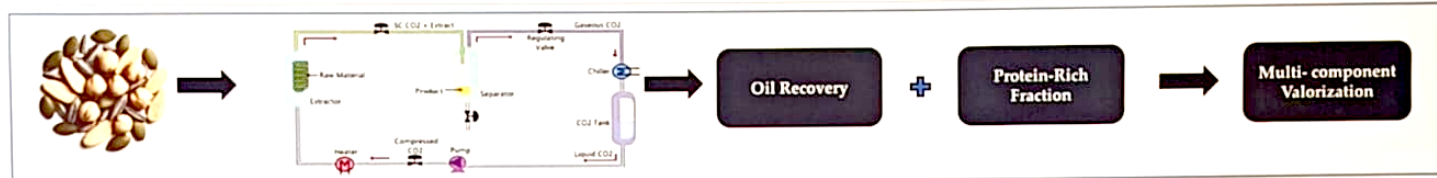
DÖHLER GIDA SANAYİ AŞ. Bahçelievler Mahallesi, Recep Tayyip Erdoğan Bulvarı, No:136,70100 Karaman, Türkiye

Introduction

The increasing global demand for sustainable and high-quality protein sources has intensified interest in plant-based proteins and the valorization of underutilized agricultural resources. Oilseeds and nuts represent promising protein sources due to their substantial protein content and the presence of valuable lipids and other bioactive compounds. In particular, oilseed-derived meals and defatted fractions, which are traditionally obtained as secondary streams of oil production and frequently directed toward relatively low-value applications, have gained increasing attention as potential sources of value-added plant protein ingredients (Touirais et al., 2024; Zhang et al., 2023). The production of protein-rich fractions from oilseeds and nuts commonly requires efficient lipid removal prior to further protein processing. Conventional defatting is predominantly based on mechanical pressing and/or organic solvent extraction, with hexane being widely used at industrial scale. Despite its efficiency, conventional solvent-based processing raises environmental, safety, and solvent-residue concerns and may involve intensive thermal treatment that can affect protein structure and functionality (Zhang et al., 2023).

Supercritical carbon dioxide (SC-CO₂) extraction has emerged as an attractive alternative for the selective removal of lipophilic components from plant matrices. Its tunable solvent properties, high selectivity, relatively low processing temperatures, and easy separation from the extracted material make SC-CO₂ particularly suitable for cleaner lipid extraction and defatting processes (Ahangari et al., 2021). Importantly, selective lipid removal can simultaneously increase the relative protein concentration of the residual solid fraction, enabling the generation of protein-rich product fractions while recovering valuable oil as a co-product (Yang et al., 2024).

In this study, pumpkin seed (*Cucurbita Pepo*), sunflower seed (*Helianthus Annuus*), sweet apricot kernel (*Prunus Armeniaca*), and hazelnut (*Corylus Avellana*) were investigated as multipurpose raw materials for SC-CO₂ processing. The aim was to evaluate the potential of SC-CO₂ extraction for lipid removal and the production of protein-rich fractions, while simultaneously recovering valuable oil fractions. This approach establishes a multi-component valorization strategy in which protein and lipid fractions are recovered from the same agricultural resources, contributing to improved resource efficiency and the development of more sustainable plant-protein production pathways.



Methodology

Preparation of Protein-Rich Fractions- Oil Extraction

Pumpkin seed (*Cucurbita pepo*), sunflower seed (*Helianthus annuus*), sweet apricot kernel (*Prunus armeniaca*), and hazelnut (*Corylus avellana*) were subjected to supercritical CO₂ extraction under optimized processing conditions to remove lipids and obtain protein-rich solid fractions. Following extraction, the recovered solid fractions were milled and characterized (Yang et al., 2024).

Protein and Residual Oil Content

Crude protein content was determined using the Kjeldahl method (AOAC 2001.11), while residual oil content was analyzed by Soxhlet extraction (AOAC 920.85).

Extraction Yield

Protein enrichment was evaluated by comparing the protein contents of the raw material and the corresponding defatted fractions. Oil yield and mass balance calculations were also performed to assess the efficiency of the SC-CO₂ process.

Oil Fraction

Recovered oils were characterized for peroxide value (AOAC 965.33) and free fatty acid content (as oleic acid) (AOAC 940.28) to assess their oxidative quality and hydrolytic stability.

Results and Discussion

1. Protein Enrichment via Lipid Removal

Pilot scale SC-CO₂ extraction performed at 280 bar and 45 °C, without the use of a co-solvent, effectively reduced the lipid content of all investigated raw materials to <2% in the resulting solid fractions. This efficient lipid removal was accompanied by a substantial increase in relative protein concentration.

Protein content increased from 32% to 70% in pumpkin seed, from 18% to 53% in sunflower seed, from 24% to 58% in sweet apricot kernel, and from 15% to 50% in hazelnut. Pumpkin seed exhibited the highest final protein concentration (70%), followed by apricot kernel (58%), sunflower seed (53%), and hazelnut (50%). The increased in protein content from 18% to 53% observed in the present study is consistent with the findings of Frioli et al. (2023), who reported approximately 55% protein in sunflower flour obtained following SC-CO₂ assisted defatting.

2. Process Performance and Product Recovery

The extraction was performed in a 5-L pilot-scale extractor using 2.5 kg of each raw material for each process. Static extraction times were 1 h for pumpkin seed, and apricot kernel, 1.5 h for sunflower seed, and 2 h for hazelnut, followed by dynamic extraction for 4, 5, 6, and 8 h, respectively.

The obtained protein-rich fractions were approximately 1.4 kg for pumpkin seed, 1.3 kg for apricot kernel, 1.15 kg for sunflower seed, and 0.9 kg for hazelnut. The consistent reduction of lipid content to below 2% across all matrices demonstrates the applicability of SC-CO₂ for efficient defatting and protein enrichment.

3. Oil Quality and Multi Component Valorization

The recovered lipid fractions exhibited peroxide values below 7 meq O₂/kg and acid values below 10 mg KOH/g indicating limited oxidative and hydrolytic deterioration under the applied extraction conditions.

Overall, the simultaneous production of protein-rich solid fractions and recoverable lipid fractions demonstrates the potential of SC-CO₂ extraction as a sustainable multi-component valorization strategy for oilseeds and nuts. The process therefore enables the conversion of a single agricultural raw material into multiple value-added fractions, improving overall resource utilization.

Type	Init. Prot. Cont., %	Final Prot. Cont., %
Pumpkin Seed	32	70
Sunflower Seed	18	53
Apricot Kernel	24	58
Hazelnut	15	50

Figure 1.



Figure 2.

Type	Peroxide, meq O ₂ /kg	Acid Value, KOH/g
Pumpkin Seed	<4,0	<9,0
Sunflower Seed	<6,2	<7,0
Apricot Kernel	<3,5	<4,5
Hazelnut	<5,0	<5,5

Figure 3.

Acknowledgements / References

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DEVELOPMENT OF A HIGH-ANTHOCYANIN ARONIA EXTRACT AND ITS COMPARATIVE EVALUATION WITH ELDERBERRY EXTRACT

Dilek Kelgökmen Güleş^{1*}, Şule Mete¹¹Döhler Gıda Sanayi San. A.Ş., Karaman, Turkey

*corresponding author: dilek.kelgokmen@doehler.com

INTRODUCTION

Anthocyanins are bioactive flavonoid compounds widely distributed in berries and other plant-derived foods, and their potential health benefits have been associated with antioxidant, anti-inflammatory, and cardiometabolic effects. Importantly, both the total anthocyanin content and the specific anthocyanin profile may influence the biological properties of anthocyanin-rich extracts.

Aronia (*Aronia melanocarpa*) is a rich source of anthocyanins and other bioactive compounds, making it a promising natural source for the development of anthocyanin-rich functional ingredients. In this study, an extraction process was developed and optimized to obtain a high-anthocyanin Aronia extract from the fruit matrix. Different processing parameters were evaluated to maximize anthocyanin recovery and obtain a standardized extract with a high anthocyanin content.

The health-promoting potential of berry extracts is closely related to their phytochemical composition, particularly their anthocyanin content and profile. Although chokeberry (*Aronia melanocarpa*) and elderberry (*Sambucus nigra*) are both rich sources of anthocyanins, differences in the composition and relative abundance of individual anthocyanins may result in distinct biological effects.

2.METHOD

2.1 Materials

Aronia fresh fruit was sourced from a supplier in Turkey. The elderberry was sourced from the Döhler factory in Neunkirchen.

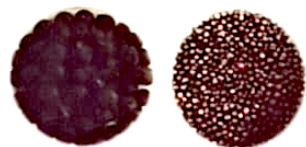


Figure 1. Raw materials picture (aronia-elderberry)

2.2 Methods

2.2.1 Extraction

Elderberry and aronia anthocyanin concentrates are processed using the same production workflow. Clear fruit juice concentrate is produced first; subsequently, the product is treated with adsorber resin to standardize the anthocyanin content.

2.2.2 Total anthocyanin content

The pH differential method (Lee,2005) was used with some modifications to determine the anthocyanin content of the samples.

2.2.3 Anthocyanin Profile

Anthocyanin profiles were analyzed by HPLC-DAD using a C18 reversed-phase column and a gradient of acidified water and acetonitrile. Detection was performed at 520 nm.

2.2.4 Total Phenolic Content

otal phenolic content was determined by the Folin–Ciocalteu method, using gallic acid as the calibration standard. Absorbance was measured at 765 nm, and results were expressed as mg GAE/g extract.

2.2.5 Product Stability

Stability was assessed by monitoring the physical characteristics of the samples during 7 days of storage at 37 °C and 4 °C. Changes in color, clarity, and overall visual appearance were evaluated at predetermined time points.

3.RESULTS AND DISCUSSION

3.1 Total anthocyanin content

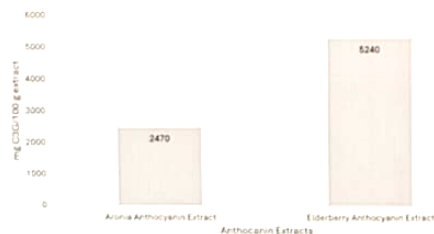


Figure 2. Comparison of results for aronia anthocyanin extract and elderberry anthocyanin extract

3.2 Anthocyanin Profile

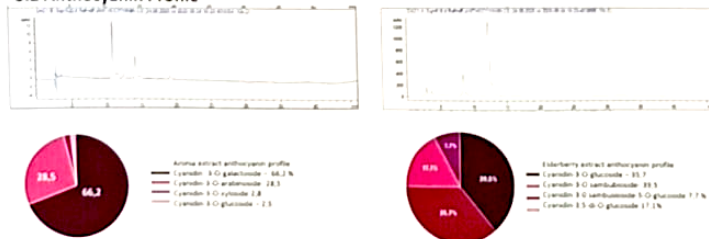


Figure 3. Differences of anthocyanin profile for aronia anthocyanin extract and elderberry anthocyanin extract

3.3 Total Phenolic Content

Sample	mg GAE /100 g extract
Elderberry Anthocyanin Extract	16245,51552
Aronia Anthocyanin Extract	8157,6489

Table 1. Total polyphenols content of elderberry extract and aronia extract

4. Product Stability

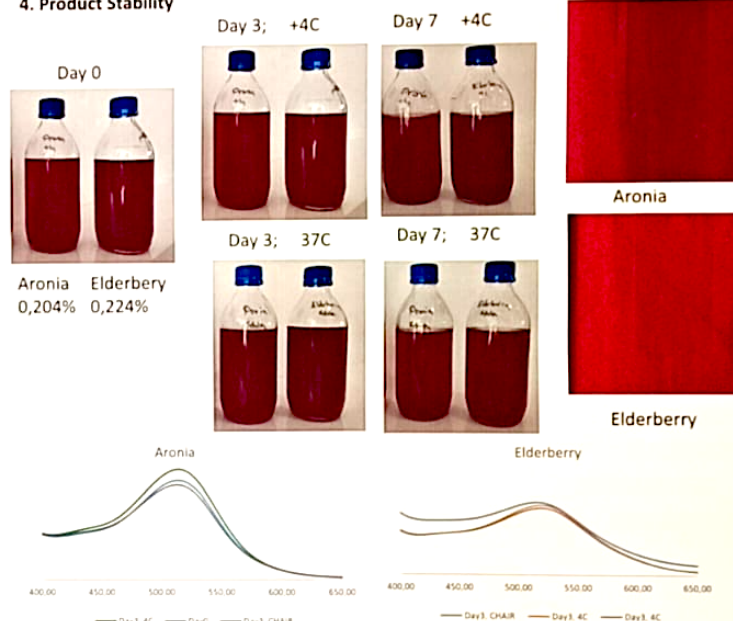


Figure 4. Stability monitoring at 4°C and 37°C

4.CONCLUSION

In conclusion, Both elderberry and aronia anthocyanin extracts demonstrated anthocyanin contents above 10%, highlighting their potential as valuable sources of natural anthocyanins. Due to their antioxidant and other potential health promoting properties, these extracts can be incorporated into a wide range of functional food, beverage, nutraceutical, and dietary supplement applications. They may also be used as natural ingredient in products such as fruit beverages, functional drinks, gummies, capsules, and other food formulations.

However, from a stability perspective, aronia anthocyanin extracts showed greater stability compared with elderberry extracts. This higher stability may provide an advantage during processing and storage, supporting their use in products where maintaining anthocyanin content and color quality over time is important. Overall, both sources offer promising opportunities for the development of anthocyanin-rich functional products, while aronia may provide an additional advantage in terms of stability.

5.REFERENCES

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8TH INTERNATIONAL CONFERENCE ON NATURAL SCIENCES AND TECHNOLOGIES

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MALT EXTRACTS: A CLEAN-LABEL ALTERNATIVE TO CARAMEL COLOUR

Gülfem Güneydere, Pınar Anıl Hacıdoğan, Şule Mete

Member of Colour TIP, Karaman, Turkey Team lead of Colour TIP, Karaman, Turkey Manager of Colour TIP, Karaman, Turkey

Döhler Gıda San. A.Ş. Karaman, Turkey

SUMMARY

All evaluated malt extracts contributed to brown color formation and provided characteristic caramelized and roasted flavor profiles. The results showed that both malt source and extraction technology significantly influenced color intensity, sensory properties, and application performance. Conventional malt extract demonstrated a balanced color and flavor profile, while gluten-free malt extract offered a suitable clean-label option for specialized formulations. Percolation malt extract showed the highest coloring potential for applications requiring darker shades, together with distinctive roasted notes. Overall, malt extracts represent promising multifunctional alternatives to E150D by combining coloring and flavoring properties in clean-label food applications.

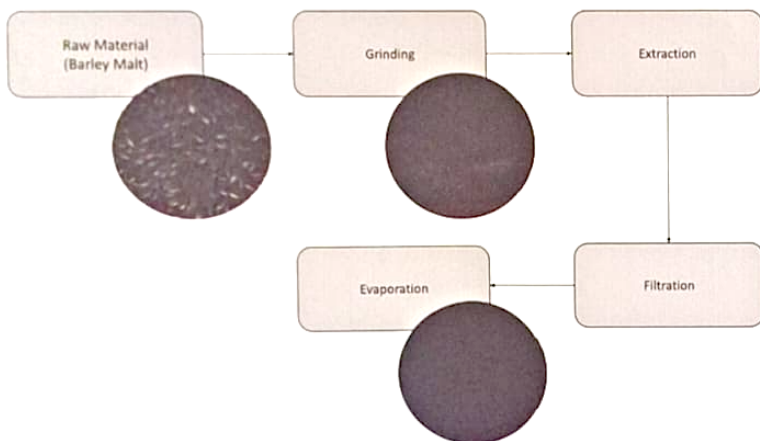
INTRODUCTION

Caramel color (E150D) is widely used in the food and beverage industry to provide dark brown coloration. However, the growing demand for clean-label products has increased the need for natural alternatives with comparable coloring performance. Malt-derived ingredients are promising candidates because they can provide both brown color and desirable caramelized or roasted flavor notes. In this study, conventional malt extract, gluten-free malt extract, and percolation malt extract were evaluated as potential natural alternatives to E150D caramel color.

MATERIALS AND METHODS

Percolation experiments will be conducted using roasted raw materials, including malt, corn, barley, and wheat. Process conditions will be systematically varied by testing different temperature levels and raw material-to-water ratios. The resulting extracts will be clarified using three filtration approaches: a separator, filter paper, and centrifugation. For each experimental run, colour (EBC), turbidity, extraction yield, and processing cost will be measured and compared. The results will be used to determine the optimal process conditions and identify the most cost-effective production method.

Figure 1. Flow chart



APPLICATION

The developed product is intended for use in applications where colour uniformity and visual appearance are not critical, particularly in turbid products. Potential application areas include bakery products, pet food, and other food products where the product can provide functional or flavour-related benefits without requiring intensive colour control.

Figure 2. Application Targets



Pet food industry

Bakery applications

Beverage applications

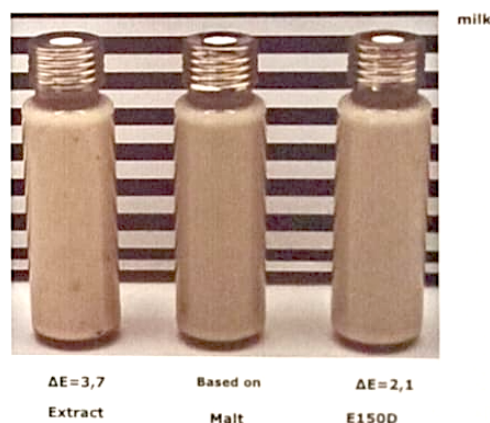
RESULTS & DISCUSSION

At pilot scale, the percolation process successfully achieved a colour intensity of 12,000 EBC, demonstrating the potential of this approach for the production of brown extracts intended for turbid emulsions. In the next stage of the project, the optimised process will be applied to alternative roasted raw materials, including corn, barley, and wheat, with the aim of achieving comparable colour intensity and a concentration of approximately 65 °Brix after evaporation. Different process conditions, such as temperature and raw material-to-water ratio, will be further evaluated to determine their effects on colour extraction, turbidity, extraction yield, and overall product performance. In addition, separator, filter paper, and centrifugation will be compared to identify the most effective clarification method for obtaining a stable and suitable extract. The use of alternative raw materials is expected to reduce dependence on malt, increase production flexibility, and provide potential cost advantages. Overall, the results are expected to support the development of a standardised, cost-effective, and commercially applicable production process for turbid brown emulsions without compromising the required colour and quality parameters.

Table 1. Results

Product	EBC (Colour)	Brix	pH
Target	15000-18000	55	8,5-10,5
Caramel E150d	46000-48000	65	2,7-3,3
Malt Extract	15000-18000	53	3-5

Figure 3. Caramel color (E150d) & Malt Extract Comparison



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RECOVERY OF POST-PROCESSING FOOD WASTE AS DIETARY FIBER AND THEIR CONVERSION INTO VALUE-ADDED PRODUCTS

Müjde Elif BOZKURT^{1,2}, Asst. Prof. Dr. Evrim Burcu UNCÜ KİRTİŞ²

¹ Döhler Gıda Sanayi A.Ş. Karaman, Türkiye, ² Faculty of Engineering, Department of Food Engineering, Karamanoğlu Mehmetbey University, ³ Karamanoğlu Mehmetbey University, Faculty of Engineering, Department of Food Engineering.

Summary

Food industry by-products such as peels, pulp, seeds, and pomace are increasingly recognized as valuable sources of dietary fiber. Through appropriate processing methods, these materials can be recovered and transformed into functional food ingredients with improved nutritional and technological properties. Their valorization helps reduce food waste, supports sustainable production, and contributes to the circular economy in the food industry.

Introduction

Growing food production and consumption have led to increasing amounts of food waste worldwide. Fruit and vegetable processing by-products such as peels, pulp, stems, and seeds are now seen as valuable raw materials with high recovery potential. Using suitable technologies to reprocess these materials can reduce waste and produce high-value ingredients. At the same time, consumer demand for natural, healthy, functional, and convenient foods is rising. This has increased interest in dietary fiber-rich ingredients for functional food development. Dietary fiber supports digestive health, satiety, blood glucose and cholesterol control, and may help lower the risk of metabolic diseases.

Fruit and vegetable by-products are especially important because of their high fiber content. Dietary fibers include cellulose, hemicellulose, pectin, and lignin, and are divided into soluble and insoluble types. Soluble fibers are associated with gelling and thickening, while insoluble fibers support bowel function and digestive health.



Suitable Processing Technologies and Methods

Appropriate processing technologies are essential for the recovery of dietary fiber from fruit and vegetable by-products. Grinding and micronization reduce particle size and improve dispersibility and integration into food systems. Enzyme-assisted processing using enzymes such as cellulases, hemicellulases, pectinases, and proteases helps break down cell wall structures and release bound fiber. Pre-treatments such as evaporation, distillation, washing, and blanching can also support fiber recovery. Laboratory analyses are necessary to determine dietary fiber content, nutritional value, and physicochemical changes caused by processing.



Valorization of Food By-Products in Modern Food Applications: Sustainability and Innovation

Dietary fibers are widely used as functional ingredients in food products such as bakery items, beverages, dairy products, meat products, and sauces. Soluble fibers are generally preferred for their thickening and stabilizing properties, while insoluble fibers mainly contribute to satiety and structural improvement. Fiber addition can increase water-holding capacity, reduce fat content, and improve texture.

Fruit and vegetable by-products such as banana peel, pear pomace, apple pomace, and grape pomace have been successfully incorporated into products like cakes, yogurt drinks, and chocolate spread to enhance nutritional and functional properties. These ingredients can improve viscosity, stability, texture, and fiber content, although high substitution levels may reduce sensory acceptance. In meat products, dietary fibers can improve water-holding capacity, reduce cooking loss, and enhance emulsion stability and texture. However, excessive addition may negatively affect color and sensory quality.



Dietary Fiber



Table 1. Main Components and Dietary Fiber Content (% DM) of Fruit and Vegetable Processing Wastes

Raw Material/ Sector	Waste/ Pomace Generated	Main Component of Waste	Dietary Fiber (TDF, % DM)	Reference
Apple- juice processing	25-30%	Pomace, peel, seeds	11-40%	Espinoza et al., 2007; Wang et al., 2019
Apple- general processing	15-25%	Peel, pomace, seeds	8%	Review sources
Carrot- juice production	20-25%	Peel, seeds, stems	45-50%	Wang et al., 2019
Citrus	Armed 50%	Peel, pomace, seeds	84.7% (orange), 82.4% (grapefruit), 84.7% (lemon)	Espinoza et al., 2007
Mango	20-45%	Peel, seeds	64.6% (peel fiber)	Burkhardt et al., 2017
Carrot	—	Pomace	61.7%	Kaewrakon et al., 2016
Pineapple	13%	Peel, core	45.2% (pomace)	Selam et al., 2014

* TEF: Total Dietary Fiber, DM: Dry Matter

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Samira Hamza Reguig^{1,2}, Sarah Zeghada^{1,3} Bentabed-Ababsa Ghenia^{1,4}, Mongin Florence⁵

hr.samira@yahoo.fr

¹Laboratory of Applied Synthesis Organic Chemistry, Faculty of Exact and Applied Sciences, The University of Oran1 Ahmed Ben Bella, BP 1524 El M'Naouer, 31000 Oran, Algeria.

²École Normale Supérieure d'Oran Ammour Ahmed (E.N.S.O), Department of Sciences Exacts, 02 avenue of martyrs, 31000 Oran, Algeria.

³Superior School of Electrical and Energetic Engineering of Oran (ESGEE), chemin vicinal N9, 31000 Oran, Algeria.

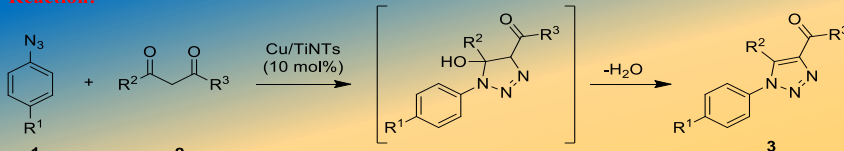
⁴Univ Oran 1 Ahmed Ben Bella, Faculty of Exact and Applied Sciences, B.P. 1524, El M'Naouer - 31000 Oran, Algeria

⁵Univ Rennes, CNRS, ISCR (Institut des Sciences Chimiques de Rennes) - UMR 6226, F-35000 Rennes, France.

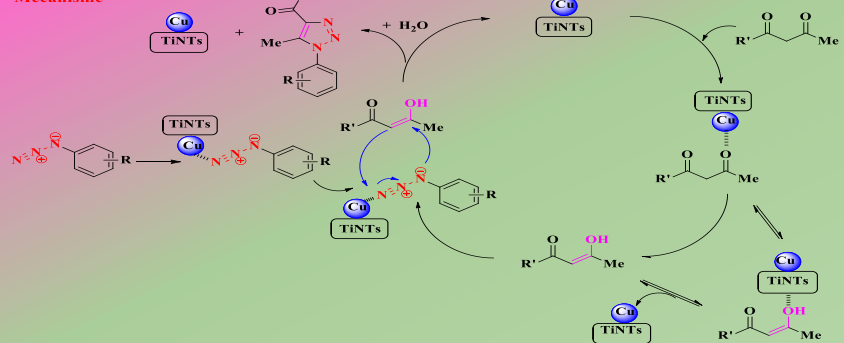
Introduction:

1,2,3-Triazoles are valuable compounds widely applied in diverse areas of chemistry such as medicinal chemistry, agrochemistry, and materials chemistry. Therefore, several synthetic methods for preparing triazole derivatives have been developed in the past decades. In this paper, we report a facile and rapid pathway for the synthesis of 1,2,3-triazoles through 1,3-dipolar cycloaddition reactions between aryl azides and activated alkenes using a new and recyclable nanocatalyst Cu/TiNTs system with recourse to less conventional activating systems than oil bath heating such as microwaves solvent free.¹

Reaction:



Mecanisme



Resultats:

Entry	R1	R2	R3	Products (3)	Conventional heating		microwaves	
					Time (h)	Rdt (%)	Time (min)	Rdt (%)
1	4-NO ₂	Me	Me	3a	1	99	10	98
2	4-NO ₂	Me	OMe	3b	1	98	10	98
3	4-NO ₂	Me	OEt	3c	1	98	10	98
4	4-NO ₂	ph	ph	3d	1	97	10	98
5	4-NO ₂	H	4,4-diMe-cyclohexanone	3e	1	75	15	80
6	4-NO ₂	H	cyclohexanone	3f	1	67	15	75
7	H	Me	Me	4a	1	76	15	85
8	OMe	Me	Me	5a	1	65	15	72

Conclusion:

We have employed a new heterogeneous catalyst for the 1,2,3-triazoles synthesis under conventional heating and microwave irradiation. The studied catalyst consists of copper nanoparticles supported on titanate nanotubes (Cu/TiNTs). A wide range of 1,2,3-triazoles have been synthesized with excellent yields obtained by both conventional heating and microwave irradiation conditions. Microwave irradiation dramatically reduces the reaction time.

¹Samira Hamza-Reguig, Sarah Zeghada, Mounia-Aouicha Bouayed, Nawal Ameer, Nisserine Hamini Kadar, Clara M. Gomez, Ghaniya Ferouani, Sumeya Bedrane, Bachir Redouane, Ghenia Bentabed Ababsa, Florence Mongin. *Reaction Kinetics, Mechanisms and Catalysis*, **2025**, 138, 2329-2350.



Introduction

Non-toxic copper perovskites have recently been intensively studied as an alternative to toxic lead perovskites used in optoelectronics, LEDs, displays, photodetectors, and other devices [1-6]. Of particular interest are ternary compounds of potassium and copper halides, in particular K_2CuCl_3 .

Most publications are devoted to various chemical methods for preparing K_2CuCl_3 and studying the luminescence and scintillation properties of the compound.

This paper proposes a simpler method for producing thin K_2CuCl_3 films and investigates their excitonic absorption spectrum. Unlike single crystals, thin films allow one to measure the transmission spectrum in the intrinsic absorption region of the compound and identify even weak absorption bands.

Experiment

K_2CuCl_3 thin films were prepared by vacuum evaporation of a melt of a mixture of pure KCl and CuCl powders of stoichiometric composition onto quartz substrates heated to 100 °C, followed by annealing of the films for an hour at the same temperature. This method of producing ternary compounds thin films is based on the fact that, as a rule, the melting temperature of ternary compounds is significantly lower than that of the original components.

The absorption spectra were measured on an spectrophotometer in the spectral range of 2-6 eV at $T = 90$ K and 290 K. In the region of the long-wave exciton band of K_2CuCl_3 (3.4-5.2 eV), the absorption spectrum was measured in the temperature range 90-333 K.

The parameters of the long-wave exciton bands (the position of E_m , the half-width Γ , and the value of the imaginary part of the permittivity at the maximum of the band $\varepsilon_{2m} = \varepsilon_2(E_m)$) were determined directly from the optical density spectrum $D = -\lg T$ using the technique of [3] by approximating the bands with two-oscillator and one-oscillator symmetric contours, which are a linear combination of the Lorentz and Gaussian contours. The parameters of the exciton bands (E_m , Γ , and ε_{2m}) were found by the best matching of the experimental and calculated contours.

Results

The absorption spectra of a 365 nm thick K_2CuCl_3 thin film are shown in Fig. 1 for temperatures 90K (curve 1) and 287K (curve 2). An intense long-wave band A at 4.7 eV, a weak band B at 5.255 eV, and a band C at 6.2 eV are observed in the absorption spectrum of a K_2CuCl_3 thin film at $T=90$ K. At a higher temperature the A and B bands shift to the long-wave region of the spectrum, broaden, and weaken (Fig. 1), indicating their exciton origin. Band C is little sensitive to temperature changes and apparently corresponds to the interband electron transitions.

In terms of the spectrum structure and the position of the absorption bands, the K_2CuCl_3 spectrum is similar to the spectra of Cu^+ impurity ions in KCl and RbCl, in which intense bands are observed at 4.75 eV and 4.7 eV, and weaker bands are observed at 5.3 eV and 5.29 eV, respectively [4]. Close positions of the main absorption bands in the spectra of K_2CuCl_3 , KCl: Cu^+ and RbCl: Cu^+ thin film (Table 1) and the similarity of their spectra indicate a common nature of the absorption bands in the spectra of the compounds.

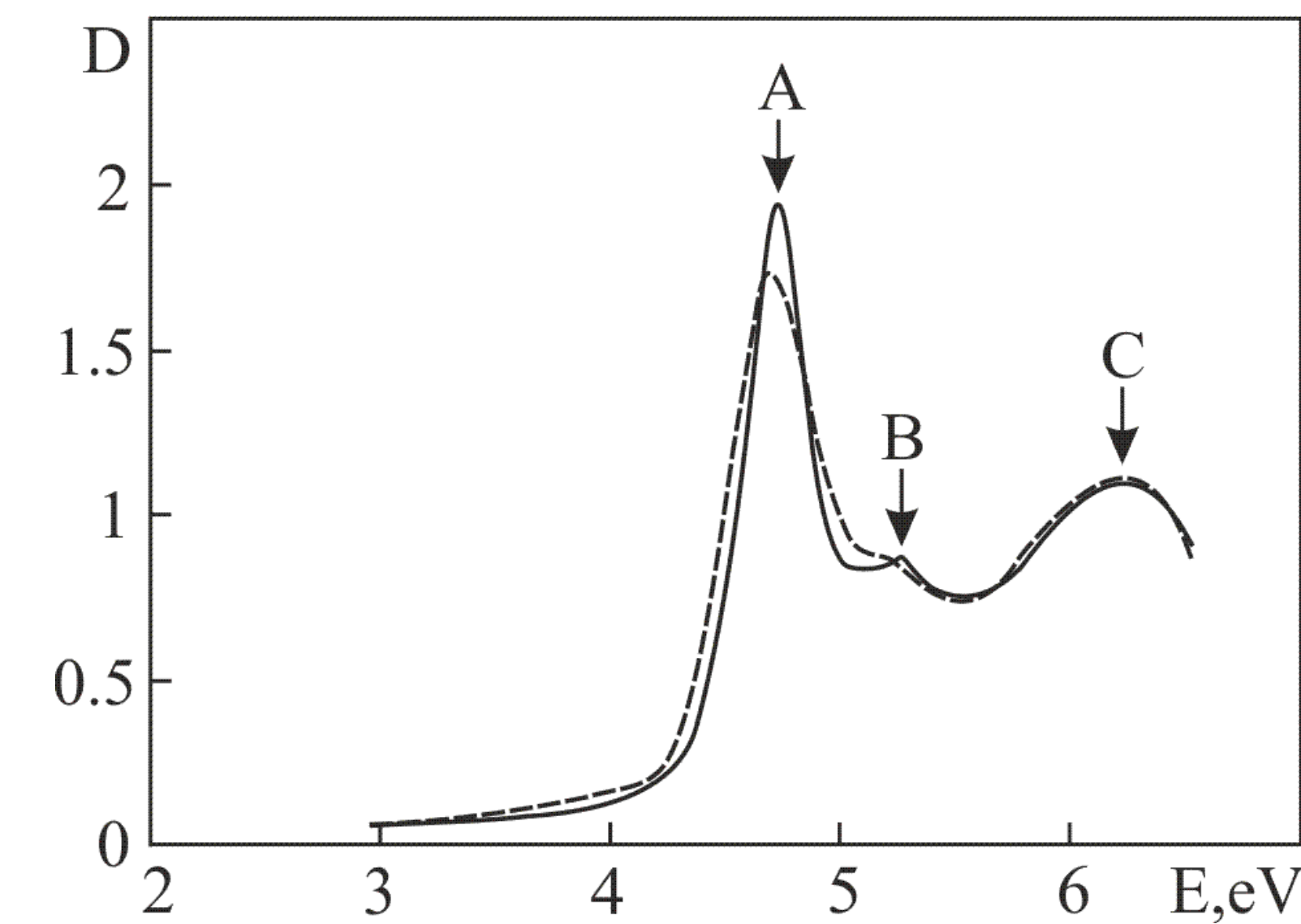


Fig. 1. Absorption spectra of a thin K_2CuCl_3 film: 1 – $T = 90$ K (solid curve) and 2 – $T = 287$ K (dashed line).

Compound	E_{mA} , eV	E_{mB} , eV	f_A	f_B
K_2CuCl_3 , $T=287$ K	4.66	5.21	0.145	0.0821
K_2CuCl_3 , $T=90$ K	4.7	5.255	0.1523	0.0749
KCl: Cu^+	4.7	5.3		
RbCl: Cu^+	4.75	5.29		

Table 1. Spectral position of absorption bands in the spectra of K_2CuCl_3 , KCl: Cu^+ and RbCl: Cu^+ thin films, oscillator strength of exciton bands A and B in K_2CuCl_3 .

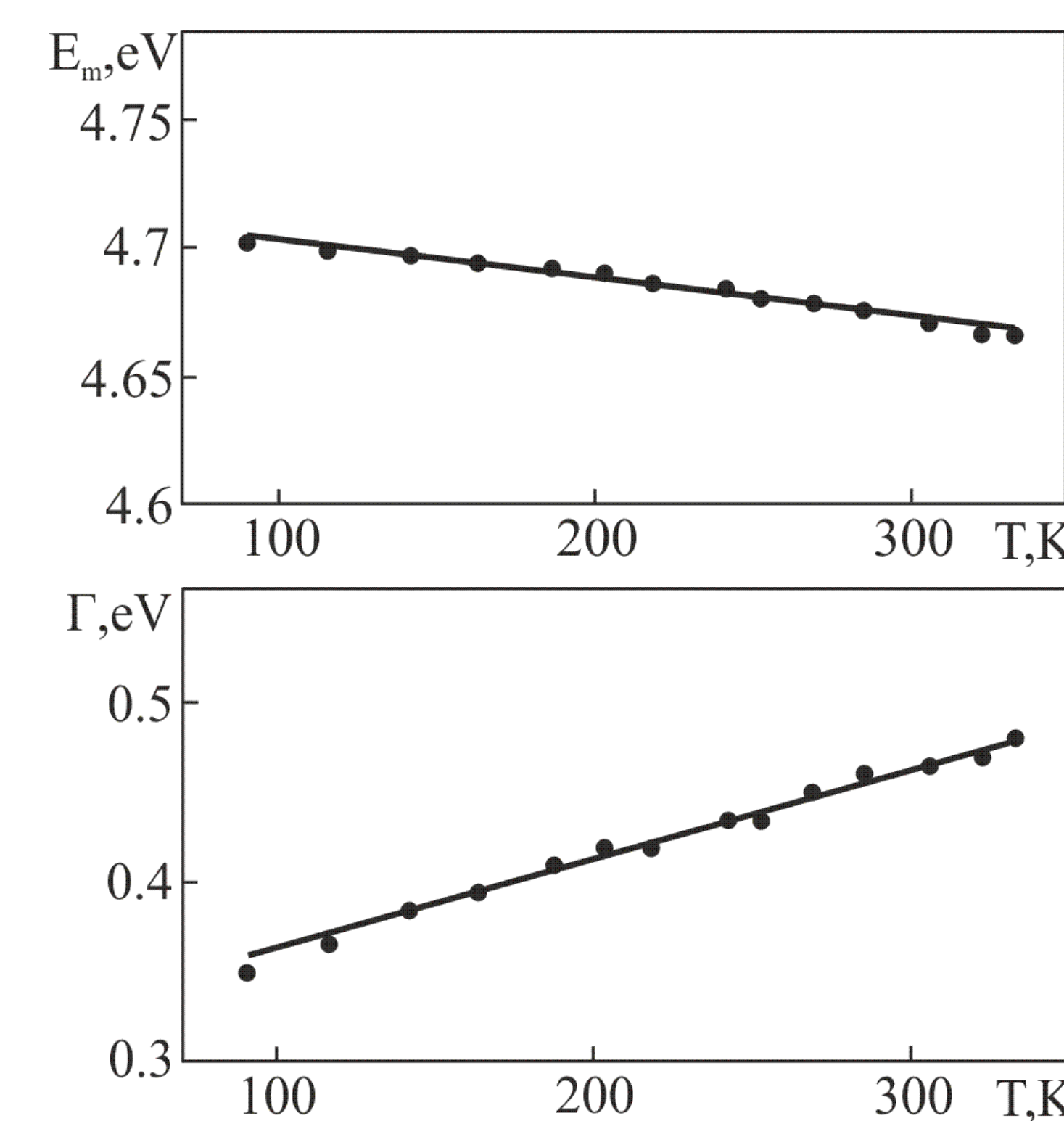


Fig. 1. Temperature dependence of the spectral position $E_m(T)$ and of the half-width $\Gamma(T)$ of the long-wave exciton band A in a thin K_2CuCl_3 film.

Temperature changes in the oscillator strength of A and B exciton bands in K_2CuCl_3 confirm this conclusion. The oscillator strength of exciton band A, calculated for the volume of one Cu^+ ion, decreases at a higher temperature from $f_A = 0.1523$ at $T = 90$ K to $f_A = 0.145$ at $T = 287$ K, while for band B, on the contrary, it increases from 0.749 (90 K) to 0.821 (287 K) (Table 1). A decrease in the oscillator strength of zero-phonon exciton bands at a higher temperature is characteristic for ionic crystals, which includes the studied compound K_2CuCl_3 [11, 12], which is what we observe for band A. The increase in the oscillator strength of exciton band B at a higher temperature is associated with an additional lifting of the ban on the transition $^1A_1 \rightarrow ^1E$ due to an increase in temperature.

At a higher temperature band A shifts linearly to the low-frequency region of the spectrum and broadens due to exciton-phonon interaction (EPI) (Fig. 2, 3). The temperature coefficient of the shift of band A is $dE_{mA}/dT = -(1.5 \pm 0.08) \cdot 10^{-4}$ eV/K. Such a value of dE_{mA}/dT is typical for ionic crystals by order of magnitude.

Conclusion

It was found that the exciton spectrum of K_2CuCl_3 thin films is caused by transitions in the Cu^+ ion in a tetrahedral environment of Cl⁻ ions. According to the selection rules for the local group C_{2v} , the intense long-wave exciton band in K_2CuCl_3 corresponds to the allowed transition, and the weak band B corresponds to the partially allowed transition.

The one-dimensional (1D) character of excitons in K_2CuCl_3 was determined from the analysis of the temperature dependence of the half-width of the long-wavelength exciton band A.

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Comparative Effects of Substituting Two Fats One Natural and One Industrial on Lipid Peroxidation in Rats Made Obese by A High-Fat Diet

Diet

Sherazad Hamza-Reguig

University of Science and Technology of Oran Mohamed BOUDIAF, Faculty of Natural and Life Sciences, Oran Algeria

INTRODUCTION

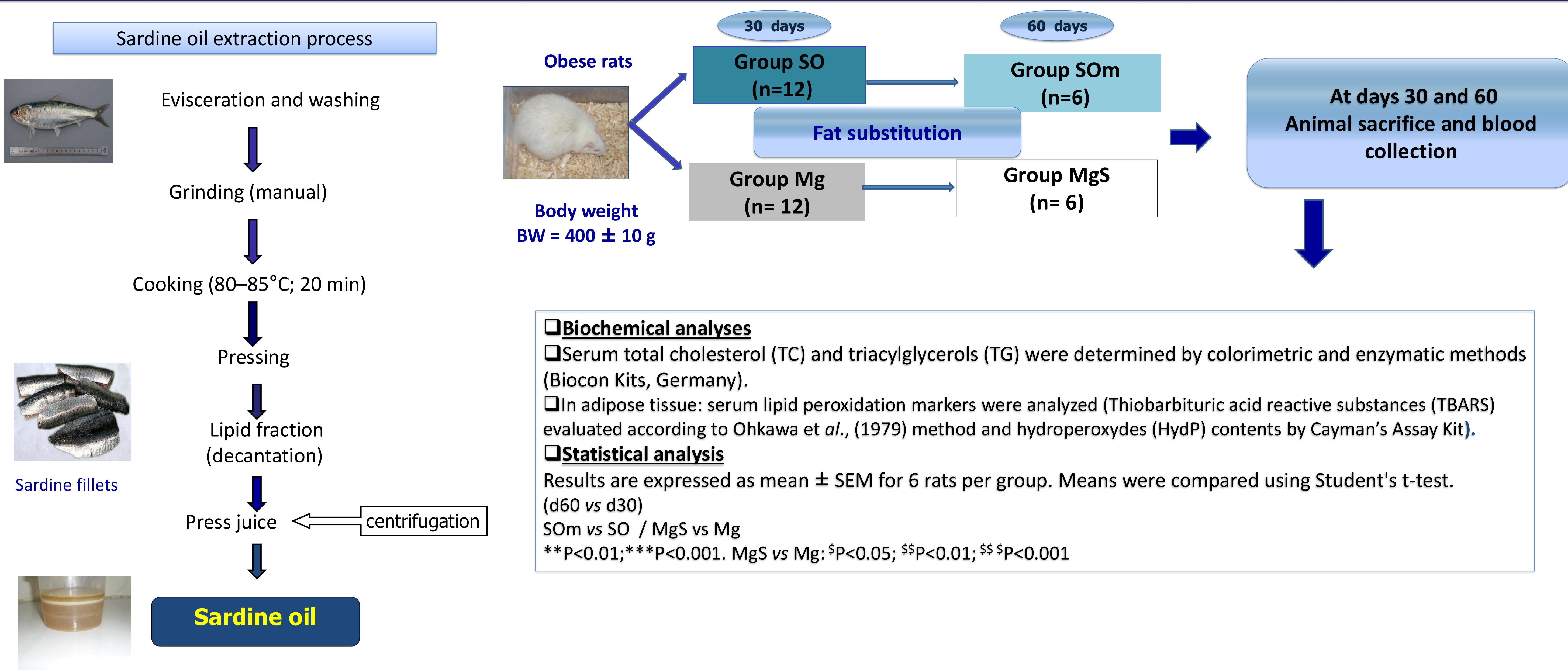
❖ High-fat diets are considered the standard for establishing rodent models of obesity and produce pathologies similar to those seen in humans. Indeed, in response to a high-fat, high-calorie diet, rats develop obesity characterized by excess weigh even in the absence of excessive caloric intake, reflecting their high metabolic efficiency and lipid accumulation in adipose tissue.

❖ Originally conceived as a butter substitute, margarine formulations have evolved alongside scientific understanding; today, they offer well-established nutritional benefits such as providing omega-3 and omega-6 fatty acids and plant sterols that are recognized for their cardioprotective effects. However, some studies indicate a significant increase in cardiovascular (CV) risk associated with excessive dietary intake of trans fats which result from the industrial partial hydrogenation of vegetable oils an effect that is even more pronounced than that of excessive fat intake in genera'

OBES

the impact of replacing two dietary fats of different origin (industrial or natural) on dyslipidemia and lipid peroxidation of adipose tissue in obese rats

MATERIEL & METHODES



RESULTS

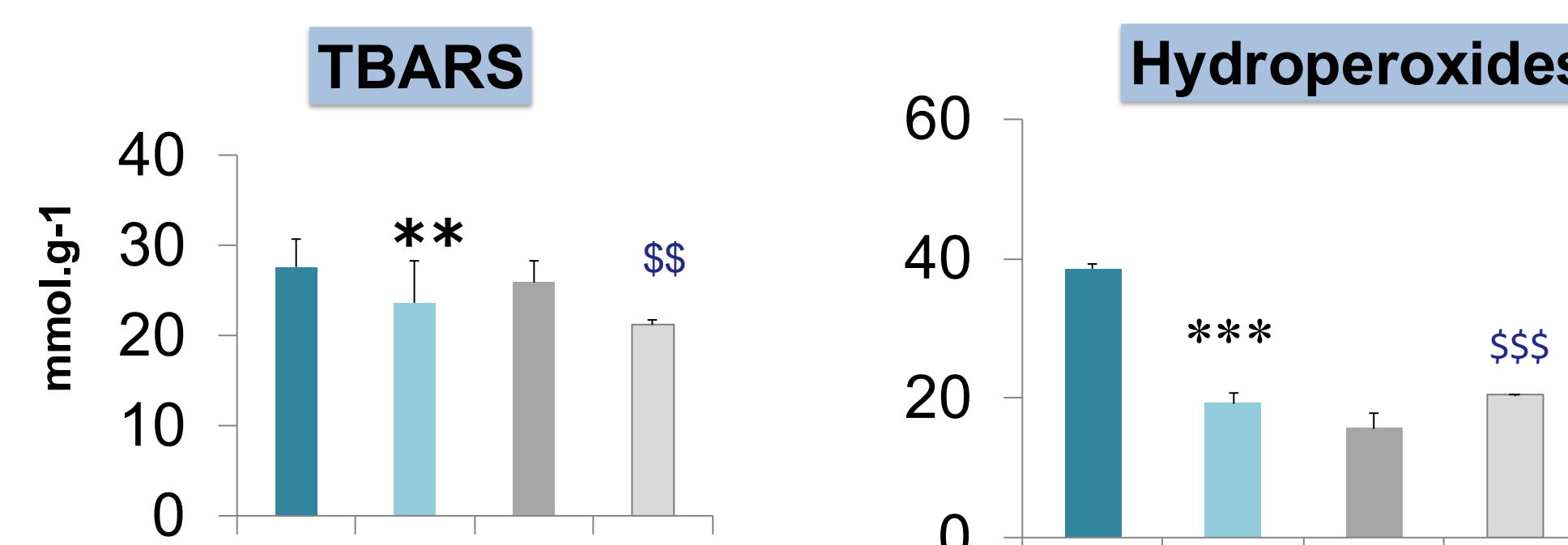
Table 1– Cholesterolemia and triglyceridemia

d30	SO	Mg
TC	1.64 ± 0.09	2.79 ± 0.69
TG	0.80 ± 0.03	1.25 ± 0.50
d 60	SOm	MgS
TC	1.61 ± 0.19	1.82 ± 0.18 ^{\$}
TG	0.89 ± 0.06	0.54 ± 0.03 ^{\$}

Cholesterolemia and triglyceridemia did not change significantly when sardine oil was replaced by margarine. In contrast, the substitution of margarine by sardine oil, reduced cholesterol and triacylglycerols levels (-35% and -57%, respectively).

TBARS levels were reduced by 14% when sardine oil was replaced by margarine and by 18% when margarine was substituted by sardine oil. The replacement of sardine oil by margarine decreased hydroperoxides levels (-50%). However, these values were increased (+23%) when margarine was replaced by sardine oil.

lipid peroxidation



Replacing margarine with sardine oil has a beneficial effect on free radical attack by reducing lipid peroxidation

CONCLUSIONS

In obese rats, the substitution of sardine oil by margarine does not modulate the dyslipidemia, but it decreases lipid peroxidation in adipose tissue and seems efficient in adipose tissue against the cytotoxic action and the oxidative stress induced by a fat enriched diet.