CBI
Ministry of Foreign Affairs

CBI Product Factsheet:

Carrageenan in Europe

Introduction

If you can guarantee the safety and sustainability of your carrageenan supplies, you will find particularly good opportunities on the European market. More than ever, European buyers are seeking to build strong trade relationships and diversify their sources. The seaweed crisis of 2008 showed them that even the mature carrageenan industry can experience severe supply shortages.

Product definition

Carrageenan is a gelling agent extracted from various red seaweeds (*Rhodophycaea*). It can be used as a binder or for suspension and stabilization in a remarkably wide range of products in the food processing, pharmaceutical and cosmetic industries. The carrageenans of commercial interest are called iota, kappa and lambda.

Table 1: Sources of carrageenan

Carrageenans derived from different seaweeds	
Chondrus crispus	mixture of kappa and lambda
Kappaphycus alvarezii (cottonii)	mainly kappa
Eucheuma denticulatum (spinosum)	mainly iota
Gigartina skottsbergii	mainly kappa, some lambda
Sarcothalia crispata	mixture of kappa and lambda

Source: FAO, 2003

Three common methods to extract carrageenan:

- Semi-refined carrageenan: Seaweed is washed with a hot alkali mix with high potassium level. The dried insoluble residue, consisting largely of carrageenan and some cellulose, is called semi-refined carrageenan (SRC). When the residue is first bleached and washed, before being dried, the resulting product is Philippine Natural Grade (PNG). In Europe, PNG is labelled as Processed Eucheuma Seaweed (PES).
- Alcohol precipitation: After washing the seaweed, dissolving it in an alkali solution and filtering, alcohol is added for coagulation. Then it is possible to separate alcohol and carrageenan. Finally, the carrageenan is dried and milled.
- Gel-pressing: After washing the seaweed, dissolving it in an alkali solution and filtering, potassium chloride is added to form a jelly mass which can be pressed to remove water. Finally, the carrageenan is dried and milled.

Codes for gum carrageenan:

- Harmonised System (HS): Carrageenan trade is registered under HS 130239 which is also used for several other vegetable thickeners
- E-number:
  - Refined carrageenan: E-407
  - Processed Eucheuma Seaweed: E-407a
- Chemical Administration Service (CAS): 9000-07-1
- Codex Alimentarius SIN No 407, INS No 407

Product specifications

Quality

- General specifications for food additives including thickeners are defined by the European Commission in Regulation 231/2012: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:083:0001:0295:EN:PDF and can be found in Codex Alimentarius.
- Main elements in carrageenan: D-galactose, D-3,6-anhydrogalactose and sulphate-ester-groups.
- Minimise variance in quality within a lot by following strict sorting and grading standards.
- Semi-Refined Carrageenan (SRC) is not food grade. It is only used for pet food manufacturing.

Labelling

- Enable traceability of individual batches.

- Use the English language and EU measures (e.g. kilograms) for labelling unless your buyer has indicated otherwise.
- Labels must include the following:
    - Product name
    - Batch code
    - If the product is destined for use in food products
    - Name and address of exporter
    - Best before date
    - Net weight
    - Recommended storage conditions.
- Organic, Kosher and Halal markings are optional.

Packaging

- Carrageenan is hygroscopic and should therefore be packaged in waterproof material, such as paper bags with a plastic (e.g. polyethylene) lining.
- Buyers often prefer a blue plastic lining, as it is easier to recognise gaps/openings.
- Enable re-use or recycling of packaging materials by, for example, using bags made of recyclable material (e.g. paper).

Buyer requirements

What legal requirements must my product comply with?

Food safety: Food processors must have a food safety management system in place based on HACCP principles to be competitive in the European market. These systems require companies to demonstrate their ability to control food safety hazards in order to ensure that food is safe at the time of human consumption. Furthermore, products must be traceable throughout the supply chain. If European companies or authorities find out that the safety of your product cannot be guaranteed, they will take the product off the market and will register it in the EU's Rapid Alert System for Food and Feed.

Media using unreliable research on carrageenan to question the safety of carrageenan have negatively affected consumer perception. However, in 2015, the Joint Expert Committee on Food Additives (JEFCA) safeguarded the use of carrageenan in the EU by concluding that the use of carrageenan in infant formula at concentrations up to 1000 mg/L is not of concern.

Tips:

- Food hygiene is the basis for food safety.
- Read more about HACCP and health control in the EU Export Helpdesk
- Search in the EU's Rapid Alert System for Food and Feed (RASFF) database to see examples of withdrawals from the market and the reasons behind these withdrawals.

Contamination: The EU has laid down maximum levels of contaminants, pesticides and criteria for microbiological contamination of food.

Tips:

- Learn more about legislation on contaminants in food. If your raw materials have been dried in an open atmosphere, verify that microbiological contamination remains within limits.
- Inform collectors of seaweeds on good agricultural collection practices.

What additional requirements do buyers often have?

Food safety certification: As food safety is a top priority in all EU food sectors, you can expect many players to request extra guarantees from you in the form of certification. Particularly many European food manufacturers require their suppliers to implement a (HACCP-based) food safety management system such as ISO 22000. The most stringent food safety management systems BRC, IFS and SQF are rarely required by European buyers.

Tip:

- Visit the website of the Global Food Safety Initiative and the Standards Map for more information on food safety management systems. Also find out if the buyers you target require certification and which food safety management system they prefer.

Religion: European buyers commonly require certificates for compliance with Kosher and Halal requirements. This enables the food and beverage industry to use the ingredient in products targeted at a wide consumer group including Jews and Muslims.

Tip:

- Obtain Kosher and Halal certificates. Often this does not require changes in your processes. Refer to the Halal Authority Board or your certifier of choice for more information.

Documentation: Buyers need well-structured product and company documentation. Buyers generally require detailed Technical Data Sheets (TDS) and Material Safety Data Sheets (MSDS). Only some big buyers will also require their suppliers to complete a questionnaire and will visit for a site audit.

Tip:

- Make sure that you have documentation (e.g. certificate of analysis, MSDS, food safety management certificates) available upon request. Prepare your TDS and MSDS in compliance with annex II of EU Regulation No 1907/2006. Here you can find an example of a MSDS for carrageenan.

Representative samples: Your sampling method should result in lot samples that represent what you can deliver in the quantities, quality and lead time as specified by the buyer.

Delivery and payment terms: Pay attention to strict compliance with delivery terms as agreed upon with your buyer. Cost-Insurance-Freight (CIF) is the most common delivery term.

New suppliers generally use a Letter of Credit as a guarantee for payment. After establishment of a reliable trade relationship, it is common to switch to Cash-Against-Documents (CAD). Long-term trade partners often allow open accounts without the extra paperwork of CAD and L/Cs.

Tip:

- Familiarise yourself with international delivery terms.

Website: European buyers look for credible suppliers. You can improve the perceived credibility of your company by developing your website accordingly.

Tip:

- The website of FMC provides a good example of a website that enhances the credibility of a company.

Corporate Social Responsibility: European buyers increasingly require their suppliers to take care of their Corporate Social Responsibility (CSR). There are different options to address CSR:

  - Safeguard occupational health and safety at your company
  - Pay decent salaries to employees
  - Do not make use of child labour
  - Etc.

Some buyers require compliance with the Code of Conduct of the Business Social Compliance Initiative (BSCI).

Tip:

- Implement a Code of Conduct. Find out if there is a Code of Conduct for your sector or if your buyer has a Code of Conduct (e.g. FMC's Code of Conduct). Alternatively, you can implement the BSCI Code of Conduct or even develop your own Code of Conduct in consultation with your buyers.

What are the requirements for niche markets?

Certified sustainable: Many European buyers ask their suppliers to improve sustainability of their business. However, only few of them require corresponding certificates. Particularly in the hydrocolloids market, certified production is very limited.

Tip:

- Consider certification of sustainable production if you specifically target the niche market for these products and aim to distinguish your company from the competition.

Find out if it is feasible to certify your production or part of it (e.g. seaweed collection or cultivation). Potentially interesting certification schemes include FairWild or Fair for Life.

In case of certification of organic production, cultivation and harvesting of seaweeds, and extraction of carrageenan must comply with requirements in EU legislation 834/2007. Read more on the EU legislation on organic production in the EU Export Helpdesk.

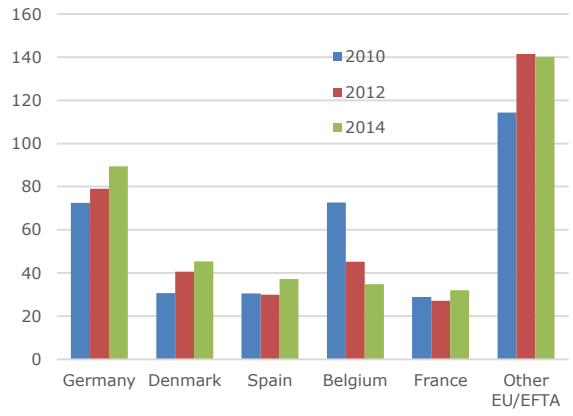
Tip:

- Visit the ITC's Standards Map for more information on certification schemes for sustainable production.
- Consider OHSAS 18001 certification for occupational health and safety or SA 8000 certification for social conditions.

Trade and Macro-economic statistics

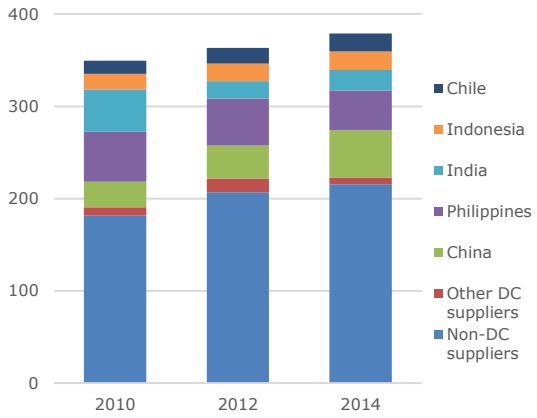
Imports

Figure 1: European imports of vegetable thickeners* (excl. locust bean gum, guar and agar; including carrageenan, alginates and others), in € million



Source: Eurostat (2015)

Figure 2: Developing country (DC) suppliers of vegetable thickeners* (excl. locust bean gum, guar and agar; including carrageenan, alginates and others) to the EU, in € million

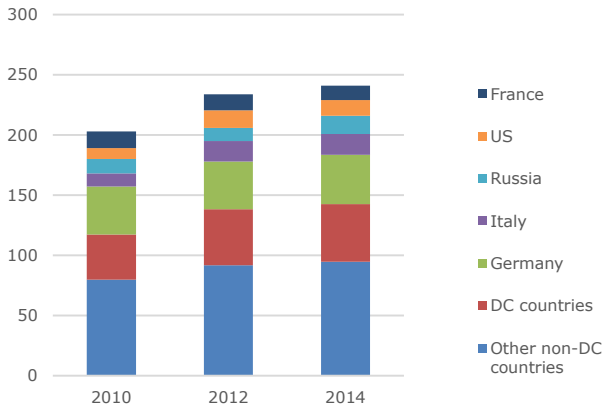


Source: Eurostat (2015)

**Carrageenan is estimated to account for most trade in this group*
Source: Eurostat, 2015

Exports

Figure 3: Destinations of European re-exports of vegetable thickeners (excl. locust bean gum, guar and agar; including carrageenan, alginates and others), in € million



Source: Eurostat, 2015

Securing carrageenan supplies is a challenge

European demand for carrageenan is steadily increasing. The current growth rate is estimated at 1-3% annually. European consumers buy more processed food, which often contain thickeners, such as carrageenan. In the next 5 years, demand from the European food industry for carrageenan is expected to continue to increase at the same rate of 1-3% annually. East European countries are a growth market for hydrocolloids, including carrageenan, as a result of increasing demand for processed food.

European production of carrageenan seaweeds has become negligible, as it is economically unattractive (FAO FishStat, 2014). Historically, France, Portugal and Spain produced Chondrus seaweed.

European producers of carrageenan mainly source their seaweeds outside Europe. Especially Indonesia and the Philippines are major suppliers of (semi-)processed seaweeds. European carrageenan manufacturers generally contract farmers in those countries to produce their raw materials.

In 2014, European carrageenan manufacturers used the (imported) seaweeds to produce 6.9 thousand tonnes of alcohol-processed refined carrageenan and 1.4 thousand tonnes of gel-pressed refined carrageenan. Production of semi-refined carrageenan for pet food and food applications takes place outside of Europe (Porse, 2015).

Some of the European processing facilities are located in Denmark (CP Kelco), France (Cargill) and Spain (CEAMSA). In addition to extracting carrageenan from seaweeds, these companies also blend SRC and refined carrageenan which they import from developing countries.

Major suppliers of vegetable thickeners (primarily carrageenan and alginates) to Europe in 2014: China (€ 51 million / 7 thousand tonnes), the Philippines (€ 43 million / 7 thousand tonnes), India (€ 22 million / 13 thousand tonnes), Indonesia (€ 20 million / 3 thousand tonnes) and Chile (€ 19 million / 1.6 thousand tonnes). Chile's supplies consist largely of agar and alginates, but they also supply carrageenan from *Gigartina skottsbergii* and *Sarcothalia crispata* which has uses in specific market niches. Particularly dairy manufacturers are interested in the carrageenans from Chilean seaweeds. European importers welcome new origins of carrageenan seaweeds. Dependence on a few sources presents a high risk, as bad weather and diseases can be destructive for an entire region. Diversification to new sources reduces this risk for importers.

Many of the European carrageenan producers process a lot of the semi-processed carrageenan which they import and then export the value added product to other countries. As these companies operate globally, they export to both European countries and beyond.

Tips:

- If you are based outside the traditional carrageenan seaweed production regions, stress that you offer an alternative source of carrageenan seaweed in your promotion.
- Find an agent with a good sales network in Easter Europe to get access to this growth market.
- Please refer to CBI Trade statistics for natural colours, flavours and thickeners for more trade statistics.

Trends

Sustainability: Carrageenan manufacturers in Europe are increasingly aware of the importance of sustainable business practices at their own company, but also in their supply chain. European consumers demand that European companies take responsibility for the impact of their business on the people involved and on the environment. Carrageenan producers risk bad publicity and subsequent brand damage if their company is associated with unsustainable practices, such as unsafe working conditions and waste of resources (e.g. water). Moreover, carrageenan producers have a strong interest in the development of a sustainable business, as they rely on the human and natural resources for their own future.

Tip:

- Show your buyer how you address sustainability. For example, use recyclable resources, reduce energy use or improve labour conditions and report on your measures and results.

Processed food: European consumers cannot resist the convenience of processed foods. Despite strong advocacy for fresh food by many health food trendies, consumption of processed food continues to grow. Consumers take less time for cooking and embrace the many options provided by food manufacturers to prepare their food easily and in a short time. As consumers do not accept an inferior taste from processed foods, food manufacturers look for ingredients which can improve the properties of their foods, such as texture. Carrageenan's functional properties and versatility meet the needs of these food manufacturers.

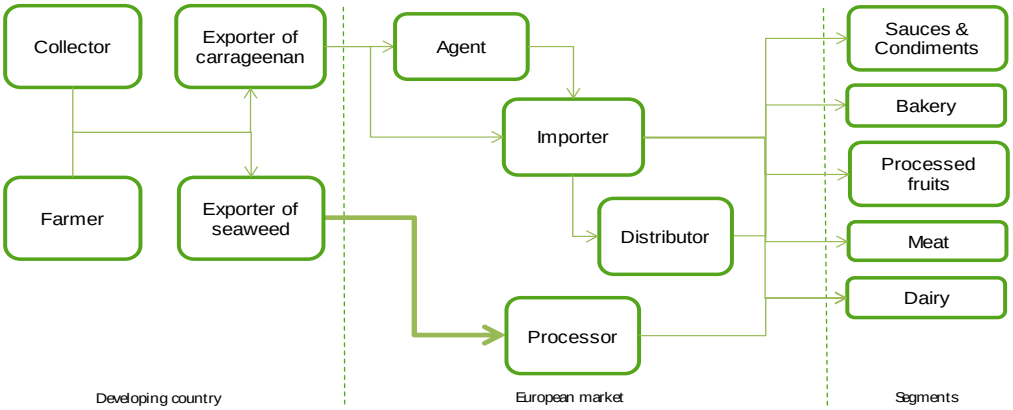
Tips:

- If you aim to supply a ready-to-use thickener to the European food industry, promote the functional properties of carrageenan and provide knowledge on its application.
- Please refer to CBI Trends for more market trends.

Market channels and segments

Market channels

Figure 4: Major market channels for carrageenan



A lot of carrageenan seaweed is only semi-processed before being exported to Europe. Most value addition by processing takes place in Europe by a small group of companies. These processors have complex industrial production systems for extraction of different types of carrageenan.

European processing plants for carrageenan are located in Denmark (CP Kelco/Danisco), France (Danisco) and Spain (CEAMSA).

Moving away from integrated supply chains

About 30 years ago, the European market for thickeners including carrageenan was very concentrated among few large companies. Three companies (Cargill, FMC and CP Kelco) would control roughly 75% of the industry covering a large range of activities, from seaweed procurement to R&D, production development and marketing.

In recent years, the balance in the industry has shifted. The three large companies mentioned above currently control less than 20-25% of the industry. They are less involved in raw material production and primary processing, outsourcing such operations to other companies. Instead, they are focused in services such as R&D and product development and establish long-term trade relationships with part of their seaweed suppliers. In return for their commitment to the trade relationship, which can include technical assistance, they can demand an exclusivity agreement.

Consequently, the seaweed supply chain has changed from a highly integrated chain to an extremely fragmented one in which suppliers and buyers are focused on price competition. Dozens of new companies mainly located in the Asia-Pacific region are involved in the raw material sourcing, while being responsible for processing seaweed into refined or semi-refined carrageenan.

Due to market volatility, European companies increasingly prefer to source their carrageenan supplies from farmers instead of collectors. Reducing reliance on wild-collected carrageenan improves stability of supply.

More opportunities for value addition in the country of origin

Increasingly, opportunities have surfaced for value addition and further processing of carrageenan in the country of origin. For example, Indonesia which is one of the main suppliers of seaweeds is developing the capacity to process seaweeds and aims to restrict exports of unprocessed seaweeds. At the same time, the aim is also to target the domestic market, in order to develop knowledge on food formulations with carrageenan. This way, Indonesia is expected to become a bigger player in the market for processed seaweeds and ready-to-use thickeners which comply with specifications of EU food manufacturers.

Filipino companies have already developed the capacity to process seaweeds and supply directly to food manufacturers.

Tips:

- Long-term trade relationships with European companies can provide access to knowledge and sometimes even capital. However, exclusivity agreements increase dependency on the buyer. Carefully consider costs and benefits of such an agreement and include a fair price mechanism based on market competitive prices.
- Provide technical assistance to attract buyers with a need for tailored solutions. They need knowledge on application of carrageenan in their specific food or beverage formulation.

Manufacturers get more involved in the supply chain

Manufacturers mitigate risks related to quality issues by getting more involved with the production process. They do that either by sourcing directly from producers or by giving importers responsibility to guarantee transparency and good practices all along the supply chain up to the producers in the countries of origin.

Tip:

- Working directly with European food manufacturers gives you more opportunities for value addition (e.g. supplying refined carrageenan or blending). However, supplying an end product means that requirements are higher than in the case of supplying semi-refined carrageenan (certifications, high understanding of food formulations, product insurance, investment in marketing etc.).

Market segments

Table 1: Major food industry segments and applications for carrageenan

Segment	Application	Particularities
Meat	Re-structured meats (e.g. ham and chicken products)	Water binder and texturing agent for improvement of yields and texture. The meat industry mainly uses PES and low-cost gel-press refined carrageenan
Dairy	Chocolate milk, creams, desserts	Cocoa suspension, improvement of milk stability, improvement of emulsion stability, milk gelling. Dairy manufacturers mainly use PES and alcohol-refined (kappa/lambda) carrageenan
Confectionary	Jellies	Improvement of texture, body and sheen
Bakery	Glazes	Improvement of sheen

The main application of carrageenan is processed meat. Globally, meat processing is estimated to account for approximately 40% of the market.

Dairy products account for around 30% of the global carrageenan market.

Pet food used to be another major segment. However, due to a shift to dry pet food and reformulation with cheaper gelling agents, this segment has declined.

As PES contains cellulose, it will give a cloudy solution. Manufacturers that want a clear solution will need refined carrageenan or another thickener.

In general, interest in organic thickeners remains small. European food manufacturers can label their products as 'organic' using non-organic carrageenan due to an exception rule in EU legislation. EU legislators allow the use of small amounts of non-organic ingredients if an organic equivalent is not widely available. Nonetheless, interest in organic carrageenan is increasing.

Tips:

- Target meat industries if you produce gel-press refined carrageenan and target dairy industries if you produce alcohol-refined carrageenan.
- Please refer to CBI Market channels and Segments for a visualisation of market channels and more information.

Price

The carrageenan (seaweed) market has become more volatile

Currently, prices for semi-refined carrageenan range between € 4 /kg and € 6 /kg, depending on the type of carrageenan. Kappa carrageenan fetches higher prices than iota carrageenan, due to their different specifications and possible applications.

Prices for refined carrageenan range between € 8 /kg and € 14 /kg depending on the type of extraction and type of carrageenan. Alcohol-refined and kappa carrageenan fetch higher prices than gel-pressed and iota carrageenan.

Prices for carrageenan seaweed peaked at the end of 2013 at € 1,400 /tonne and eased to € 1,100 /tonne early 2014.

After the "seaweed price bubble" of 2008, when prices reached exorbitant levels (€ 17 /kg of refined carrageenan) following a strong increase in Chinese demand, the market collapsed in the course of a few months. Given the sudden price increase, many farmers rushed to harvest immature or low-quality seaweed, flooding the market and causing the subsequent price crash.

In 2007, before the seaweed price bubble, prices of refined carrageenan amounted to approximately € 7 /kg.

Since the seaweed price bubble, the seaweed market has become more volatile and tighter. Particularly wild-collected seaweeds have become scarcer, but there is pressure on all carrageenan seaweeds.

In 2011, the earthquake in Chile caused another seaweed crisis. This time, users of *Gigartina* and *Sarcothalia* seaweed were most affected.

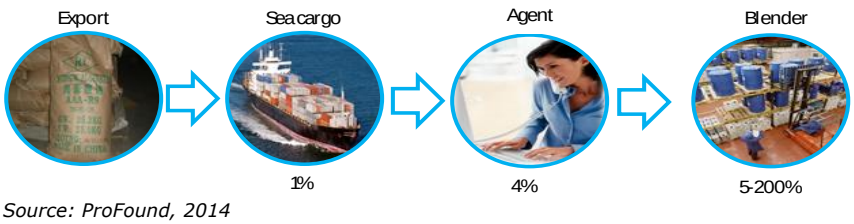
Early 2014, prices for carrageenan increased strongly. At the end of 2013, the typhoon Yolanda, and following typhoons Agaton and Basyang, in the Philippines destroyed part of the seaweed harvest and damaged some logistic facilities. This caused a reduction in availability, while demand remained strong.

Tips:

- Monitor harvests in the Philippines and Indonesia to anticipate price developments for cottonii seaweed and development of general carrageenan prices.
- The following website provides frequent market reports: http://www.roeper.de/.
- Build strong relationships with seaweed farmers/collectors and inform them regularly on price developments to regulate supplies and reduce fluctuations.

The following price breakdown shows which mark-ups are applied by some of the intermediaries.

Figure 5: Price breakdown for carrageenan, mark-ups in %



Source: ProFound, 2014

Price breakdown

- If European agents are involved, they typically receive a commission of a few percent (3-4%). However, their actual profit margin strongly depends on volumes sold and gross margin.
- Blenders add up to a few hundred percent depending on their activities, such as R&D and blending.
- Distributors usually add 10-20% to the value of the product depending on the size of the order.

Competition

Buyer power is decreasing

Although production/collection and drying of carrageenan seaweeds is very accessible, extraction of carrageenan from these seaweeds requires significant investments.

Carrageenan, agar and alginates have very similar applications. Nonetheless, each of them has unique properties which make them more suitable for some specific applications. For example, carrageenan is the preferred water binder for meat processors, but not for all bakery applications. The higher melting point of agar makes that thickener more suitable for use in bakery applications where the thickener is applied before baking.

The globally operating companies focus on the supply of tailored solutions for their buyers. In practice, this often implies measurement of customer performance needs followed by an identification of the most appropriate hydrocolloid (blend).

In some cases, carrageenan suppliers develop a tailored solution on behalf of their buyers without disclosing information on the composition of the product. Their knowledge on thickening solutions is their asset. By keeping this knowledge to themselves, they prevent their buyers from sourcing the raw materials for the thickening solution directly, which is generally cheaper. However, this practice is becoming less common, as buyers demand transparency to make their business more sustainable. They need to know the composition of their thickener in order to mitigate potential risks, such as supply shortages.

Producers of alcohol-refined carrageenan face strong competition from European processing facilities. Producers of gel-press refined carrageenan and particularly PES face considerably less competition from European processors.

The Philippines and Indonesia dominate supplies of *cottonii* seaweed, while Chile is a major competitor in the market for *Gigartina skottsbergii* and *Sarcothalia crispata* seaweed and carrageenan made from those seaweeds. Canada is a major competitor in the niche market for *Chondrus* seaweed.

European buyers are looking for alternative sources of carrageenan outside the Philippines and Indonesia to reduce dependency on production in these countries, where supply is frequently threatened by bad weather.

European trade in carrageenan is very concentrated. Very few buyers (i.e. processors) control most of the market. Their negotiating power is very strong. However, their buyer power is eroding. Continuously increasing demand, also from outside Europe, increases competition amongst these buyers for carrageenan (seaweed) supplies. Particularly in South East Asian countries, demand for carrageenan (seaweeds) is increasing. Production of carrageenan (seaweeds) does not increase as fast as demand.

Especially China is becoming a major user of carrageenan, but not a producer, driving global demand both for raw material and processed carrageenan (for domestic consumption and re-exports). This in turn increases the competition between buyers and puts pressure on the supplies of seaweed. Production of seaweed must increase or otherwise EU buyers of carrageenan will face difficulties in securing their carrageenan supplies.

Tips:

- Measurement of customer performance needs requires a high-tech laboratory with highly skilled technical staff. This requires large investments in R&D capacity and is generally only feasible for large-scale companies.
- Differences between types of seaweeds in kappa, iota and lambda carrageenan contents can provide interesting market niches for producers of seaweeds other than *cottonii*. Demand for these other seaweeds is lower than for *cottonii*, but competition is also smaller.
- If you can produce carrageenan seaweed outside of the Philippines and Indonesia, you can promote this as a Unique Selling Point.
- Please refer to CBI Competition for more information.

Main sources

Trade fairs

- Food Ingredients Europe (http://fieurope.ingredientsnetwork.com/)

- Food Ingredients Natural Ingredients (FI/NI) and Health ingredients Natural Ingredients (HI/NI) (every year, the subject of the international trade fair changes between food and health ingredients) (http://www.figlobal.com/fieurope/home)
- Vitafoods (http://www.vitafoods.eu.com/)
- Alimentaria (http://www.alimentaria-bcn.com)

More information

CBI market information: Promising EU export markets.
EU Expanding Exports Helpdesk - http://exporthelp.europa.eu - go to 'trade statistics'.
Eurostat - http://epp.eurostat.ec.europa.eu/newxtweb - statistical database of the EU. Several queries are possible. For trade, choose 'EU27 Trade Since 1995 By CN8'.
International Trade Statistics - http://www.trademap.org – you have to register

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November 2015