



Gelatine Species Determination - to aid labelling claims



A new approach to gelatine testing

An overview

Now more than ever, there is a growing demand for highly accurate labelling in the food and pharmaceutical industries. Events such as the horsemeat scandal of 2013 have severely dented public confidence with consumer trust in the food industry having plummeted by a quarter* since the news broke. The correct identification of the species origin of animal products used in food, pharmaceuticals and animal feed is of particular importance given consumer interest in traceability and also the religious and ethical concerns for consumers who wish to avoid certain products.

Food manufacturers and their supply chains must now focus on restoring this confidence. They must answer the market's ever growing appetite for transparency, and enable customers to make informed and responsible choices about the food and drink they purchase.

**Which consumer poll, 2013*

What is gelatine?

Gelatine is a protein found in a wide variety of foods including confectioneries (gums, chewable sweets, nougat, liquorice, chewing gum and marshmallows), desserts, yogurts, icing, hams, corned beef, canned meats, injection powders/binding agents and stock cubes.

It is often added to food products to bind ingredients, provide elasticity or add texture. Gelatine is also used by the pharmaceutical industry, for example, in drug capsules. It is prepared from skin and bone material, mainly from pig, cow and fish carcasses but also potentially from any mammalian or bird species.

Many consumers choose to avoid the consumption of porcine and bovine material, including vegetarians and those of religious faiths which prohibit the consumption of certain species.

There are no plant sources of gelatine, and there is no chemical relationship between gelatine and other materials referred to as vegetable gelatine, such as seaweed extracts. The earliest commercial production of gelatine appears to have been in Holland around 1685, followed shortly thereafter in England about 1700.





Physical properties

Gelatine is tasteless and odourless. It is a vitreous, brittle solid faintly yellow in colour. Gelatine contains 8-13% moisture and has a relative density of 1.3-1.4. When gelatine granules are soaked in cold water they hydrate into discrete, swollen particles. On being warmed, these swollen particles dissolve to form a solution. Behaviour of gelatine solutions is influenced by temperature, pH, ash content, method of manufacture, thermal history and concentration.

Gelatine stored in air-tight containers at room temperature remains unchanged for long periods of time and when dry gelatine is heated above 45°C in air at relatively high humidity (above 60% RH) it gradually loses its ability to swell and dissolve. Two of gelatine's most useful properties, gel strength and viscosity, are gradually weakened on prolonged heating in solution above approximately 40°C. It is not a single chemical entity, but a mixture of fractions composed entirely of amino acids joined by peptide linkages to form polymers varying in molecular mass from 15,000 to 400,000. In terms of basic elements Gelatine is composed of 50.5% carbon, 6.8% hydrogen, 17% nitrogen and 25.2% oxygen.

A versatile ingredient

For many years, gelatine has been a key ingredient in a diverse number of industry sectors. These include:

Food manufacture

Gelatine has many applications in food production. It is often used to increase shelf-life. For example, it can act as a protective coating for drying out pepperoni, helping to prevent it drying out. Many dairy products such as mousse desserts owe their distinctive texture to gelatine. It also gives jellies and the like their distinctive transparency and wobbliness. Indeed, in confectionary, edible gelatine can be found in gummy bears, jelly babies, toffees, marshmallows, and many other consumer favourites.

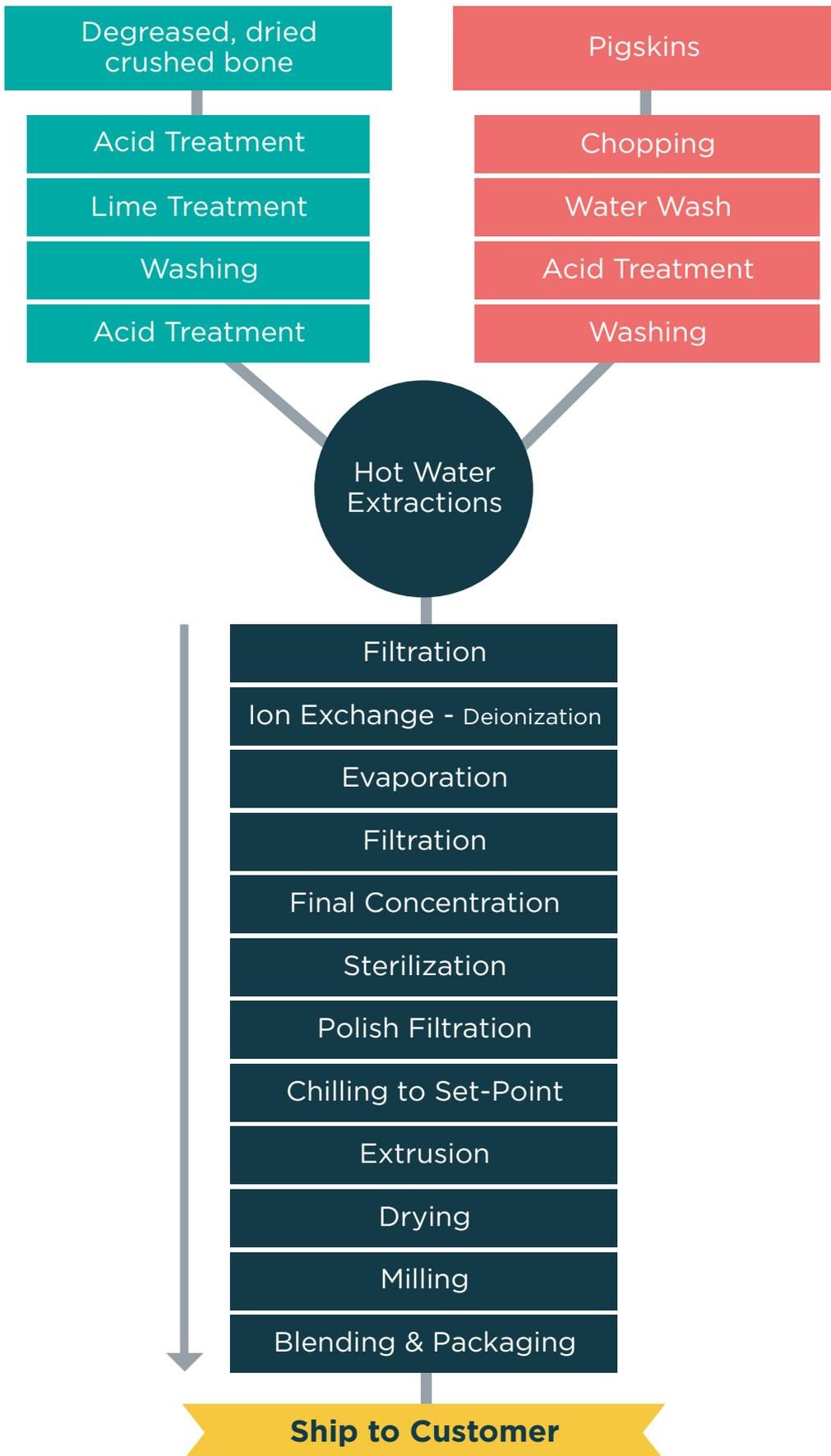
Pharmaceuticals

In pharmaceuticals, gelatine is commonly used in the manufacture of capsules and tablets, preventing drugs from being damaged by light and air yet at the same time making them easily digestible.

Electronics

It's not just edible products that utilise gelatine. LCD screens and displays often have liquid crystals that use gelatine based cholesterol, while gelatine can also be found in batteries where it improves the metallic structure.

Gelatine Production Process



“ The use of peptides from public databases can lead to incorrect assignment of species. The use of a high number of verified biomarkers is paramount. ”

Why test?

The fraudulent blending of animal products such as gelatine is a highly relevant issue for consumers, business and regulatory bodies alike, due to quality, safety and ethical concerns.

Food crime

The aforementioned horsemeat scandal highlighted weaknesses and the potential for fraudulent activity that can occur in today's increasingly fragmented supply chains. With food changing hands up to twenty times before reaching the vendor, the opportunities for mislabelling, cross contamination or downright deception are all too numerous. By being able to trace provenance accurately companies can help restore consumer confidence.

Cultural

As we have seen, gelatine is derived from animals. Depending on the type of animal involved, this can have profound implications for potential users of the product. For example, Judaism, Hinduism and Islam have strict laws regarding the use of certain meats, while vegetarians and vegans do not wish to be associated with many types of animal products. Determining the species origin of gelatine supports many ethical and religious preferences of consumers, in determining whether gelatine of ruminant or pig origin is present in a product. This testing service also allows retailers and suppliers to better understand the authenticity of their gelatine.

Authenticity

Major supermarkets invest a lot of money in ensuring the quality and provenance of their food. One mislabelled item can prove a public relations disaster and cost millions. Yet when a typical supermarket has to oversee the origins of over 35,000 to 40,000 different food products it becomes a very sizeable task. By testing regularly for gelatine, a supermarket can confirm risk mitigation, audit trail, confidence in supply chain, etc.

Existing methods of testing

Currently, companies wishing to test for the presence of gelatine have a limited number of options available. Most food testing methods rely on DNA and antibody based tests. However, the aggressive processing we see in gelatine manufacturing often degrades and even destroys the DNA and protein structures. In many cases the species of animal the meat came from is not even identifiable.

Origin Speciation

Recent technological advancements have resulted in the ability to recover this lost genetic data. Modern high resolution mass spectrometers and software mean it is possible to 'read' and interpret degraded species specific sequence information. At the forefront of this new approach is GelSpec.

The advantages of GelSpec

GelSpec from Fera was developed since no reliable tests were available to determine the animal origin (ruminant or porcine) of gelatine. It uses a revolutionary approach of high resolution, highly sensitive mass spectrometry to detect minute differences in the amino acid sequence of the gelatine protein.

We then use a large proprietary database of mass spectrometry data, which has been developed in order to specify the species of origin (ruminant or porcine) and contains a comprehensive number of peptides, which coupled with our team's interpretative expertise ensures an unprecedented level of accuracy.

Indeed, research findings showcased the fact that other tests simply couldn't compete with GelSpec's 100% levels of accurate detection of both pork and beef species of gelatine. Only the GelSpec laboratory was able to correctly identify the gelatine species in all eight samples.

The technology to test

Gelspec uses a state of the art high resolution accurate mass spectrometer with liquid chromatography modules, to give a comprehensive breakdown of the peptides in question. The data is then interrogated against a large database of collagen peptides.

The database contains score of peptides which are unique to ruminant, and scores of peptides unique to porcine, gelatine. These datasets can, if necessary, also be used retrospectively, as a control reference for future sampling, and as a benchmark to compare any subsequent testing methods.

Our In-House Testing Method - The Science of Trust

To ensure the most robust results, we follow a strict and rigorous methodology at all times in order to test a method prior to offering it as a service, as detailed below;

Step 1

With the initial extraction of the gelatine we select one matrix, spiked at 0.5% w/w (equivalent to half of the reporting level of meat species in food), in line with our established in-house testing work. We then extract 7 aliquots on each of the 3 days, together with 3 blanks to determine selectivity, accuracy, repeatability, applicability and robustness. These samples are then analysed through our high resolution LC-MS/MS scanners. This gives the $cc\beta$ (screening concentration/detection capability) confidence needed to obtain the level of detection we are after.

Step 2

We then take a further two matrices spiked at 0.5% w/w and extract seven sub-samples of each on one day to determine selectivity, accuracy, repeatability, applicability and robustness.

This qualitative testing service will confirm if ruminant or porcine gelatine is present in the sample (reporting level 0.5% w/w). The test would also indicate if gross contamination of another species was present such as equine. This is not a quantitative analysis.

The people behind GelSpec

GelSpec has been developed by Fera, the UK's foremost provider of agri-food and environmental testing and analysis solutions. Our cutting edge expertise and unrivalled experience produce robust scientific evidence that protect clients and their customers alike.

Fera began life as a research wing of the government's Department for Environment, Food & Rural Affairs (DEFRA). As such, we are in the unique position of working in exclusive partnership with our academic colleagues who hold unique protein and peptide datasets. This allows for far greater accuracy than any publicly available benchmark.

GelSpec, is the result of 5 years of development and validation on a range of foods and ingredients, uses state of the art technology and a unique database to determine the identity of the species from which the gelatine is derived.

Paul Brereton Head of Agri-food research at Fera Science Ltd, said: "Gelatine can be prepared from the skin and bone material of a number of animal species, and is an important component of food, beverage and pharmaceutical products.

The ability to identify ingredients in a fragmented and complex supply chain can be difficult, GelSpec is a major step forward that will help manufacturers and retailers ensure the integrity of gelatine containing components in their supply chains. With today's consumers wanting to know not only what is in their food but also how it is produced, the results of GelSpec will strengthen public trust in the integrity of the food supply".

“ More than ever this new generation of consumers will want the reassurance that only stringent food testing can provide. ”

The benefits to business

GelSpec can offer several key advantages to businesses which use gelatine in any part of their production process.

Brand reputation

GelSpec provides customers with accurate data that they can trust. It offers an unprecedented level of transparency for gelatine that the industry has not seen before.

Correct labelling

Providing assurance to consumers and other stakeholders about the safety, authenticity, quality and integrity of European food is essential for those companies wishing to take full advantage of the European agri-food economy.

Minimise downtime

Safeguarding the integrity of ingredients can reduce the need for any costly pauses in production should any cross-contamination or mislabelling occur. It can also protect companies from heavy fines imposed by regulatory bodies.

Sensitive markets

Perhaps one of the biggest benefits to business is the opportunity that GelSpec can bring to companies looking to expand in various religious and ethical markets.

Faiths

Judaism, Islam and Hinduism all have strict laws governing the use of either porcine or bovine meat products, and so the marketplace for determining the origin of gelatine is huge. Indeed, the Halal food industry alone is worth \$1.1 trillion dollars as of 2013. And that is why major food service chains such as KFC, Nandos and Pizza Express all now offer Halal versions of their best selling items.

Vegetarians & Vegans

Depending on personal beliefs, vegetarians & vegans will seek to exclude many or all animals products from their diet or lifestyle. According to the Vegetarian Society, the vegetarian market in the UK alone is worth £670 million a year.

Any company that provides a more robust reassurance to these sensitive markets that their products with clear labelling will undoubtedly find themselves in a commercially advantageous position.

A growing global market

By 2050 the world population is predicted to reach 9.4 billion people. To meet demand, global food production will have to increase by 60% to 110% from today's levels. It is also expected that incomes will rise, meat consumption will increase, and appetites will become more varied. More than ever this new generation of consumers will want the reassurance that only stringent food testing can provide.

Summary

GelSpec represents the only certain way for companies to keep track of their gelatine content. It provides the capability to better understand your supply chain and addresses consumer concerns about the origin of animal bi-products.