
بسم الله الرحمن الرحيم

Gelatin from the Perspective of Biological Sciences and Islamic Jurisprudence:

A Study of Its Nature, Production Process, and Jurisprudential Ruling

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Research Project Title: Gelatin from the Perspective of Biological Sciences and Islamic Jurisprudence:A Study of Its Nature, Production Process, and Jurisprudential Ruling

Client/Sponsor: Islamic Chamber Research and Information Center (ICRIC)/ Research Center of the Iran Chamber of Commerce, Industries, Mines and Agriculture

Publication Date: Fall 2026

Research Center of the Iran Chamber of Commerce, Industries, Mines and Agriculture

Islamic Chamber Research and Information Center

الغرفة الإسلامية للتجارة والتنمية
Islamic Chamber of Commerce and Development
Chambre Islamique de Commerce et de Développement

Table of Contents

Abstract 9
1- Introduction: 11
2. Necessity and Statement of the Problem 11
3. Research Background 12
4. Research Methodology 14
5. Gelatin: Subject-Matter Analysis 14
5-1. Proteins and the Position of Collagen 14
5-2. Definition of Gelatin and Its Physical and Chemical Properties 17
5-3 Main sources of gelatin (by animal species) 19
5-3-1. Two Main Production Methods: Gelatin Types A and B 19
5.3.2 Alternative and growing resources 19
5.3.3 Completely plant-based alternatives 20
5.3.4 Summary and Conclusion 20
5-4. Applications of Gelatin 20
5-4-1 Food industry 21
5.4.2 Industrial applications 21
5-4-3. Pharmaceutical and Medical Applications 21
5-4-4 Cosmetics and health care industries 21
5-4-4-1 Skin care products (Skin Care) 21
5-4-4-2 Hair Care Products 22
5-4-4-3 Colored cosmetic products (Color Cosmetics) 22
5-4-4-4 Oral hygiene products 23
5-4-4-5 Personal hygiene products 23

6. Technical properties of gelatin in cosmetic formulations 23
6-1 Film-Forming Property 23
6-2. Humectancy 23
6.3 Emulsification and stability 24
6-4 New gelatin-based cosmetic formulations 24
6-5. Advantages of Using Gelatin over Alternative Ingredients 24
7. Challenges and Limitations of Using Gelatin in the Cosmetic Industry 25
7.1 Religious and cultural restrictions 25
7-2. Microbial Stability 25
7-4. Odor and Taste 25
8. New Research and Future Trends 25
8.1 Gelatin in vegan and sustainable cosmetic products 25
8-2. Engineered Gelatin 26
8-3. Smart Cosmetic Products Based on Gelatin 26
9. Gelatin Consumption in Various Industries 26
9-1. Global Gelatin Consumption Statistics 26
9-2. Detailed Consumption by Industry 27
9-2-1. Food and Beverage Industry 27
9-2-2. Pharmaceutical Industry 29
9-2-3. Cosmetics and Personal Care Industry 30
9-2-4. Photography and Printing Industries 31
9-2-5. Chemical and Technical Industries 32
9-2-6. Other Industries 32
9-3. Geographical Distribution of the Gelatin Market 33
9-4. Key Trends in Gelatin Consumption, 2024–2030 34
9-5. Quantitative Interpretation of the Global Gelatin Market 36
9-6. Overall Conclusion 37
10. Gelatin Production Process 38
10-1. Production of Gelatin from Bones and Skin 38
10-2. Production of Gelatin from Bone 39
10-3. Production of Gelatin from Skin 42
11. Jurisprudential Foundations of Istihalah 44
11-1. Applied Concepts 44
11-1-1. The Concept of Istihalah 44
11-1-2. The Nature of Istihalah 45
11-1-3. Difference between Istihalah, Inqilab, and Istihlak 45
11-1-4. The Nature of Istihlak 45

11-1-5. Istihalah as a Purifying Agent 45
11-2. Failure of Istihalah to Occur in Gelatin 45
11-3. Jurisprudential Ruling on Different Types of Gelatin 46
11-3-1. Proposed Theory Concerning Gelatin Extracted from Bovine Bone 46
11-4. Fatwas of Prominent Shi'a Scholars 46
11-5. Jurisprudential Views of Sunni Scholars 48
11-6. View of the Islamic Fiqh Academy 50
11-7. Ruling on Gelatin Obtained from the Skin of a Halal Animal That Was Not Slaughtered According to Islamic Law 51
11-8. Opinions of Jurists on Extracting Gelatin from Pigs 52
11-8-1. Those Who Consider Gelatin Permissible When Istihalah Occurs 52
11-8-2. Those Who Do Not Consider Gelatin Permissible through Istihalah 52
12. Requirements for the Production of Halal Gelatin 53
12-1. Source of Raw Materials 53
13. Comparative Fatwas of Different Schools of Islamic Jurisprudence on Gelatin Istihalah 57
13-2. Views of International Jurisprudential Institutions 58
13-4. Conclusion and Practical Recommendations 59
Resources: 61

Tables

Table 1- Types of gelatin and its derivatives in the cosmetic industry..... 23
Table 2 - New gelatin-based cosmetic formulations 24
Table 3 - Advantages of using gelatin over alternative ingredients 24
Table 3 - Advantages of using gelatin over alternative ingredients 24
Table 4. Estimated Global Gelatin Consumption by Industry in 2024 27
Table 5. Estimated Gelatin Consumption in the Food Industry 28
Table 6. Estimated Gelatin Consumption in the Pharmaceutical Industry 29
Table 7. Estimated Gelatin Consumption in Cosmetics and Personal Care..... 30
Table 8. Estimated Gelatin Consumption in Photography and Printing 31
Table 9. Estimated Gelatin Consumption in Chemical and Technical Industries 32
Table 10. Estimated Gelatin Consumption in Other Industries..... 32
Table 11. Estimated Geographical Distribution of Global Gelatin Consumption 33
Table 12. Key Trends in Global Gelatin Consumption, 2024–2030..... 34
Table 13. Quantitative Summary of Major Gelatin-Consuming Industries..... 37

Figures

Figure 1 – Structure of proteins..... 15
Figure 2 - Collagen structure..... 16
Figure 3 – Collagen amino acids..... 16
Figure 4- Gelatin..... 17
Figure 5- Amino acids of gelatin..... 18
Figure 6 – Raw Materials Used in Gelatin Production 38
Figure 7 – Flowchart of Gelatin Production from Bone 38
Figure 8 – Flowchart of Gelatin Production from Skin 42

Abstract

Gelatin is a widely used raw material in the food, pharmaceutical, medical, and cosmetic industries. It is primarily produced from collagen found in the skin, bones, and other connective tissues of animals. The animal origin of gelatin and the processes used for its extraction and production, particularly when the raw material is obtained from animals whose meat is prohibited for consumption or from animals that have not been slaughtered according to Islamic law, raise important questions in Islamic jurisprudence concerning the ritual purity and permissibility of the final product. The most important jurisprudential issue in this regard is whether istihalah (transformation) occurs during the conversion of collagen into gelatin.

The present study employs a descriptive-analytical method and draws on scientific sources in the fields of biological sciences and gelatin production technology, sources of Imami and Sunni jurisprudence, fatwas issued by Islamic jurists, and the views of jurisprudential assemblies. It examines the nature and characteristics of gelatin, its sources and production methods, industrial applications, the jurisprudential foundations of *istihalah*, and the requirements for halal gelatin production. It also comparatively examines the views of different Islamic schools of jurisprudence, as well as those of selected jurisprudential assemblies and institutions, regarding *istihalah* in gelatin production.

The findings indicate that the jurisprudential ruling on gelatin in different circumstances depends on several factors, including the animal origin of the raw material, the status of its Islamic slaughter (*tadhkiyah*), the type of raw material, the production process, and the jurisprudential position concerning the occurrence of *isti-*

halah. There is disagreement among Islamic jurists and jurisprudential assemblies as to whether *istihalah* occurs during the gelatin production process. Therefore, the use of gelatin with a known and halal origin, compliance with the requirements governing the supply chain and production process, prevention of cross-contamination, and reliance on a credible halal certification system constitute practical approaches to reducing uncertainty and Shariah-related risks in the production and consumption of gelatin-containing products. Accordingly, while clarifying the scientific and jurisprudential dimensions of the issue, this study presents a set of practical requirements for the production and certification of halal gelatin.

Keywords: Gelatin, collagen, *istihalah*, food jurisprudence, halal, Islamic slaughter (*tadhkiyah*), animal products, halal certification

1- Introduction:

Today , gelatin is one of the most widely used raw materials in the food , pharmaceutical, cosmetic and medical industries . This material is used in a wide range of products due to its unique properties such as gelling , emulsifying , stabilizing and creating a suitable texture . The majority of the world ‘s commercial gelatin is produced from the skin and bones of animals , especially pigs and cows . Since the animal origin of gelatin and the method of its processing can affect the Islamic jurisprudential ruling on its consumption , the issue of gelatin has become one of the important issues in food jurisprudence and the halal industry in recent decades .

The disagreement among jurists about whether or not transformation occurs in the gelatin production process has led to different views on its purity and halal status . Therefore , a simultaneous examination of the scientific and jurisprudential dimensions of gelatin seems necessary for halal certification bodies and Muslim consumers .

2. Necessity and Statement of the Problem

Gelatin is a proteinaceous substance mainly obtained through the partial hydrolysis of collagen found in the skin, bones, and connective tissues of animals. Despite its widespread use in various industries, its animal origin raises a number of jurisprudential questions.

The most important question is whether the conversion of collagen into gelatin constitutes istihalah (substantial transformation) from the perspective of Islamic jurisprudence. If istihalah does not occur, what is the ruling on consuming gelatin obtained from animals that were not slaughtered according to Islamic law or from

animals whose meat is prohibited? Answering these questions requires a precise understanding of the scientific nature of gelatin, its production process, and its applications, followed by an assessment of the findings in light of the jurisprudential principles of istihalah and tadhkiyah. The present study seeks to explain the nature of gelatin and examine its jurisprudential implications on the basis of scientific and jurisprudential sources.

3. Research Background

Based on available sources, research on halal gelatin reveals a continuous and multi-layered scientific and jurisprudential search that began decades ago and continues to this day. This research can be categorized into several main axes :

1. Historical background and first jurisprudential research (1950s to 1990s)

The main concern during this period was to trace the origin of gelatin, especially with the increasing use of pig skin as a cheap raw material in the industry .

- Origin of the problem : In the 1950s , with the widespread production of gelatin from pig skin in America, Orthodox Jewish communities (kashrut) and then Muslims became deeply concerned about the halalness of products such as jelly, because their origin was traced back to “pigs” . This concern was the starting point of jurisprudential research in this field .
- Early field research in South Africa (1990s) : One of the most documented examples of research in this field is the Davis Gelatine factory study. It is in South Africa that it led to several fatwas :
    - The Muslim Judicial Council (MJC) and the Natal Ulema Association : Based on initial investigations and arguing that istihalah (change of nature) or (transformation of essence) occurred in the production process, they declared the gelatin from this factory to be halal .
    - Transvaal Ulema Association : A delegation of Ulema from this Association visited the same factory in 1990. They believed that the production process did not produce sufficient substantive change and even the smell of beef remained in the final product. As a result, their opinion was that gelatin is not permissible .
    - Re-investigation and scientific consensus : In December 1990 , a team of Newcastle University scholars and chemical scientists conducted a more detailed inspection of the factory. They came to the scientific conclusion that collagen and gelatin are completely different in nature, physical and chemical properties, and that this change is irreversible. Accordingly, they

unanimously emphasized the halal status of gelatin, confirming the previous opinion of Mufti Abdul Wahab Rahmani .

2. Scientific analysis of the concept of transformation (substantial transformation)

Subsequent research has examined the jurisprudential concept of istihalah in more detail in the light of chemistry. Here, two main views emerged, which are the root of the differences in jurisprudential views :

- Correct istihalah (complete transformation): This view, accepted by the Hanafi and Maliki schools and by some contemporary scholars, holds that the chemical and physical changes occurring during production are sufficient to transform the original impure material into a new and pure substance (gelatin).
- Incomplete istihalah (incomplete transformation): This view, associated with the Shafi'i and the predominant Hanbali position, holds that the changes are not complete and substantial. According to this view, the original protein structure is retained to some extent and, with advanced technologies, porcine DNA can be detected in the final product; therefore, the prohibition remains.

3. Contemporary research (2000 onwards): development of alternative sources and diagnostic methods

With the increasing demand for halal products, research has been directed towards producing gelatin from alternative halal sources and providing scientific methods to verify solubility .

- Development of alternative resources :
  - Halal bovine gelatin : Efforts to produce gelatin from cows slaughtered according to Islamic law have begun in Islamic countries and Turkey .
  - Poultry gelatin : Chicken and duck skin and feet have been proposed as economical and high-quality options that are completely halal if the conditions of religious slaughter are met. For example, gelatin from chicken skin has a higher gel strength than bovine gelatin .
  - Fish gelatin : This source is particularly well-suited for pharmaceutical and food products that seek specific properties such as a lower melting point, and is free of any religious concerns (except for the general requirement that fish be halal) .
  - Plant-based hydrocolloids : Materials such as agar and carrageenan, which are obtained from seaweed, have been introduced as completely plant-based and halal alternatives to gelatin, although they are not completely functionally similar to gelatin .

- New detection methods for verifying gelatin origin:
  - With the advancement of technology, precise laboratory methods have been developed to identify the origin of gelatin. The most common and reliable method is the polymerase chain reaction (PCR) , which can detect even very small amounts of pig DNA in the final product . These methods have become a powerful tool for regulatory and halal certification bodies .

4. Developing international standards

Finally, efforts have led to the development of unified standards. The Standards and Metrology Institute for Islamic Countries (SMIIC) has published OIC/SMIIC 22:2021, entitled "Halal Edible Gelatine – Requirements and Test Methods," as an international standard addressing the religious and technical aspects of halal gelatin production and certification.

Summary of the Research Background

Research on halal gelatin has a long history and has developed from a basic concern about the origin of raw materials into a complex interdisciplinary field. It encompasses factory inspections, jurisprudential debates over the concept of istihalah, scientific methods for identifying gelatin origin, and efforts to establish international standards for halal gelatin.

4. Research Methodology

This research was conducted using a descriptive-analytical method. Scientific data were collected from specialized sources in food science and gelatin technology, while jurisprudential data were collected from Imami and Sunni jurisprudential sources, the opinions of religious authorities, and resolutions of jurisprudential assemblies.

5. Gelatin: Subject-Matter Analysis

5-1. Proteins and the Position of Collagen

Gelatin is a widely used colloidal protein with unique properties and applications in the food, pharmaceutical, medical, and photographic industries. In the food industry, gelatin is used in products such as jellies, marmalades, gummy candies, confectionery, and ice cream. Consumers seeking halal and wholesome foods may have concerns about the nature and origin of gelatin. These concerns should be addressed by explaining what gelatin is, what raw materials it is made from, how it is processed, whether it is derived from plants or animals, whether the animal is

halal or non-halal, whether the animal was slaughtered according to Islamic law, and whether istihalah occurs during processing. The relevant jurisprudential rulings should then be clarified so that the status of gelatin and products containing it can be properly understood.

Biological functions of proteins in the body:

1- Structural proteins: collagen

2- Catalytic proteins: enzymes

3- Transport proteins: hemoglobin

4- Regulatory proteins: hormones

5- Protective proteins: antibodies

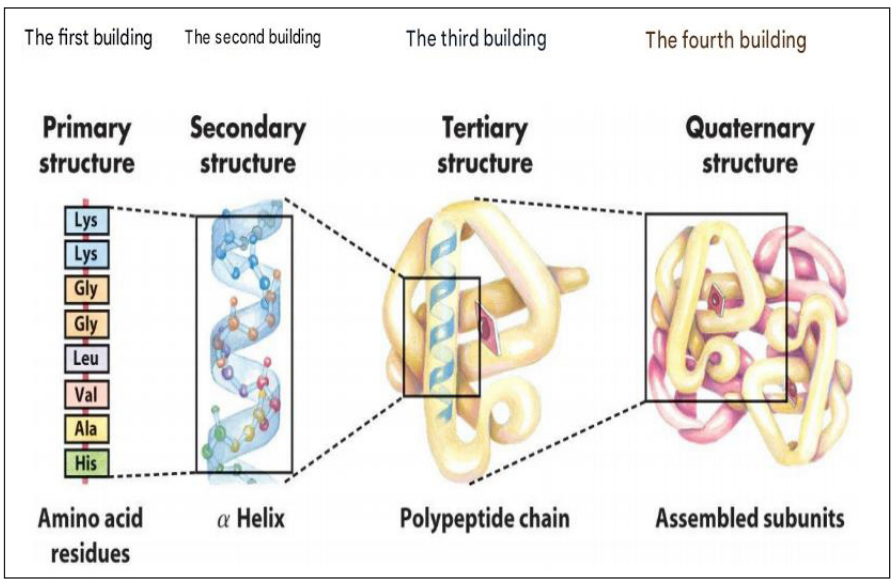


Figure 1 – Structure of proteins

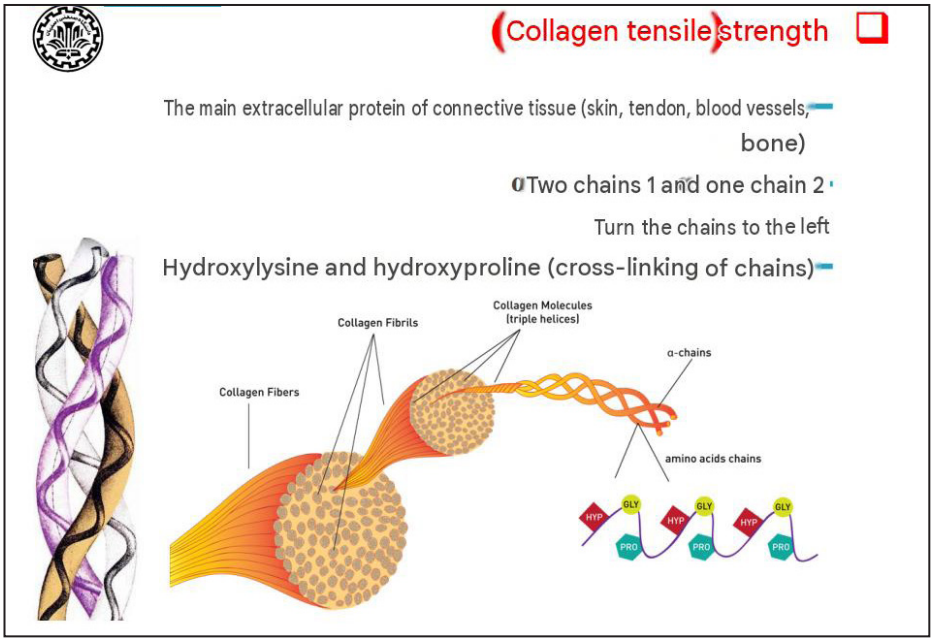


Figure 2 - Collagen structure

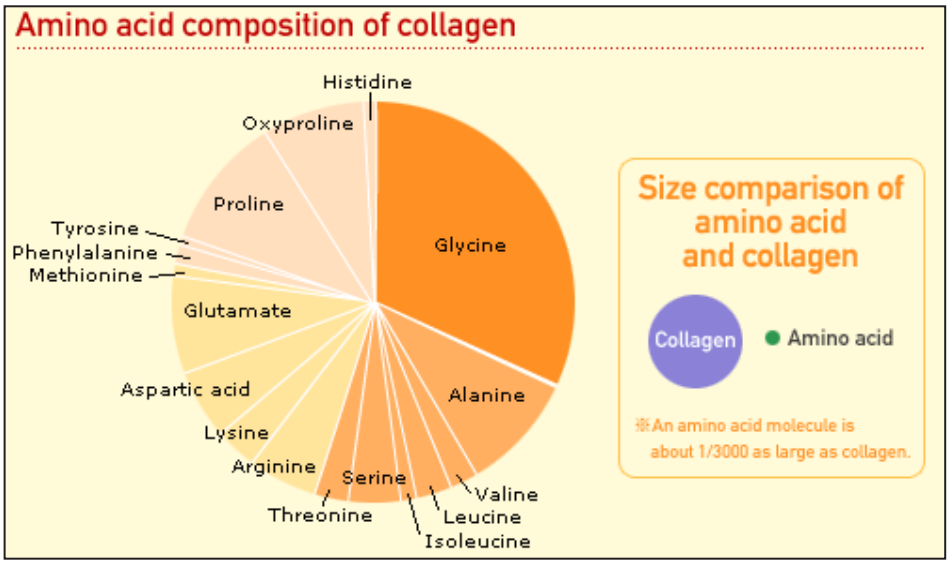


Figure 3 – Collagen amino acids

5-2. Definition of Gelatin and Its Physical and Chemical Properties

When collagen is hydrolyzed, the triple-stranded tropocollagen structure is disrupted, resulting in gelatin.

1. Gelatin is a solid, semitransparent substance, usually yellowish to brownish in color, with little or no odor and almost no taste. In its dry state, it is relatively transparent and brittle. It is generally produced in powder or granule form.

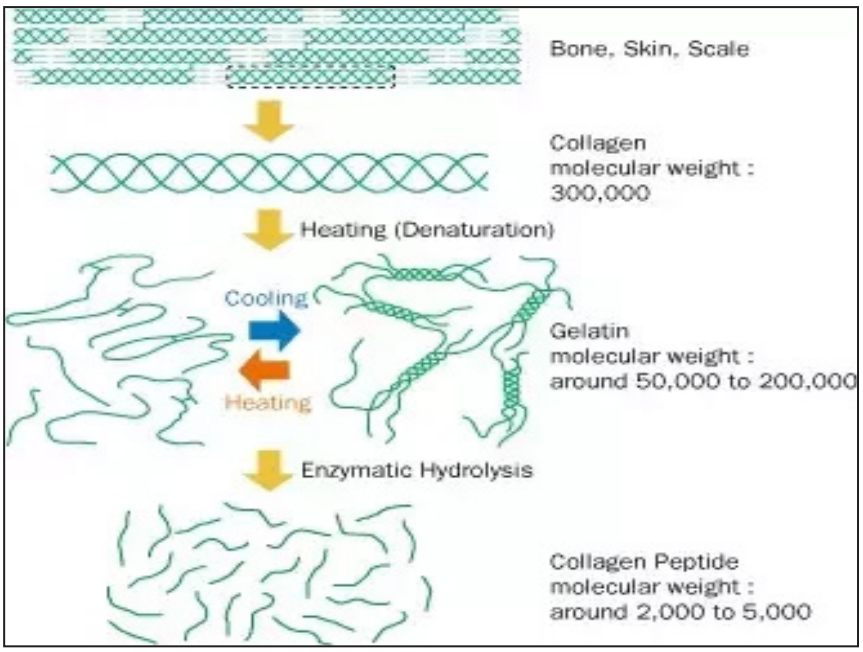


Figure 4- Gelatin

2. Gelatin contains approximately 84–90% protein, 1–2% mineral salts, and 8–15% water, depending on its source and intended use. It contains no sugar or fat and no added materials in its basic form.

3. Gelatin may contain approximately 84% protein, 14% moisture, and 2% ash. Because gelatin absorbs moisture during storage, it should be kept in a cool, dry place. If its moisture content exceeds approximately 16%, fungal and mold growth may occur, creating a potential safety risk.

4. Gelatin is soluble in warm water, glycerol, and acetic acid, while it is generally insoluble in cold water and some organic solvents. It can absorb up to approxi-

mately ten times its weight in water and forms a gel at about 40–50 °C.

Gelatin is a transparent, colorless, brittle protein when dry, with little or no taste. It is soluble in water and polyhydric alcohols such as glycerol and polyethylene glycol and is produced from collagen. According to the figures cited in the study, global gelatin production increased from approximately 32,600 tons in 2007 to about 395,840 tons in 2017. The study reports that approximately 80% came from pig skin, 15% from bovine skin, and the remainder from bones, fish, and other sources.

Gelatin has multiple functions, including foaming, stabilizing, emulsifying, clarifying, film formation, coating, and moisture retention. Accordingly, it has numerous industrial applications, particularly in the food industry (meat and dairy products, confectionery, and desserts) and the pharmaceutical industry (tablets, ointments, and capsules).

Gelatin offers several advantages, including its suitability as a structural material for various tissues and organs, good surface-active properties at non-fat interfaces, high biodegradability, low antigenicity, and high biocompatibility compared with some other polymeric materials. These properties make gelatin useful in food, biomedical, and pharmaceutical applications.

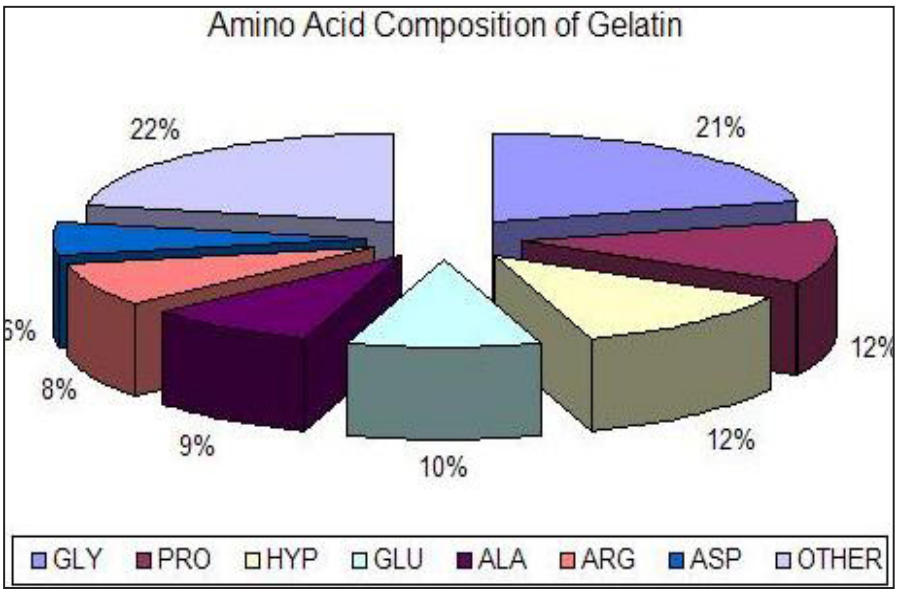


Figure 5- Amino acids of gelatin

5-3 Main sources of gelatin (by animal species)

The global gelatin market is mainly segmented based on the following animal sources :

- Pork (Porcine) : The largest source, with a share of about 40 Up to 46 % of global production . This type of gelatin is widely used in Europe, accounting for about 80 % of the continent's edible gelatin .
- Cow (Bovine) : The second largest source, which is supplied from two main sectors : Cowhide with a share of about 29.4 Percentage and beef bones with a share of about 23.1 Percentage of total production . Some sources have cited the share of total cattle resources as up to 52.5 %, indicating fluctuations in the statistics .
- Other sources : They account for a very small share of the market and include poultry (chicken, etc.) and aquatic (fish, etc.) sources, which total about 1.5 percent of global production .

5-3-1. Two Main Production Methods: Gelatin Types A and B

The type of raw material and the chemical pretreatment process have a direct impact on the properties of the final gelatin, dividing it into two general types :

- Acid-process gelatin (Type A): This method is used for materials with fewer cross-links, such as pig skin, young calf bones, and fish skin and bones. Acid is used as the pretreatment agent, and the isoelectric point of the resulting gelatin is generally between pH 6 and 9.
- Alkaline-process gelatin (Type B): This method is used for materials with more stable and numerous cross-links, such as the skin and bones of adult cattle. Alkaline materials such as lime are used for pretreatment, and the process takes longer. The isoelectric point of this gelatin is approximately pH 5.

5.3.2 Alternative and growing resources

Due to religious restrictions (halal and kashrut) and health concerns (such as mad cow disease), there has been increased attention to alternative sources :

- Marine gelatin (Fish Gelatin) : Although its current market share is small (around 1 %) , it is considered a sustainable and acceptable option for Muslim and Jewish consumers. This gelatin is extracted from fish processing waste (skin, scales and bones) . However, due to its lower content of the amino acids proline and hydroxyproline, it is usually weaker in gel strength and thermal stability than the mammalian type .

- Poultry gelatin (Poultry Gelatin) : Poultry processing wastes, such as chicken skin, feet, and bones, are being investigated as a new source of collagen .

5.3.3 Completely plant-based alternatives

To meet the needs of the vegetarian, vegan, and halal markets, there are several plant-based alternatives to gelatin, made from plant gums and polysaccharides . Some of the most popular include :

- Agar agar (Agar-Agar) : It is obtained from red algae and has strong gelling properties .
- Carrageenan (Carrageenan) : It is extracted from red-purple seaweed and is mostly used as an emulsifier and thickener .
- Pectin (Pectin) : It is extracted from apple pulp and citrus peel and is used in making jams and jellies .
- Different gums : Such as gum arabic, guar gum, xanthan gum, etc., each of which is obtained from different plant sources .

5.3.4 Summary and Conclusion

The choice of gelatin source depends on several factors :

1. Cost and availability : Pig and cattle sources are the most economical options due to mass production and high waste .
2. Religious regulations : For Muslim (halal) and Jewish (kashrut) markets, pork gelatin is prohibited, and bovine gelatin must come from an animal slaughtered according to Sharia law. In these cases, fish gelatin or plant-based alternatives are preferred .
3. Final application : The desired physical properties, such as gel strength, melting point, and viscosity, determine which source and production method is most suitable. For example, fish gelatin with a lower melting point is suitable for products that are stored in the refrigerator .

5-4. Applications of Gelatin

• Food industry

• Various industrial applications

• Pharmaceutical and medical applications

• Cosmetic and personal-care applications

The following sections describe some of the major applications.

5-4-1 Food industry

It is used in the food industry to prepare marmalades, jellies, sweets, ice creams, etc., which are easily absorbed by the body and help digest other foods by forming an emulsion with fats and proteins. Gelatin is also used as a clarifying agent in beverages and juices .

5.4.2 Industrial applications

Gelatin has played an important role in the rapid development of the cinema and photography industries. Gelatin is also used in other industries such as textiles, glue production, match making, printing ink, polycopy paper, cardboard making, and in the manufacture of mercury lamp filters, as well as as a transparent agent for objects.

5-4-3. Pharmaceutical and Medical Applications

In medical applications, gelatin is used in blood-clotting products, as a plasma substitute, as a coating material for the gastrointestinal tract, and in the preparation of bacterial culture media. It is also used in the pharmaceutical industry to manufacture medicinal capsules and tablets.

5-4-4 Cosmetics and health care industries

Gelatin is widely used in cosmetic and personal-care formulations because of its high biocompatibility, film-forming ability, moisturizing properties, and amino-acid content, particularly proline, hydroxyproline, and glycine. It can function both as an active ingredient and as a carrier for other active ingredients.

The most important uses of gelatin in cosmetic products include:

5-4-4-1 Skin care products (Skin Care)

- Moisturizing creams and lotions : Due to its hygroscopic (moisture-absorbing) properties, gelatin helps retain skin moisture and improve the skin barrier .
- Face masks (Sheet Masks) : Gelatin is used as the main film-forming ingredient in sheet masks and peel-off masks .

Rebelo and colleagues (2021) designed gelatin hydrogels for topical drug delivery and facial-mask applications. The results indicated that gelatin can serve as a matrix for carrying plant extracts and vitamins. Source: Journal of Biomedical Materials Research Part B, 109(11), 1800–1812.

Kang et al. (2022) developed gelatin masks containing vitamin C and E nanoemul-

sions and investigated their stability and permeability. Source: Cosmetics, 9(3), 58.

- Anti-aging and rejuvenation : Gelatin hydrolysate (collagen peptides) is used in anti-wrinkle products because it stimulates collagen synthesis in the skin .

Asserin et al. (2015) A randomized clinical trial examined the effect of oral administration of collagen peptides (gelatin hydrolysate) on skin elasticity, moisture, and wrinkle reduction. Results showed significant improvement after 8 weeks. Source : Skin Pharmacology and Physiology, 28(1), 47-55

Choi et al. (2019) studied a topical cream containing collagen peptides derived from fish gelatin and its potential role in skin-barrier regeneration. Source: Marine Drugs, 17(7), 401.

5-4-4-2 Hair Care Products

- Shampoos and conditioners : Gelatin hydrolysate is used as a hair cuticle repair agent and to increase hair shine .
- Styling gels and tonics : Gelatin is used in hair styling products due to its ability to form a film and create temporary styling .

A study investigated the role of gelatin protein hydrolysate in repairing damaged hair . The study showed that low molecular weight gelatin peptides were able to penetrate the hair cuticle and repair its structure . Source : International Journal of Cosmetic Science , 30(6), 417-425)

Giessen and colleagues (2011) reported a double-blind clinical study on the effect of collagen hydrolysate (gelatin) on hair thickness and strength. Source: Journal of Cosmetic Dermatology, 10(3), 201–208.

Davoudi et al. (2019) designed gelatin nanoparticles for the delivery of chondroitin sulfate and hyaluronic acid in anti-aging products. Source: International Journal of Biological Macromolecules, 133, 1153–1160.

Sallustio and colleagues (2022) synthesized gelatin microgels containing retinol with the aim of reducing irritation and improving the effectiveness of retinol in cosmetic products. Source: Journal of Cosmetic Science, 73(2), 89–104.

5-4-4-3 Colored cosmetic products (Color Cosmetics)

- Lipstick and lip gloss : Gelatin is used as a film-forming agent and to increase adhesion and color stability .
- Cream-to-powder and concealer : As a binding agent and creating a soft tex-

ture in the formulation .

- Eyeshadow and eyeliner : As a binder and stabilizer for pigments.

5-4-4-4 Oral hygiene products

- Toothpaste : Gelatin as a thickener and stabilizer in some formulations .
- Teeth whitening strips : as a matrix to carry whitening agents .

5-4-4-5 Personal hygiene products

- Soaps and detergents : as a moisturizer and foam improver .
- Deodorants : In the formulation of solid sticks and antiperspirant gels .
- Shaving products (Shaving Products) : As a skin softener and protector .

Table 1- Types of gelatin and its derivatives in the cosmetic industry

Type	Features	Application
Gelatin type A (Acidic)	**Positive charge, pH Acidic**	**Face masks, creams**
Gelatin type B (Alkaline)	**Negative charge, neutral pH**	**Shampoos, lotions**
Gelatin hydrolysate (collagen peptides)	**Low molecular weight, high absorption**	**Anti-aging products, beauty supplements**
GelMA (Methacryloylated gelatin)	Can be cross-linked using UV light	**Advanced masks, cosmetic hydrogels**

6. Technical properties of gelatin in cosmetic formulations

6-1 Film-Forming Property

Gelatin acts as a protective agent by forming a thin, transparent layer on the skin or hair. Studies have shown that :

Lu et al. (2020) Gelatin films modified with nanocellulose have higher mechanical strength and adhesion for use in facial masks. Source : Carbohydrate Polymers , 236, 116018

6-2. Humectancy

Gelatin can absorb and retain moisture because of its hydrophilic functional groups, including hydroxyl (OH) and amino (NH2) groups. This property has been investigated in comparison with other hydrocolloids.

Bajpai and Sony (2021) The moisture retention capacity of gelatin and its hybrid compounds was compared with glycerin and sorbitol. Source : Journal of Applied Polymer Science, 138(19), 5034

6.3 Emulsification and stability

Gelatin acts as a natural emulsifier in creams and lotions :

Dai et al. (2020) investigated modified gelatin as an emulsifier in Pickering formulations for natural cosmetic products. Source: Food Hydrocolloids, 105, 105770.

6-4 New gelatin-based cosmetic formulations

Table 2 - New gelatin-based cosmetic formulations

Product type	Main ingredients	Benefits	Source
Gelatin-hyaluronic acid sheet mask	Gelatin, hyaluronic acid, glycerin	Deep hydration, elastic properties	Wang et al ., 2020
Anti-aging cream with gelatin-retinol nanoparticles	Gelatin nanoparticles, retinol, tocopherol	Reduced irritation, targeted release	Sallustio et al. , 2022
Hair styling gel with gelatin hydrolysate	Gelatin hydrolysate, polyquaternium, panthenol	Hair repair, shine, soft styling	Secchi, 2008
Eye cream with collagen peptides	Gelatin hydrolysate, caffeine, niacinamide	Reduce puffiness, dark circles and wrinkles	Choi et al. , 2019
Gelatin lip gloss with fruit extract	Gelatin, castor oil, natural pigments	Lasting shine, soft lips	Kim & Park , 2021
Gelatin and aloe vera soap	Gelatin, aloe vera gel, glycerin	Gentle cleanser, moisturizer	Hussain et al ., 2018

6-5. Advantages of Using Gelatin over Alternative Ingredients

Table 3 - Advantages of using gelatin over alternative ingredients

Feature	Gelatin	Hyaluronic acid	Collagen	Guar gum
Cost	Low	High	Very high	Medium
Film formation	Excellent	Good	Excellent	Weak
Penetration capability	High (hydrolysate)	Medium	Low	Very low
Thermal stability	Good	Good	Medium	Good
Biodegradability	Excellent	Excellent	Excellent	Excellent
Renewable resource	Yes (waste)	Semi-synthetic	Limited	Herbal

Table 3 - Advantages of using gelatin over alternative ingredients

7. Challenges and Limitations of Using Gelatin in the Cosmetic Industry

7.1 Religious and cultural restrictions

- Bovine and porcine gelatin may not be suitable for some markets, including halal, kosher, and vegan markets.
- Solution: Use halal-certified fish gelatin or plant-based alternatives such as agar-agar.

7-2. Microbial Stability

- Gelatin can provide a suitable environment for the growth of bacteria and fungi.
- Solution: Use appropriate preservatives and comply with suitable storage conditions.

7-3. Limited Thermal Stability

- Gelatin may lose its functional properties at elevated temperatures.
- Solution: Use cross-linking or combine gelatin with more heat-resistant polymers, such as polyvinyl alcohol.

7-4. Odor and Taste

- Low-quality gelatin may have an unpleasant odor or taste.
- Solution: Use advanced purification processes and, where appropriate, natural flavoring or fragrance agents.

8. New Research and Future Trends

8.1 Gelatin in vegan and sustainable cosmetic products

- Andreani and colleagues (2023) examined plant-based alternatives to gelatin in cosmetic products with a circular economy approach and emphasized the importance of using waste from the fisheries industry. Source : Sustainable Chemistry : and Pharmacy, 31, 100934
- Maghsoudi et al. (2024) developed gelatin-chitosan nanocomposites for packaging cosmetic-health products with natural antibacterial properties. Source : International Journal of Biological Macromolecules, 254, 127845

8-2. Engineered Gelatin

- Zhu and Colleagues (2023) Methacryloylated gelatin (GelMA) was introduced for the production of wearable hydrogels with the ability to target the release of cosmetic active ingredients. Source : Advanced Functional Materials, 33(12), 2211530
- Shin et al. (2024) Gelatin microneedles containing anti-aging serum were designed to penetrate the ingredients deeper into the skin layers. Source : Journal of Controlled Release, 365, 201-214

8-3. Smart Cosmetic Products Based on Gelatin

- Zhang et al. (2025) developed pH- sensitive gelatin-based smart face masks that indicate moisture levels by changing skin color. Source : ACS Applied Materials & Interfaces, 17(2), 3456-3470
- Lee and colleagues (2024) Gelatin-polydopamine hydrogels with self -healing capabilities were designed for skin care products. Source : Biomaterials Science, 12(8), 2056-2068)

9. Gelatin Consumption in Various Industries

Gelatin is one of the most important protein-based functional raw materials used across a wide range of industrial applications. Its unique physicochemical properties—including gel formation, film-forming capacity, water binding, foaming, emulsification, stabilization, and adhesive properties—have led to its widespread use in the food, pharmaceutical, cosmetic, photographic, chemical, and technical industries.

Based on the industry estimates adopted in this study, global gelatin production/consumption in 2024 was approximately 550,000–600,000 metric tons per year. The global gelatin industry is estimated to have been expanding at an annual rate of approximately 5–7%, although growth rates vary considerably across application sectors and geographical regions.

The following analysis uses these estimated production and consumption figures as a quantitative basis for assessing the major end-use industries.

9-1. Global Gelatin Consumption Statistics

The global gelatin market is distributed across several major industries. The food

industry is the largest consumer, followed by pharmaceutical applications, cosmetics and personal care, photography and printing, chemical and technical applications, and other specialized uses.

The estimated distribution of global gelatin consumption in 2024 is presented in Table 4.

Table 4. Estimated Global Gelatin Consumption by Industry in 2024

Industry	Estimated Market Share (%)	Estimated Annual Consumption (Metric Tons)	Main Sources / Basis
Food and beverages	45–50%	265,000–295,000	GME; Grand View Research; industry estimates
Pharmaceuticals	20–25%	120,000–145,000	GIA; pharmaceutical industry estimates
Cosmetics and personal care	10–15%	55,000–80,000	Grand View Research; industry estimates
Photography and printing	5–8%	30,000–45,000	MarketsandMarkets; industry estimates
Chemical and technical industries	5–7%	25,000–40,000	GIA; industry estimates
Other industries	5–10%	25,000–50,000	Grand View Research; industry estimates

Source: Compiled from industry market estimates and relevant literature for each sector.

The estimated figures indicate that the food and beverage industry consumes approximately 265,000–295,000 metric tons of gelatin annually, making it the largest application sector. This finding is consistent with current market studies identifying food and beverages as the dominant application segment of the global gelatin market. Grand View Research reported that food and beverages constituted the largest application segment of the gelatin market in 2024.

It should be noted that the ranges presented in Table 4 are independent industry estimates and should therefore be interpreted as approximate rather than exact values. In particular, the lower and upper bounds of the different sectors should not be mechanically summed because the relevant market reports use different market definitions and estimation methodologies.

9-2. Detailed Consumption by Industry

9-2-1. Food and Beverage Industry

The food and beverage industry is the largest consumer of gelatin, with annual

consumption estimated at approximately 265,000–295,000 metric tons, equivalent to approximately 45–50% of global gelatin consumption.

Gelatin is widely used in this sector because of its ability to form thermoreversible gels, stabilize foams and emulsions, modify texture, bind water, and produce transparent or flexible films. Major applications include confectionery, dairy products, meat products, beverages, desserts, sauces, soups, and edible coatings.

The dominance of the food and beverage sector is also supported by current market research. Grand View Research identifies food and beverages as the largest application segment of the global gelatin market, while other market analyses estimate its share at approximately 52–58%, depending on market definition and methodology.

Table 5. Estimated Gelatin Consumption in the Food Industry

Product / Application	Share within Food Industry	Approximate Share of Global Gelatin Consumption	Primary Function
Confectionery	35–40%	15–18%	Gel formation, texture, and elasticity
Gummies and fruit gums	Approximately 60% of confectionery	Approximately 10%	Formation of a chewy gel structure
Marshmallows	Approximately 20% of confectionery	Approximately 3%	Foam and structural stabilization
Caramel and toffee	Approximately 15% of confectionery	Approximately 3%	Texture modification
Dairy products	20–25%	9–11%	Stabilization and texture improvement
Yogurt and dairy desserts	Approximately 50% of dairy applications	Approximately 5%	Texture and stabilization
Ice cream	Approximately 25% of dairy applications	Approximately 3%	Texture control and reduction of ice-crystal formation
Cream and cheese products	Approximately 25% of dairy applications	Approximately 3%	Structural modification
Meat products	15–20%	6–9%	Binding, water retention, and structure
Ham and sausage products	Approximately 50% of meat applications	Approximately 4%	Binding and stabilization
Meat jellies	Approximately 25%	Approximately 2%	Gel formation
Protective meat coatings	Approximately 25%	Approximately 2%	Surface protection

Beverages	5–10%	2–4%	Clarification and stabilization
Clarification of fruit juices and wine	Approximately 70% of beverage applications	Approximately 2%	Purification/clarification
Protein powders and supplements	Approximately 30%	Approximately 1%	Protein functionality
Other food applications	10–15%	3–6%	Diverse functional applications
Sauces and soups	Approximately 40% of other applications	Approximately 2%	Thickening and stabilization
Edible coatings	Approximately 30%	Approximately 1%	Film formation and preservation
Baked confectionery	Approximately 30%	Approximately 1%	Texture and structural modification

Source: Adapted from Schrieber & Gareis (2007), Ghosh & Bhowmik (2019), Gómez-Guillén et al. (2011), and industry estimates.

9-2-2. Pharmaceutical Industry

The pharmaceutical sector is estimated to consume approximately 120,000–145,000 metric tons of gelatin annually, representing approximately 20–25% of global gelatin consumption.

Gelatin has long been used in pharmaceutical manufacturing because of its film-forming properties, biocompatibility, digestibility, and suitability for capsule production. Hard and soft gelatin capsules remain its principal pharmaceutical applications.

Current market research also confirms pharmaceuticals as one of the major end-use sectors for gelatin.

Table 6. Estimated Gelatin Consumption in the Pharmaceutical Industry

Product / Application	Share within Pharmaceutical Industry	Approximate Share of Global Gelatin Consumption
Soft capsules	35–40%	8–10%
Hard capsules	25–30%	5–7%
Plasma expanders	10–15%	2–4%
Surgical adhesives / hemostatic agents	5–8%	1–2%
Tablet coatings	5–7%	1–2%
Other applications, including matrix tablets	5–10%	1–3%

Soft gelatin capsules represent the largest pharmaceutical application, accounting for approximately 35–40% of gelatin consumption in the pharmaceutical sector. They are widely used for liquid and semi-solid formulations, including medicinal products, vitamins, oils, and nutraceutical products.

Hard gelatin capsules account for approximately 25–30% of pharmaceutical gelatin consumption. They are particularly suitable for powders, granules, pellets, and other solid dosage forms.

Other pharmaceutical applications include gelatin-based hemostatic materials, selected plasma-volume-expanding formulations, tablet coatings, and experimental drug-delivery systems.

An important trend in this sector is the increasing availability of non-gelatin capsule materials, particularly hydroxypropyl methylcellulose (HPMC). Nevertheless, gelatin remains an important capsule-shell material because of its established manufacturing technology and functional performance.

9-2-3. Cosmetics and Personal Care Industry

Under the quantitative framework adopted in this study, the cosmetics, personal care, and hygiene sector is estimated to consume approximately 55,000–80,000 metric tons of gelatin annually, representing approximately 10–15% of global gelatin consumption.

Gelatin and collagen-derived materials are used because of their film-forming, water-binding, texturizing, and conditioning properties. The cosmetics sector is also experiencing relatively strong growth. Grand View Research estimated the global cosmetics gelatin market at approximately USD 289.8 million in 2024, with a compound annual growth rate (CAGR) of 8.2% through 2030.

Table 7. Estimated Gelatin Consumption in Cosmetics and Personal Care

Product Category	Estimated Annual Consumption (Metric Tons)	Estimated Share of Cosmetic Consumption
Skin-care products	30,000–40,000	50–55%
Creams and lotions	15,000–20,000	25–30%
Facial masks	10,000–12,000	15–20%
Anti-aging serums	5,000–8,000	8–10%
Hair-care products	10,000–15,000	15–20%
Shampoos and conditioners	6,000–9,000	10–12%
Hair gels and tonics	4,000–6,000	5–8%

Color cosmetics	8,000–12,000	12–18%
Lipstick and lip gloss	3,000–5,000	5–7%
Foundation and concealer	3,000–4,000	4–6%
Eye shadow and eyeliner	2,000–3,000	3–4%
Oral and dental care products	3,000–5,000	5–7%
Toothpaste	2,000–3,000	3–4%
Whitening strips	1,000–2,000	2–3%
Other personal-care products	4,000–8,000	7–10%

Source: Adapted from industry estimates and selected sources, including Rebelo et al. (2021), Kang et al. (2022), Choi et al. (2019), and Secchi (2008).

It is important to distinguish conventional gelatin from hydrolyzed collagen and collagen peptides. A significant portion of the growing "collagen beauty" market is based on hydrolyzed collagen rather than conventional gelatin. Therefore, the figures above should be interpreted as estimates for gelatin-related applications rather than direct measurements of all collagen-based cosmetic ingredients.

9-2-4. Photography and Printing Industries

The photography and printing sector is estimated to consume approximately 30,000–45,000 metric tons of gelatin annually, corresponding to approximately 5–8% of global gelatin consumption under the assumptions used in this study.

Historically, gelatin has been an important binder in photographic emulsions because it can form uniform films and immobilize photosensitive materials.

Table 8. Estimated Gelatin Consumption in Photography and Printing

Application	Estimated Annual Consumption (Metric Tons)
Photosensitive layers of photographic paper	15,000–25,000
Adhesives/binders in paper and cardboard	10,000–15,000
Binder in printing inks	5,000–10,000
Total estimated consumption	30,000–45,000

The long-term trend in this sector is negative because of the transition from conventional photographic film to digital imaging. Accordingly, gelatin consumption in traditional photography is expected to continue declining.

For the purposes of this study, an annual decline of approximately 3–5% is used as an indicative estimate for this application sector. This percentage should be interpreted as a scenario assumption rather than a directly measured global annual rate.

9-2-5. Chemical and Technical Industries

The chemical and technical industries are estimated to consume approximately 25,000–40,000 metric tons of gelatin annually, representing approximately 5–7% of global gelatin consumption.

Gelatin is used in these applications mainly because of its adhesive, film-forming, binding, and surface-modifying properties.

Table 9. Estimated Gelatin Consumption in Chemical and Technical Industries

Application	Estimated Annual Consumption (Metric Tons)
Adhesives and binding agents	10,000–15,000
Paper production and paper sizing	5,000–8,000
Matchstick adhesives and abrasive applications	3,000–5,000
Ceramic industry as a binder	2,000–4,000
Textile industry	2,000–3,000
Other technical and laboratory applications	3,000–5,000
Total estimated consumption	25,000–40,000

These applications are generally smaller than food and pharmaceutical uses, but they remain technologically important because they provide opportunities for higher-value gelatin products with specific functional characteristics.

9-2-6. Other Industries

The remaining applications are estimated to account for approximately 25,000–50,000 metric tons per year, representing approximately 5–10% of global gelatin consumption.

Table 10. Estimated Gelatin Consumption in Other Industries

Industry	Estimated Annual Consumption (Metric Tons)
Leather industry	8,000–15,000
Agricultural fertilizers	5,000–10,000
Stationery products	3,000–5,000
Sports equipment	2,000–3,000
Toy and game manufacturing	2,000–4,000
Other specialized applications	5,000–13,000
Total estimated consumption	25,000–50,000

These applications are diverse and generally represent a small share of total global consumption. Nevertheless, they demonstrate the functional versatility of gelatin beyond conventional food and pharmaceutical applications.

9-3. Geographical Distribution of the Gelatin Market

The geographical distribution of gelatin consumption is strongly influenced by the development of food processing, pharmaceutical manufacturing, cosmetics, nutraceuticals, and gelatin production capacity.

Under the quantitative framework adopted in this study, the Asia-Pacific region accounts for approximately 35–40% of the global gelatin market, followed by Europe and North America.

Table 11. Estimated Geographical Distribution of Global Gelatin Consumption

Region	Estimated Market Share	Estimated Consumption (Metric Tons per Year)
Asia-Pacific	35–40%	200,000–240,000
China	Approximately 50% of Asia-Pacific	100,000–120,000
Japan and South Korea	Approximately 20%	40,000–50,000
India and Southeast Asia	Approximately 30%	60,000–70,000
Europe	25–30%	140,000–170,000
Germany and France	Approximately 40% of Europe	56,000–68,000
Italy and Spain	Approximately 30%	42,000–51,000
Other European countries	Approximately 30%	42,000–51,000
North America	20–25%	110,000–140,000
Latin America	5–8%	Approximately 27,500–48,000

Source: Quantitative framework derived from Grand View Research, GIA, MarketsandMarkets, and industry estimates.

The regional distribution should be interpreted as an estimated allocation of the market rather than an independently verified production balance. Current market research confirms the importance of Europe and Asia-Pacific. Grand View Research reported that Europe accounted for approximately 38.3% of global gelatin market revenue in 2024, while other market studies similarly identify Europe as a leading region.

The Asia-Pacific market is expected to remain one of the fastest-growing regions because of the expansion of food processing, nutraceuticals, pharmaceuticals, and consumer health products.

China

Under the assumptions adopted in this study, China is estimated to account for approximately 50% of the Asia-Pacific market, equivalent to approximately 100,000–120,000 metric tons per year.

Japan and South Korea

Japan and South Korea together are estimated to account for approximately 20% of the Asia-Pacific market, equivalent to approximately 40,000–50,000 metric tons per year.

India and Southeast Asia

These markets account for approximately 30% of the Asia-Pacific market, equivalent to approximately 60,000–70,000 metric tons per year. Continued growth in food processing, pharmaceuticals, nutraceuticals, and functional foods is expected to support demand in these markets.

9-4. Key Trends in Gelatin Consumption, 2024–2030

The gelatin industry is expected to experience steady growth through 2030, although growth rates will vary considerably across application sectors.

Several trends are affecting the market simultaneously. Increasing demand for natural and biodegradable materials, collagen peptides, dietary supplements, and pharmaceutical capsules is expected to support gelatin consumption. Conversely, the development of plant-based products and non-gelatin capsule technologies may reduce consumption in selected applications.

Table 12. Key Trends in Global Gelatin Consumption, 2024–2030

Trend	Expected Impact on Consumption	Estimated Annual Change	Assessment
Replacement of gelatin capsules with plant-based capsules	Reduced demand for pharmaceutical gelatin	2–3% decrease	Negative
Growth of vegan and plant-based products	Reduction in selected food applications	1–2% decrease	Negative
Increasing demand for natural and biodegradable products	Growth in cosmetics and personal care	8–12% increase	Positive
Growth of collagen and hydrolyzed collagen peptides	Growth in dietary supplements	10–15% increase	Strongly positive
Advances in nanotechnology and drug delivery	New pharmaceutical and biomedical applications	7–10% increase	Positive

Digital photography	Reduction in photographic applications	3–5% decrease	Negative
Circular economy and by-product utilization	Improved production sustainability and efficiency	4–6% increase in sustainable applications	Positive

Replacement of gelatin capsules with plant-based capsules

The pharmaceutical industry faces increasing competition from HPMC and other plant-based capsule materials. Under the scenario adopted in this study, this substitution could result in an estimated annual reduction of 2–3% in gelatin consumption in the affected pharmaceutical applications.

However, this reduction should not be interpreted as a 2–3% decrease in the entire pharmaceutical gelatin market. It represents an estimated change in the affected application segment.

Growth of vegan and plant-based foods

Growing demand for vegan and plant-based foods is another factor that may reduce gelatin consumption in selected food applications. Accordingly, an annual reduction of 1–2% in applications where plant-based hydrocolloids can technically substitute for gelatin is considered plausible.

Natural and biodegradable materials

Increasing demand for natural, renewable, and biodegradable materials presents an important opportunity for gelatin. In cosmetics and personal care, the relevant application segment is estimated, under the assumptions used in this study, to grow by approximately 8–12% annually.

This overall direction is consistent with current market research. For example, Grand View Research estimates a compound annual growth rate of 8.2% for the cosmetics gelatin market from 2024 to 2030.

Collagen and hydrolyzed collagen peptides

One of the strongest growth opportunities relates to collagen and hydrolyzed collagen peptides. Their applications in dietary supplements, sports nutrition, beauty products, and functional foods are expanding rapidly.

Under the scenario adopted in this study, the collagen and hydrolyzed collagen peptide segment is estimated to grow by approximately 10–15% annually.

However, it is important to distinguish this growth from direct gelatin consumption because hydrolyzed collagen peptides are chemically and commercially distinct products from conventional gelatin.

Nanotechnology and drug delivery

Advances in nanotechnology, biomaterials, and controlled drug-delivery systems are creating new opportunities for gelatin-based materials. Under the current scenario, these emerging applications could experience annual growth of approximately 7–10%.

Digital photography

The transition from conventional photography to digital imaging has resulted in a structural decline in photographic gelatin consumption. In this analysis, an approximate annual decline of 3–5% is assumed for the traditional photography segment.

Circular economy and by-product utilization

Gelatin production is closely linked to the valorization of collagen-rich by-products from the meat and leather industries. Greater emphasis on circular-economy principles can improve resource efficiency and support the development of sustainable gelatin production systems.

Under the assumptions of this study, applications and production approaches associated with circular-economy strategies may expand by approximately 4–6% annually.

9-5. Quantitative Interpretation of the Global Gelatin Market

Based on the estimated global production/consumption range of 550,000–600,000 metric tons in 2024, the food industry alone consumes approximately 265,000–295,000 metric tons per year.

The pharmaceutical sector represents the second-largest major application, with an estimated 120,000–145,000 metric tons per year, while cosmetics and personal care account for approximately 55,000–80,000 metric tons.

Accordingly, the combined estimated consumption of these three major sectors is approximately:

440,000–520,000 metric tons per year.

This is approximately equivalent to 73–95% of estimated global gelatin consumption, depending on the values selected within each range.

The remaining consumption is distributed among photography and printing, chemical and technical applications, and other specialized industries.

Table 13. Quantitative Summary of Major Gelatin-Consuming Industries

Industry	Estimated Annual Consumption (Metric Tons)	Approximate Position
Food and beverages	265,000–295,000	First
Pharmaceuticals	120,000–145,000	Second
Cosmetics and personal care	55,000–80,000	Third
Photography and printing	30,000–45,000	Fourth
Chemical and technical	25,000–40,000	Fifth
Other industries	25,000–50,000	Sixth
Global gelatin production/ consumption	550,000–600,000	—

9-6. Overall Conclusion

Based on the quantitative estimates used in this study, global gelatin consumption in 2024 is estimated at approximately 550,000–600,000 metric tons, with an annual growth rate of 5–7%.

Food and beverages are the dominant consumer, accounting for approximately 265,000–295,000 metric tons annually. Confectionery products, particularly gummies and marshmallows, represent the main food applications, followed by dairy products, meat products, beverages, and other specialized food applications.

The pharmaceutical industry, with estimated annual consumption of 120,000–145,000 metric tons, represents the second-largest application sector. Soft and hard capsules constitute the principal pharmaceutical applications.

Cosmetics and personal care consume approximately 55,000–80,000 metric tons annually and are expected to remain one of the fastest-growing application areas. Current market data support expectations of relatively strong growth in this sector; Grand View Research estimates a compound annual growth rate of 8.2% for the cosmetics gelatin market during 2024–2030.

The photography and printing sector, estimated at 30,000–45,000 metric tons annually, is undergoing a structural decline because of digitization. In contrast, emerging applications—including collagen peptides, edible films, biodegradable packaging, drug delivery, biomedical materials, and other biotechnologies—are expected to create new sources of demand.

From a geographical perspective, the quantitative framework used in this study estimates that Asia-Pacific accounts for approximately 35–40%, Europe for 25–

30%, and North America for 20–25% of global gelatin consumption. Europe remains a highly important market, and current market research confirms its leading position in terms of gelatin market revenue.

10. Gelatin Production Process

10-1. Production of Gelatin from Bones and Skin

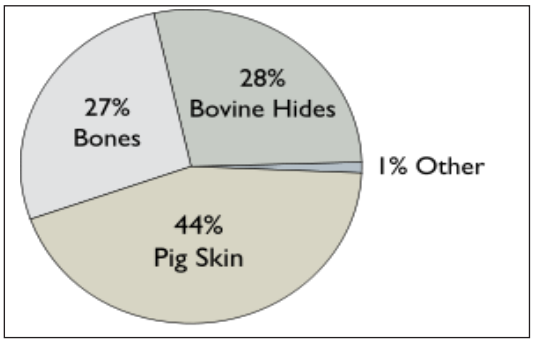


Figure 6 – Raw Materials Used in Gelatin Production

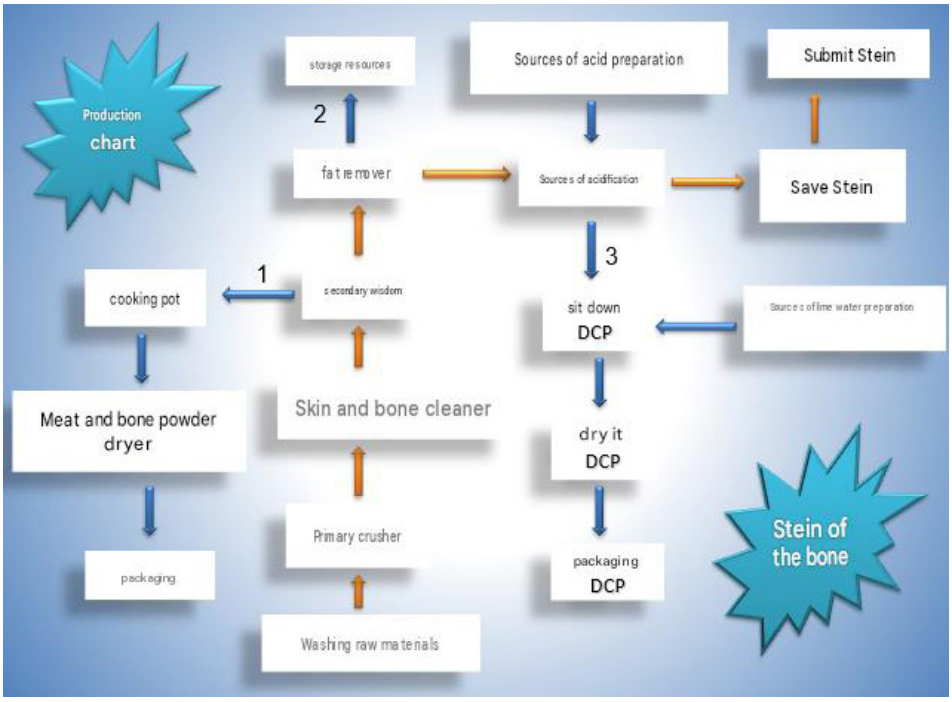


Figure 7 – Flowchart of Gelatin Production from Bone

10-2. Production of Gelatin from Bone

A. Production of Bone Chips

Bones collected from slaughterhouses, meat-packing centers, hotels, restaurants, and other sources are transported to the bone-chip production facility, where they undergo degreasing. After hot-water degreasing, the bones are dried. They are then passed through a primary crusher and reduced to smaller pieces before entering a secondary crusher, which produces bone chips of the required size.

B. Hot-Water Washing before the Production Process

Before the acidification stage, the bone chips are washed with hot water to remove possible secondary contamination from their surface.

C. Acidification Process

At this stage, the bone chips react with hydrochloric acid to remove mineral components. Over a period of approximately 4–7 days, the reaction removes minerals mainly as dicalcium phosphate and calcium chloride, converting the bone chips into a material known as ossein. Ossein is the final product of the acidification stage.

D. Preliminary Liming

At this stage, the ossein undergoes neutralization to adjust its pH. The operation is carried out using lime water. After treatment, the ossein reaches an approximately neutral pH and may either be dried for storage or transferred directly to the liming area.

E. Liming Process

During this stage, alkaline hydrolysis of the covalent bonds in ossein takes place, ultimately exposing the collagen structure. Organic materials are separated from the ossein, and intratissue fats are released, allowing the protein structure of collagen to become accessible. The duration of this process is approximately 45–56 days.

F. Washing and Chemical Conditioning

The product obtained from the previous stage has a high (alkaline) pH and is therefore unsuitable for direct transfer to the extraction tanks. Lime particles may also have penetrated the porous tissue. During this stage, the proteinaceous material is thoroughly washed and purified, and its pH is adjusted to approximately 5.5–6.

G. Extraction Process

After liming, washing, and chemical conditioning, the prepared ossein is transferred to the extraction tanks. Contact with hot water at different temperatures, generally in the range of 50–85 °C, gradually converts collagen into gelatin. The

gelatin dissolves in water and increases the concentration of the liquor in the extraction tanks. When the desired Brix level is reached, the liquor is transferred to the filtration stage.

H. Filter Press

The gelatin liquor first undergoes preliminary filtration. Coarse and suspended materials are removed, and a relatively clear liquor leaves the filter. The operating temperature is similar to that of the extraction process, and the working pressure varies between approximately 1 and 3.5 bar. A pressure of about 3.5 bar indicates that the filter path is becoming blocked and that the flow path needs to be changed.

I. Secondary Filtration

The liquor leaving the filter press enters a secondary filter, referred to in the source as an Eco-filter. Perlite and alpha-cellulose filter aids are used to improve filtration efficiency and remove particles that were not separated by the filter press.

The operating pressure during secondary filtration varies between approximately 2 and 6 bar. A pressure of about 6 bar indicates blockage of the filter path and the need to change the liquor flow path.

J. Ion Exchange

At this stage, the clear gelatin liquor enters cation- and anion-exchange columns to adjust the gelatin to its isoelectric pH. The parameters monitored for correction are electrical conductivity and pH. The performance of the columns is evaluated using these parameters; after the resin capacity is exhausted, the liquor is sent to the next stage and the first set of columns is regenerated using acid and alkali solutions.

K. Ultrafiltration

The gelatin liquor then enters an ultrafiltration system for preliminary concentration. Special membranes remove part of the water from the liquor, approximately doubling the gelatin concentration (for example, from about 4 Brix to about 8 Brix).

L. Evaporation

The liquor, once concentrated to approximately 6–8 Brix, is further concentrated in this stage to approximately 25–30 Brix. This operation prepares the gelatin for conversion from a liquid to a solid form.

The steam pressure entering the system at this stage is approximately 8 bar, and the temperature in the effective heating stages varies between about 50 and 85 °C.

M. Quality-Control Tanks

The liquor leaving the evaporation stage is discharged into an intermediate tank used for quality control. Physicochemical properties of the gelatin, including pH,

viscosity, H2O2, and SO2, are measured in these tanks, and values outside the required range are corrected.

N. Sterilization

To eliminate microbial contamination, the gelatin liquor enters a sterilizer and is exposed to approximately 138–142 °C for 4–8 seconds. The incoming steam pressure is approximately 6–8 bar, and the outlet liquor temperature is about 50 °C.

O. Extrusion

At this stage, the gelatin is transferred from the liquid state into a semi-solid gel through an extruder. Glycol at approximately 10 °C is used to cool the gelatin until its temperature reaches about 17–19 °C, the reported solidification temperature.

P. Drying

The gelatin noodles leaving the extruder are placed on the conveyor belt of the dryer. The dryer contains nine chambers, in which the temperature gradually increases within a range of approximately 26–65 °C.

The gelatin enters the dryer with a moisture content of about 70% and leaves with a moisture content of approximately 11–14%. The air supplied to the dryer is prepared by a Catabar system, which removes moisture from the air using a chemical desiccant referred to in the source as Katen.

Q. Blending

After drying, the gelatin is converted into granules by a crusher located beneath the discharge hopper. The granules are then stored in polyethylene tanks with a capacity of approximately 1,000 kg until the physical, chemical, and microbiological parameters are determined by quality control. Gelatin grades with different Bloom values are then blended according to customer requirements.

R. Packaging

Gelatin with the required Bloom value is transferred from the blender to the packaging system and packed in double-layer PP/HDPE bags in 25-kg and 50-kg sizes.

10-3. Production of Gelatin from Skin

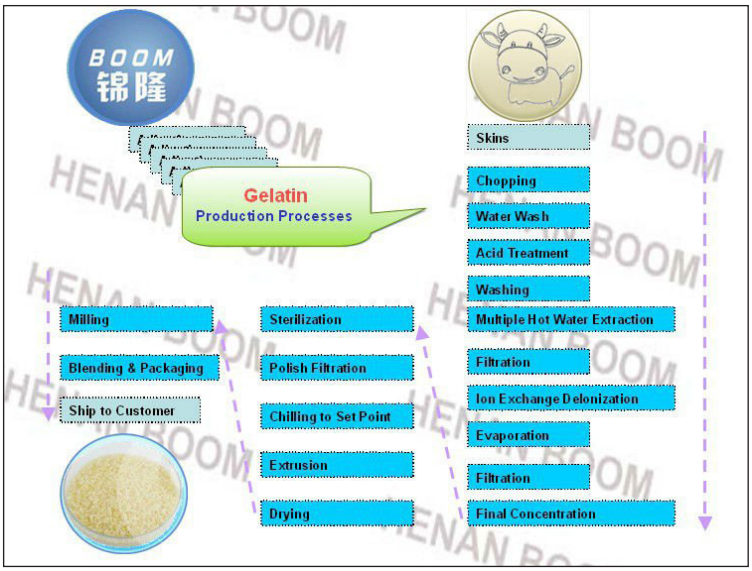
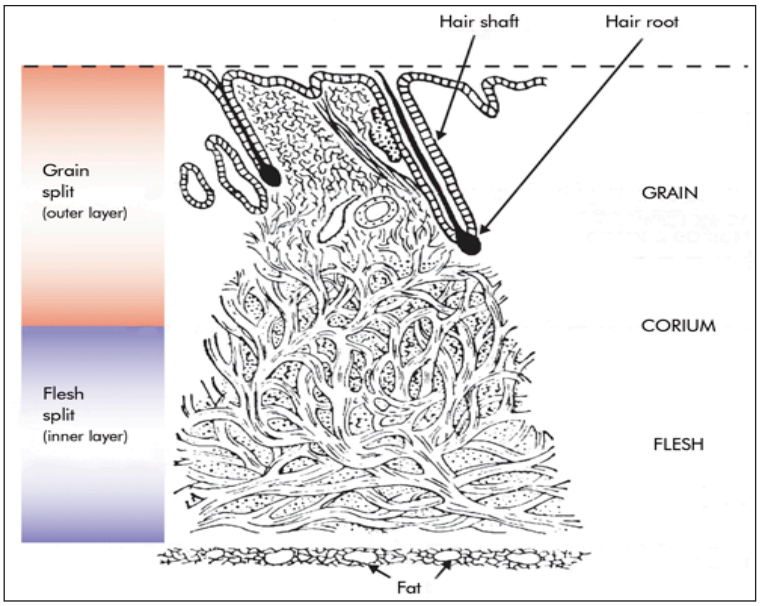


Figure 8 – Flowchart of Gelatin Production from Skin





A. Raw-Material Reception
The raw material, consisting of bovine and calf skins, is received at this stage.
B. Cutting
The received skins are cut by machine into palm-sized pieces and transferred to the pre-washing unit.

C. Pre-Washing
The skin pieces are washed with treated water for approximately 24 hours to remove fat and other impurities.

D. Alkaline Treatment
The skin pieces are transferred to alkaline-treatment tanks and immersed in a food-grade alkaline solution for approximately 8–12 weeks.

E. Washing, Neutralization, and Final Washing
The treated skins are washed with treated water for approximately 24 hours to remove residual alkaline solution. Mineral hydrochloric acid is then added to bring the pH to approximately neutral, after which washing is repeated to remove residual acid.

F. Cooking
The neutralized skins are transferred to cooking vessels. Cooking begins at approximately 55 °C and gradually increases to the boiling point. The process is repeated about five times, ultimately producing a dilute gelatin solution with an approximate concentration of 5%.

G. First-Stage Filtration
The dilute gelatin solution passes through a cellulose filter, producing a clear solution.
H. Ultrafiltration and Evaporation
The gelatin solution is concentrated through membrane filtration to approximately 12% and then through a two-effect evaporator to approximately 30–40%.

I. Sterilization
The concentrated gelatin solution is sterilized by direct steam injection for approximately 6 seconds at 142 °C.

J. Chilling and Noodling
The gelatin solution is cooled in an enclosed space through indirect contact with cold water. The cooled gelatin, which becomes dough-like, passes through an extruder and emerges as strands or noodles.

K. Drying and Crushing
The gelatin strands are placed on drying trays in a sterile environment and exposed to warm, dry, sterile air at approximately 30–60 °C. At the end of this stage, the moisture content is reduced to below 10%, and the strands are crushed into smaller pieces.

L. Crushing, Blending, and Packaging
In the final stage, the gelatin is crushed to the particle size required by the customer. Gelatins with different properties, including Bloom strength, clarity, and viscosity, are blended to obtain the required specification. The final product is packed in three-layer paper bags with an inner PE layer, and all stages are carried out in a sterile environment.

11. Jurisprudential Foundations of Istihalah

11-1. Applied Concepts

11-1-1. The Concept of Istihalah

One of the important jurisprudential questions concerning the production of animal gelatin is whether istihalah, which is regarded as one of the purifying agents in Shi'a jurisprudence, occurs during gelatin processing and consequently renders

the gelatin pure and permissible. This section therefore examines the concept of istihalah.

11-1-2. The Nature of Istihalah

Istihalah means a change in the nature of a thing and its transformation into another nature, such as wood becoming ash as a result of burning.

11-1-3. Difference between Istihalah, Inqilab, and Istihlak

The difference between istihalah and inqilab or istihlak is that, although inqilab is regarded as one of the forms of transformation, it specifically refers to the conversion of wine into vinegar. For this reason, some jurists have not treated it as a separate category among the purifying agents and have discussed it under the broader heading of istihalah.

11-1-4. The Nature of Istihlak

Istihlak means that the components of one substance become dispersed and absorbed into another dominant substance. In this respect, it differs from istihalah.

11-1-5. Istihalah as a Purifying Agent

Istihalah is generally counted among the purifying agents. However, some jurists regard describing it as a purifying agent as a form of approximation, because purification normally means removing impurity while preserving the identity of the substance, whereas in istihalah the identity of the impure or contaminated substance changes according to customary understanding and, with the change of the subject matter, the ruling also changes.

11-2. Failure of Istihalah to Occur in Gelatin

Because gelatin is a subject that must be assessed scientifically and technically rather than merely through ordinary or legal terminology, the scientific and technical aspects of its extraction are important. According to the scientific account presented in the study, the triple-stranded collagen structure is opened by breaking the hydrogen bonds between the strands, without a complete change in the underlying substance. On this basis, the study argues that, scientifically and technically, the transformation may be regarded as partial rather than complete, which is relevant to the jurisprudential ruling.

11-3. Jurisprudential Ruling on Different Types of Gelatin

1. Gelatin obtained from the skin or bones of halal animals slaughtered according to Islamic law: pure and halal.

2. Gelatin obtained from the skin or bones of halal animals not slaughtered according to Islamic law: skin is impure and prohibited; bones are pure and halal according to the predominant view.

3. Gelatin obtained from the skin or bones of animals whose meat is prohibited, but which were slaughtered according to Islamic law: pure but prohibited.

4. Gelatin obtained from the skin or bones of animals whose meat is prohibited and which were not slaughtered according to Islamic law: impure and prohibited.

5. Gelatin obtained from an intrinsically impure animal (porcine material): impure and prohibited.

11-3-1. Proposed Theory Concerning Gelatin Extracted from Bovine Bone

1. From a scientific perspective, the structure of bone may be considered analogous in some respects to that of skin and living tissue.

2. The narrations cited in the study concerning the permissibility of using bone and ivory are presented as supporting evidence.

3. The gelatin-extraction process from skin and bone does not, in the author's view, establish jurisprudential istihalah.

11-4. Fatwas of Prominent Shi'a Scholars

Ayatollah al-Khoei

Question: Is it permissible to consume animal gelatin imported from a non-Muslim country?

Translation:
Answer: If it is known that the gelatin was taken from an animal, it is not permissible to consume it unless it is known that the animal was slaughtered according to Islamic law.

Ayatollah Sistani
Question: Gelatin is manufactured in the West and is used in many drinks and foods. Is it permissible to consume it when we do not know whether it is derived from plants or animals? If it is derived from animals, is it obtained from the bones or from the tissue surrounding the bones? We also do not know whether the animal

was slaughtered according to Islamic law. What is the ruling?
Answer: If there is doubt as to whether the gelatin is derived from an animal or a plant, it is permissible to consume it. However, if it is known to be of animal origin, it is not permissible to consume it unless it is established that the animal was slaughtered according to Islamic law. If the raw materials undergo a substantial chemical change during manufacturing, there is no objection to consumption on that basis, provided the relevant transformation is established.

Yes, with knowledge, as the raw materials change chemically in the manufacturing process, there is absolutely nothing wrong with eating them, except that it is unproven. »

Translation:
Question: Gelatin is produced in the West and is used in many drinks and foods. Is it permissible to consume it when we do not know whether it is derived from plants or animals? If it is derived from animals, is it obtained from bones or from the tissue surrounding the bones? In addition, we do not know whether the animal was slaughtered according to Islamic law.

Answer: If there is doubt as to whether it is derived from an animal or a plant, it is permissible to consume it. If it is established that it is of animal origin, it is not permissible to consume it unless it is established that the animal was slaughtered according to Islamic law, even if it is derived from the animal's bones.

Ayatollah Makarem Shirazi on the Ruling on Gelatin Obtained from Animals
The collagen present in the structure of bones, cartilage, ligaments, skin, and animal coverings consists largely of proteins. These proteins cannot ordinarily be obtained simply by boiling. Through special heat treatment and alkaline or acidic treatment, collagen can be converted into gelatin.

In many cases, gelatin is obtained from collagen in bovine or ovine tissues, which may be among the best sources. However, it may also be obtained from animals whose meat is prohibited or from halal animals that were not slaughtered according to Islamic law. With regard to istihalah, the ruling depends on whether the relevant transformation has occurred.

First: If the source material is unknown, the ruling is permissibility and purity, and investigation is not required. Second: If it is known with certainty that the gelatin was obtained from an animal whose meat is prohibited or from an animal not slaughtered according to Islamic law, the ruling depends on the extent of the transformation established during processing.

Grand Ayatollah Sayyed Muhammad Hussein Fadlallah
Question:
Is it correct to avoid animal gelatin—whether bovine gelatin or gelatin extracted from pork—because you consider its transformation permissible? Please provide a detailed answer.

Translation:
Peace be upon you, and may the mercy and blessings of God be upon you.

Question: Is it correct to avoid animal gelatin, whether bovine or extracted from pork, because you consider its transformation permissible? Please provide a detailed answer. May God reward you.

Please provide a detailed answer . May God reward you .

Continue
In the name of the Almighty:
Istihalah is a purifying agent. If it occurs in impure or contaminated substances, it purifies them, regardless of whether the impurity is intrinsic or acquired. Experts have testified that gelatin used in many processed foods does not retain its original animal form; rather, it undergoes a substantial change in its nature. This change renders it halal and pure from the Islamic perspective, even if it was obtained from an animal whose meat is prohibited or from an animal that was not slaughtered according to Islamic law. Accordingly, there is no objection to consuming foods containing this substance, regardless of the country of origin.

Translation:
In the name of God Almighty :
A. Istihalah is a purifying agent. If it occurs in impure or contaminated substances, it purifies them, regardless of whether the impurity is intrinsic or acquired. Experts have testified that gelatin used in many processed foods does not retain its original animal form; rather, it undergoes a substantial change in its nature. This change renders it halal and pure from the Islamic perspective, even if it was obtained from an animal whose meat is prohibited or from an animal that was not slaughtered according to Islamic law.

11-5. Jurisprudential Views of Sunni Scholars

“Islamic Fiqh Academy
At its fifteenth session, held in Makkah, the Academy recognized that gelatin is used in the manufacture of confectionery and some medicines and is extracted from animal skins and bones. Accordingly, it adopted the following position:

It is permissible to use gelatin extracted from permissible materials and from permissible animals slaughtered according to Islamic law. It is not permissible to extract it from prohibited materials such as pig skin, pig bones, or other prohibited animals and materials.

It is permissible to use gelatin extracted from the prohibited materials, and from the permitted animals, Al-Makkah Shariah Tazkiyyah, and it is not permissible to extract from the prohibited materials: such as pig skin, bones, etc., from the prohibited animals and materials.

The Eighth Medical Fiqh Symposium

Istihalah, meaning the transformation of one substance into another with different properties, transforms impure or contaminated substances into pure substances and prohibited substances into substances permissible under Islamic law.

Accordingly:
Gelatin produced through the transformation of the bones, skin, and tendons of impure animals is considered pure and permissible to consume.

Soap produced by the transformation of pork fat or carrion becomes pure through that transformation and is permissible to use. Cheese made with rennet obtained from a dead animal whose meat is permissible is considered pure and permissible to consume.

Ointments, creams, and cosmetics containing pork fat are impure and may not be used according to Islamic law unless the fat has undergone complete transformation.

Contemporary scholars disagree about the permissibility of using hard capsules made from porcine gelatin and hold two main positions.

First opinion: Medicines (capsules) made from porcine gelatin are not permissible except in cases of necessity or need and subject to the conditions prescribed by Islamic law.

This is the view attributed to Dr. Abd al-Fattah Idris, Dr. Muhammad al-Zuhayli, and Dr. Ahmad al-Hajji al-Kurdi.

Second opinion: Medicines manufactured using porcine gelatin are permissible if the bones and skins have undergone complete transformation.

This is the view attributed to Sheikh Mahmoud Shaltout, Dr. Abd al-Karim Zaydan, Dr. Abd al-Majid Salahine, Dr. Muhammad al-Ashqar, and the Islamic Organization of Medical Sciences in its Eighth Medical Fiqh Symposium.

Literally, istihalah means changing the reality or nature of something into another reality or nature. In jurisprudential terminology, it means the actual change of an impure substance or a substance prohibited for consumption into another substance that differs from it in name, properties, and characteristics—i.e., a complete chemical transformation.

It means, in the jurisprudential terms, the actual change of the impure material or the prohibited consumption and the conversion of the same to another material similar to it in terms of name, characteristics, and attributes (i.e. complete alchemical transformation by 100%). »

11-6. View of the Islamic Fiqh Academy

At its fifteenth session, held in Makkah, the Academy recognized that gelatin is used in the manufacture of confectionery and some medicines and is extracted from animal skins and bones.

It adopted the following position: gelatin extracted from permissible materials and from permissible animals slaughtered according to Islamic law is permissible; gelatin extracted from prohibited materials, such as pig skin and bones or other prohibited animals and materials, is not permissible.

It is permissible to use gelatin extracted from permissible materials and from permissible animals that have been slaughtered according to Islamic law . It is not permissible to extract it from forbidden materials such as pig skin, bones , and other animals and forbidden materials .

The Eighth Medical Fiqh Symposium

The symposium defined istihalah as the transformation of one substance into another with different properties, through which impure or contaminated substances become pure and prohibited substances become permissible under Islamic law.

Accordingly:
Gelatin produced through the transformation of the bones, skin, and tendons of impure animals is considered pure and permissible to consume.

Soap produced through the transformation of pork fat or carrion becomes pure and permissible to use. Cheese made using rennet from a dead animal whose meat is permissible is considered pure and permissible to eat.

Ointments, creams, and cosmetics containing pork fat are impure and may not be used according to Islamic law unless the fat has undergone complete transformation.

Contemporary scholars disagree about the permissibility of using hard capsules made from porcine gelatin and hold two main positions.

First opinion: Medicines (capsules) made from porcine gelatin are not permissible except in cases of necessity or need and subject to the conditions prescribed by Islamic law.

This is the view attributed to Dr. Abd al-Fattah Idris, Dr. Muhammad al-Zuhayli, and Dr. Ahmad al-Hajji al-Kurdi.

Second opinion: Medicines manufactured using porcine gelatin are permissible if the bones and skins have undergone complete transformation. This is the view attributed to Sheikh Mahmoud Shaltout, Dr. Abd al-Karim Zaydan, Dr. Abd al-Majid Salahine, Dr. Muhammad al-Ashqar, and the Islamic Organization of Medical Sciences in its Eighth Medical Fiqh Symposium.

Literally, istihalah means changing the reality or nature of something into another reality or nature. In jurisprudential terminology, it means the actual change of an impure substance or a substance prohibited for consumption into another substance that differs from it in name, properties, and characteristics—that is, a complete chemical transformation.

11-7. Ruling on Gelatin Obtained from the Skin of a Halal Animal That Was Not Slaughtered According to Islamic Law

The jurists differ regarding the ruling on the carcass of a halal animal and the permissibility of consuming its skin after tanning. Before tanning, there is consensus that the skin of a carcass may not be eaten. After tanning, the majority of jurists among the Hanafis, Malikis, Shafi'is (according to the earlier position), and Hanbalis allow the use or consumption of the skin of a carcass after tanning, while the later Shafi'i position also recognizes this view. Their reasoning is that the tanned skin of a halal animal becomes pure and resembles the skin of an animal slaughtered according to Islamic law.

And the Shafi'i school of thought in the modern school of thought has accepted the permissibility of eating dead skin after tanning, because the clean skin of an animal is halal meat and resembles that of a male animal.

Source: Al-Bahr al-Ra'iq 1/101; Hashiyat al-Dasuqi 1/53; Al-Majmu' 1/221; Al-Sharh al-Kabir 1/21; Kashshaf al-Qina' 1/1.

11-8. Opinions of Jurists on Extracting Gelatin from Pigs

11-8-1. Those Who Consider Gelatin Permissible When Istihalah Occurs

The Hanafis, except Abu Yusuf, and Abu Dawud of the Zahiri school consider transformation capable of purifying the original substance; therefore, they permit the use of the resulting material and, on this basis, permit the extraction and use of porcine gelatin in food and medicine.

The resolution of the Islamic Fiqh Assembly of India states, in substance, that when a prohibited object undergoes a change in its nature and essence, the previous ruling of prohibition no longer applies because the characteristics of an object constitute its nature and essence. The Assembly based its position on the findings of specialists.

" It is known that what the Islamic Sharia has forbidden from objects, by changing their nature and essence, the previous prohibition is lifted from them. Because the characteristics of each object constitute the nature and essence of that object. The Assembly was informed of the results of the experts' research, and they prove that the gelatin substance does not have any natural characteristics of the animals from whose skin and bones it is extracted. Rather, it is transformed into a chemical substance that has nothing to do with collagen. And for these reasons it is said: The use of gelatin is permissible according to Sharia ."

11-8-2. Those Who Do Not Consider Gelatin Permissible through Istihalah

The second view, attributed to Abu Yusuf among the Hanafis and to the Malikis, Shafi'is, and Hanbalis, holds that pork is not purified through istihalah and therefore that substances derived from it may not be used. Accordingly, gelatin extracted from pork is considered impure and impermissible for Muslims.

(1) Al-Hidaya 3/72, Al-Al-Hidaya 1/12, Al-Qawani al-Fiqhiyyah 1/151/722, Al-Muduna 3/732 Al-Umm 1/23, Al-Muzni 1/2/13, End of al-Muttalib fi Daraya al-Mahahab 1/20 Al-Mughani

Reasons for Preferring the Second View
Gelatin can be extracted from halal materials such as livestock, fish, poultry, and plant sources. Therefore, there is no need to resort to prohibited sources unless a genuine necessity exists.

If a person is compelled by necessity, the existence of such necessity should be determined by qualified and trusted Muslim experts in the relevant fields: jurisprudence by jurists, medicine by physicians, chemistry by chemists, and so forth. No field should be treated as inherently superior to another in determining the relevant

technical facts.

The question is whether the situation constitutes a genuine necessity. If specialists determine that gelatin obtained from halal sources in Muslim countries can meet people's needs, then imported medicines, foods, confectionery, and beverages derived from prohibited sources should not be relied upon.

The resolutions of Islamic councils cited in the study indicate that the transformation occurring in porcine skin and bones is partial and does not reach the level of complete transformation. According to this view, the amino-acid chains remain substantially present in the gelatin. Therefore, the relevant jurisprudential principles should be applied.

The jurisprudential principle "certainty is not removed by doubt" means that certainty regarding the impurity of pork is not overturned by doubt about whether complete istihalah has occurred.

A second principle states that the original state of a thing is presumed to continue. On this basis, the impurity of gelatin is linked to the impurity of its original porcine source.

A further jurisprudential principle holds that preventing harm takes precedence over obtaining benefits.

Accordingly, any benefit obtained by applying the theory of istihalah to porcine material does not outweigh the harm of consuming pork or products derived from its bones.

For all the reasons above, the author prefers the second view, according to which porcine gelatin is impure and its use is prohibited for Muslims unless there is a genuine necessity.

Darwish Mursi Abd al-Ma'ti Muhammad (Department of Fiqh, Islamic Girls' College, Al-Azhar University, Assiut, Egypt)

12. Requirements for the Production of Halal Gelatin

12-1. Source of Raw Materials

Halal gelatin should be produced only from halal animals slaughtered according to Islamic law or from scaly fish.

Source	Halal status	Explanations
cattle /sheep	✓ Halal	It must be slaughtered according to Islamic law
Scaly fish	✓ Halal	All types of fish with scales are halal
Pig	✗ Forbidden	All pork derivatives are forbidden
Non - slaughtered cattle /sheep	✗ Forbidden	The slaughter has not been performed according to Islamic law
Bones /skin of dead animals	✗ Forbidden	May

Source: OIC/SMIIC 1:2019 - General Requirements for Halal Food , Section 4.1.2

12-2. Islamic Slaughtering (Zabiha) Process

Key requirements for the Islamic slaughter of animals whose bones and skins are used to produce gelatin include:

- Intention: The slaughterer must be Muslim and must intend to perform the prescribed Islamic slaughter.
- Recitation of "Bismillah – Allahu Akbar" at the time of slaughter.
- Simultaneous cutting of the esophagus, trachea, and the two jugular veins.
- Complete bleeding of the animal.
- The animal must die as a result of the bleeding process.
- The animal must be alive at the time of slaughter.

The animal's relevant body orientation at slaughter should be toward the qiblah.

12-3. Extraction Process

In halal gelatin production, the chemical and physical processing steps must comply with halal requirements.

- Stage | Halal requirements
- Washing: Pure and halal water.
- Acid treatment: Halal-compliant acids, such as hydrochloric acid and phosphoric acid.
- Liming: Lime (calcium hydroxide) is permissible.
- Hot-water extraction: Pure water and, where required, separation from non-halal production lines.
- Filtration and drying: Dedicated equipment or equipment that has been properly cleaned.

Important: All processing aids and auxiliary chemicals must also be halal and free from najasah.
Source: Malaysian Halal Standard MS 1500:2019, Section 5.3.

12-4. Production Line Requirements

A. Segregation of Production Lines

• The halal gelatin production line should be completely separated from non-halal gelatin production lines, such as those handling pork.

• If production lines are shared, they must be thoroughly cleaned in accordance with applicable halal requirements.

B. Equipment and Utensils

• Equipment must not be contaminated with impure materials.

• If previously contaminated, equipment must undergo the required religious purification (tathir).

Source: Codex Alimentarius, Guidelines for the Use of the Term "Halal" (CAC/GL 24-1997), Section 3.4.

12-5. Storage, Packaging, and Logistics

Section | Requirements

Storage: Separate from non-halal or impure materials.

Packaging: Packaging materials must be halal and clean.

Labeling: A valid halal mark and ingredient information should be provided.

Transportation: Vehicles used to transport halal materials should be dedicated or properly cleaned.

Storage: Contact with prohibited or impure materials must be prevented.

Source: OIC/SMIIC 1:2019, Section 10-12.

12-6. Certifications and Standards

Recognized international standards cited in the study include:

1. OIC/SMIIC 1:2019 – General Requirements for Halal Food (Organisation of Islamic Cooperation).

2. MS 1500:2019 – Malaysian Halal Standard.

3. CAC/GL 24-1997 – Codex Guidelines for the Use of the Term "Halal".

4. UAE.S/GSO 2055-1:2015 – Gulf-region halal standard.

5. GSO 993:2015 – Gelatin standard in GSO member countries.

12-7. Special Considerations for Halal Gelatin in the Pharmaceutical and Food Industries

To ensure the halal status of gelatin in finished products:

• Pharmaceutical capsule gelatin should have halal certification covering the production chain ("from farm to fork").

• Food-grade gelatin used in desserts, gummy candies, and confectionery should have a declared halal source.

• Continuous monitoring should be conducted by recognized halal-certification bodies, such as JAKIM Malaysia, SFDA Saudi Arabia, the Iranian Food and Drug Organization, and GIMDES Türkiye.

12-8. Comparison of Bovine/Ovine and Fish Gelatin

Criteria	Bovine gelatin (halal)	Fish gelatin
Need for religious slaughter	! Required	✕ No need.
Religious considerations	Higher	Very high
Melting point	28-34 Degrees Celsius	18-25 Degrees Celsius
Halal supply-chain difficulty	High	Easy

12-9. Common Challenges in Halal Gelatin Production

1. Supply-chain verification (traceability): Full traceability from the slaughterhouse to the final product.

2. Cross-contamination: A major risk where production lines are shared.

3. Differences among schools of jurisprudence: Different interpretations of concepts such as istihalah may lead to different rulings.

4. Verification of chemical purity: Some enzymes and catalysts may have an animal origin that is not halal.

12-10. Final Summary

Five basic conditions should be met for halal gelatin production:

1. Halal animal source (cattle or sheep slaughtered according to Islamic law, or an eligible fish source).

2. No use of pork or its derivatives at any stage.

3. Separation of halal production lines from non-halal products.

4. Halal processing aids, including acids, enzymes, and filters.

5. An official halal certificate issued by a reputable certification body.

13. Comparative Fatwas of Different Schools of Islamic Jurisprudence on Gelatin Istihalah

The issue of gelatin istihalah is controversial in contemporary Islamic jurisprudence. The principal disagreement among the schools concerns whether the chemical production process of gelatin constitutes istihalah in the jurisprudential sense—i.e., a complete and substantive transformation that purifies an impure material and changes the ruling on its permissibility.

The following sections present the comparative views of major schools and jurisprudential institutions, together with the references cited in the study.

13-1. Summary of the Views of the Sunni Schools

Religion	The main view on gelatin transformation	Jurisprudential basis
Hanafi	They believe that gelatin is pure and soluble if it is completely transformed.	They consider transformation to be purifying and consider the change in nature to be the cause of the nullification of the ruling on impurity. Ibn Taymiyyah and Ibn Qayyim have also confirmed this view .
Maliki	They believe in purity and sanctity (according to a famous saying).	Like the Hanafis, they consider transformation to be a cause of changing the ruling, although some Maliki jurists have considered intentional change of impurity to be makruh .
Shafi'i	In general, they believe in respect and do not accept transmutation in this matter.	They accept transformation only in specific cases (such as the conversion of wine into vinegar) and do not consider it permissible to apply it to new cases .
Hanbali	There is a difference of opinion. The popular saying is that it is forbidden, but some jurists have also accepted the existence of hiliyah.	The scholars of the school act like Shafi'i, but due to Ibn Taymiyyah's acceptance of the rule of istihālah, some later Hanbali jurists have ruled on hilīyah .

13-2. Views of International Jurisprudential Institutions

• Islamic Fiqh Academy of the Organisation of Islamic Cooperation (OIC): Resolution No. 210 (2015, Kuwait) states that when complete istihalah occurs—that is, a complete change in the nature and properties of the substance—the final product is considered pure; the study cites gelatin as an example.

• Islamic Fiqh Academy (Jeddah): The study presents a stricter position that does not permit consumption of gelatin derived from prohibited or non-slaughtered animals, even after processing.

• Islamic Fiqh Assembly (India): At its fourteenth session (2004), it considered the use of gelatin permissible on the basis of istihalah and the view attributed to Imam Muhammad ibn Hasan al-Shaybani (Hanafi).

Two Key Approaches in Scientific and Jurisprudential Analysis

The disagreement among jurists is closely related to their interpretation of the scientific changes occurring during gelatin production.

1. Favorable view (complete transformation): This group of jurists and scientists, including Dr. Mohammad Hawari as cited in the study, holds that collagen in animal bones and skin undergoes extensive chemical and physical changes during production and becomes a new substance with a different name, properties, and chemical structure—gelatin. They compare this transformation with the conversion of wine into vinegar.

2. Opposing view (no complete transformation): Some scientists, including Dr. Hani Mansour Musa al-Mazidi as cited in the study, hold that the change is not complete and substantial but is instead a physical change or a partial change in molecular structure. In their view, the conversion of collagen into gelatin is comparable to cooking an egg: the material changes form, but its essential identity does not completely change.

13-3. Summary of the Views of International Institutions

The following table summarizes the key sources and their positions.

Institution/Jurisprudential Authority	Key source/document	Position on gelatin transformation
Islamic Jurisprudence Council (OIC)	Resolution No. 210 (2015)	Agree (if fully transformed)
Islamic Jurisprudence Council (India)	Fourteenth meeting (2004)	Agreed (based on the saying of Imam Muhammad Shaybani)
Dar al-Afta (Hanafi/Maliki)	Fatwa on IslamQA	Agree (they consider the transformation to be pure)
Ibn Taymiyyah (Hanbali)	Numerous fatwas	Agreed (complete transformation changes the sentence)
SeekersGiddness Network (Shafi'i)	Fatwa in IslamQ	Opposite (it is not permissible to compare transformation to new cases)
Supreme Council of Saudi Scholars	Fatwa No. 22/281	Opposite (only gelatin of halal origin is allowed)
Islamic Medical Sciences Organization	Kuwait Seminar (1995)	Agree (if complete transformation is achieved)

The disagreement is rooted in jurisprudential principles and in different understandings of the concept of istihalah. Both positions cite sources in support of their respective views. Consequently, many halal-certification institutions adopt a precautionary approach and recommend using gelatin from reliable, traceable sources.

13-4. Conclusion and Practical Recommendations

Given the substantial disagreement among jurists and scientists regarding the occurrence of istihalah, gelatin remains a matter of juristic uncertainty (shubha) in some contexts. For this reason, many reputable halal-certification bodies do not recommend gelatin of unknown origin or gelatin derived from prohibited animals and instead emphasize gelatin from halal sources, such as properly slaughtered cattle and fish, or plant-based alternatives such as agar and pectin.

Recommendation: The safest approach for consumers is to choose products carrying a valid halal certificate that verifies the source of the gelatin. Where such information is unavailable, caution in consuming gelatin-containing products and asking about the source is a more prudent approach.

Resources:

- OIC/SMIIC 1:2019 - General Requirements for Halal Food
- MS 1500:2019 - Halal Food Production (Malaysia Standard)
- CAC/GL 24-1997 - Codex Alimentarius Guidelines for Halal
- GSO 993:2015 - Standard for Gelatin

Gelatin Handbook (GME - Gelatin Manufacturers of Europe)

International Standards Resources

1. OIC/SMIIC (Organization of Islamic Cooperation – Istanbul) Standards

These standards have been developed by The Standards and Metrology Institute for Islamic Countries (SMIIC) affiliated with the Organization of Islamic Cooperation (OIC) :

Standard Code Title Year Relationship with Halal Gelatin

OIC/SMIIC 1 General Requirements for Halal Food2019 Main Framework of Halal Requirements

OIC/SMIIC 2 Guidelines for Halal Slaughtering2019 Shariah Slaughtering of Animals of Origin

OIC/SMIIC 4 Guidelines for Halal Cosmetics2019 Gelatin in Halal Cosmetics

OIC/SMIIC 6 Guidelines for Halal Pharmaceuticals2019 Gelatin in Halal Pharmaceutical Capsules

2. Codex Alimentarius Standard

Reference	Title	Details
CAC/GL 24-1997	General Guidelines for Use of the Term "Halal"	Basic guidelines for halal food
CXS 192-1995	Codex Standard for Edible Gelatin	Specific standard for edible gelatin (physicochemical)

3. Malaysian standards (JAKIM - the most widely used halal standard in the world)

Code	Title	And a characteristic
MS 1500:2019	Halal Food - Production, Preparation, Handling and Storage	The most authoritative halal standard in Asia
MS 2424:2019	Halal Pharmaceuticals - General Re-quirements	Halal medicines including gelatin capsules
MS 2200-1:2008	Halal Cosmetics - General Guidelines	Halal cosmetics

Search link : halal.gov.my — JAKIM official website

4. Gulf States Standards (GSO)

Standard code	Title	Explanation
GSO 993:2015	Standard for Gelatin	Specific gelatin standard in GSO member countries
GSO 2055-1:2015	Halal Food - Part 1: General Requirements	General Halal Requirements in the Gulf Countries
UAE.S 2055-1:2016	Halal Food - General Require-ments (UAE)	United Arab Emirates version

5. Pakistan Standards (PSQCA)

Code	Title
PS:3733-2014	Halal Food Management Systems – Requirements
PS:4993-2021	General Guidelines for Halal Gelatin

Books & Scientific Papers

Reference books :

A) Specialized gelatin books :

Book title	Author/Publisher	Year	Related content
Gelatin Handbook: Theory and Industrial Practice	R. Schrieber & H. Gareis	2007	Complete gelatin production process
The Science and Technology of Gelatin	AG Ward & A. Courts (Academic Press)	1977	Still used as a basic reference
Handbook of Hydrocolloids (3rd Edition)	GO Phillips & PA Williams (Woodhead Publishing)	2020	Includes Chapter 13 on Gelatin
Gelatin: Production and Applications	Nova Science Publishers	2019	New gelatin production technologies

B) Halal books :

Book title	Author	Year	Explanation
Halal Food Production	Mian N. Riaz & Muhammad M. Chaudry (CRC Press)	2004	Classic and Comprehensive Halal Book (Chapter 10 Gelatin)
Halal Matters: Strategies, Standards and Certification	Florence Bergeaud-Blackler et al. (Routledge)	2016	Halal supply chain management
The Halal Industry: A Guide for Business and Industry	Mian N. Riaz	2018	Halal Industry Guide

Scientific articles (ISI/Scopus):

Article title	Magazine	Year	Summary
“Halal Gelatin: A Review of Production and Certification Requirements”	Journal of Halal Science and Technology	2021	Comprehensive review of production and certification requirements
“Identification of Porcine Gelatin in Halal Food Products”	Food Chemistry (Elsevier)	2019	Methods for detecting pork gelatin
“FTIR and PCR-based Detection of Porcine DNA in Gelatin”	Meat Science	2020	Laboratory methods for detecting fraud
“Consumer Perception and Market Trends of Halal Gelatin”	International Journal of Food Science & Technology	2022	Market trends and consumer attitudes
“Enzymatic Production of Halal Gelatin from Fish Scales”	Process Biochemistry	2021	Animal gelatin substitute

“Modification of Gelatin Extraction from Camel Bones for Halal Application”	Journal of Food Processing and Preservation	2023	Extracting gelatin from camel bones
“Halal Pharmaceutical Gelatin Capsules: A Comprehensive Review”	Journal of Pharmaceutical Sciences	2022	Halal pharmaceutical gelatin capsules

University diplomas :

Title	University	Year
“Development of Halal Gelatin from Fish Processing By-products”	Universiti Putra Malaysia (UPM)	2020
“Traceability System for Halal Gelatin Supply Chain”	International Islamic University Malaysia (IIUM)	2021
“Comparative Analysis of Bovine and Porcine Gelatin Using Spectroscopic Methods”	King Saud University	2019

Official Halal Certification Bodies

Institution	Country	Website	Credit
JAKIM	Malaysia	halal.gov.my	⋆ ⋆ ⋆ ⋆ ⋆
SFDA (Saudi FDA)	Saudi Arabia	sfda.gov.sa	⋆ ⋆ ⋆ ⋆ ⋆
BPPOM (MUI)	Indonesia	halalmui.org	⋆ ⋆ ⋆ ⋆ ⋆
ESMA (Emirates Authority for Standardization)	Emirates	esma.gov.ae	⋆ ⋆ ⋆ ⋆
GIMDES	Türkiye	gimdes.org	⋆ ⋆ ⋆ ⋆
Institute of Standards and Industrial Research of Iran	Iran	Inso.gov.ir	⋆ ⋆ ⋆
Halal Food Authority (HFA)	United Kingdom	halalfoodauthority.com	⋆ ⋆ ⋆
IFANCA	United States	ifanca.org	⋆ ⋆ ⋆ ⋆
Halal Control	Germany	halalcontrol.eu	⋆ ⋆ ⋆ ⋆
HFC (Halal Food Council)	United States	—	⋆ ⋆ ⋆

Analytical methods for distinguishing soluble from inhalal gelatin

Valid laboratory methods :

Method	Reference standard	Explanation
PCR (Real-Time PCR)	ISO 20813:2019	Detection of pig DNA in gelatin
FTIR Spectroscopy	—	Identifying the spectral pattern of different gelatins
ELISA	AOAC Official Method	Immunological detection of pork proteins
HPLC	Pharmacopeia Methods	Amino acid profile
LC-MS/MS	—	Identification of marker peptides

Reference :

“Analytical Methods for Halal Gelatin Detection: A Review” — Food Control (Elsevier) , 2020

Sharia References

Jurisprudential authority	Explanation
Jeddah Islamic Fiqh Academy (OIC)	Resolution No. 10 (10/2) on the Istihalah of Food
Fatwa of the Saudi Council of Senior Scholars	Regarding the permissibility of bovine and ovine gelatin
Encyclopedia of Islamic Jurisprudence (Ministry of Awqaf - Kuwait)	Volume 12, Discussion of Gelatin and Animal Derivatives
Al- Mawsu’ah Al- Fiqhiyyah Al- Kuwaitiyyah	Volume 32, pages 150-165 on the transformation and purification of food

Specialized websites (Websites & Databases)

Website	Explanation
gme-gelatin.com	Gelatin Manufacturers of Europe Gelatin Technical Information
halalgelatin.com	Specialized manufacturer of halal gelatin in the USA
halalfocus.net	Halal industry news and articles
halalhmrc.org	Halal Monitoring Committee , United Kingdom
whc-gelatin.com	Halal gelatin manufacturer - (Weishardt) – France
nitta-gelatin.com	Nitta Gelatin Japanese Halal Gelatin (approved by JAKIM)

Summary of key resources :

1. OIC /SMIIC 1:2019 — General Halal Requirements

2. CAC/GL 24-1997 — Codex Guidelines for the Term “ Halal “

3. GSO 993:2015 — Gelatin Specific Standard

4. MS 1500:2019 — Malaysian Halal Standard (the most detailed operational standard)

5. Gelatin Handbook (Schrieber & Gareis , 2007) — Technical reference for the manufacturing process 6. Halal Food Production (Riaz & Chaudry, 2004) — Scientific reference for halal in the food industry

Other general sources and reference books :

1. Asserin , J., Lati, E., Shioya , T., & Prawitt , J. (2015). The effect of oral collagen peptide supplementation on skin moisture and the dermal network: A double-blind, placebo-controlled study. Skin Pharmacology and Physiology , 28(1), 47-55.

2. Andreani , ES, & et al. (2023). Circular economy approach for gelatin from fish waste in cosmetic applications. Sustainable Chemistry and Pharmacy , 31, 100934.

3. Barel , AO, Paye , M., & Maibach , HI (Eds.). (2014). Handbook of Cosmetic Science and Technology (4th ed.). CRC Press.

4. Choi, FD, Sung, CT, Juhasz , ML, & Mesinkovsk , NA (2019). Oral collagen supplementation: A systematic review of dermatological applications. Marine Drugs , 17(7).

5. Ghosh, A., & Bhowmik, BB (2019). Gelatin: Production, Properties and Applications . Nova Science Publishers.

6. GIA (Global Industry Analysts). (2024). Gelatin: Global Strategic Business Report .

7. GME (Global Market Estimates). (2024). Gelatin Market Report: By Source, By Type, By Application - Global Forecast 2024-2030 .

8. Gómez- Guillén , MC, Giménez , B., López-Caballero, ME, & Montero, MP (2011). Functional and bioactive properties of collagen and gelatin from alternative sources: A review. Food Hydrocolloids , 25(8), 1813-1827.

9. Grand View Research. (2024). Gelatin Market Size, Share & Trends Analysis Report By Source (Bovine, Porcine, Fish), By Type (Type A, Type B), By Ap-

plication, By Region, And Segment Forecasts, 2024 - 2030 .

10. Kang, MG, Lee, JH, & Park, SY (2022). Development of gelatin masks containing vitamin nanoemulsions for enhanced skin penetration. Cosmetics , 9(3), 58.

11. MarketsandMarkets . (2023). Gelatin Market by Source, Type, Application & Region - Global Forecast to 2028 .

12. Phillips, GO, & Williams, PA (Eds.). (2009). Handbook of Hydrocolloids (2nd ed.). Woodhead Publishing.

13. Rebelo , R., Fernandes, M., & Fangueiro , JF (2021). Gelatin-based hydrogels for cosmetic applications: A review. Journal of Biomedical Materials Research Part B , 109(11), 1800-1812.

14. Sakai, S., & Taya, M. (2021). Gelatin in Pharmaceutical and Biomedical Applications . Springer.

15. Schrieber , R., & Gareis , H. (2007). Gelatine Handbook: Theory and Industrial Practice . Wiley-VCH.

16. Secchi, G. (2008). Role of protein in cosmetics. Clinics in Dermatology , 26(4), 321-325.

17. Shin, JY, & et al. (2024). Gelatin microneedles containing anti-aging serum for enhanced transdermal delivery. Journal of Controlled Release , 365, 201-214.