

## Part 1: Influence of farming methods

# Quality issues in marketing white shrimp *Penaeus vannamei* to European markets

By Hervé Lucien-Brun and Frédéric Vidal

The two principal European shrimp markets, Spain and France have special requirements for the imports of raw frozen white shrimp, *Penaeus vannamei*, which are processed and marketed as cooked and chilled. In this two part article, the authors discuss how production and harvesting methods influence shrimp quality specifications ranging from organoleptic, off flavour to shrimp colouration that are demanded by consumers in these markets.



Cooked head on shell on shrimp in markets in France



Chilled and cooked shrimp of 80/100 size in France

The white shrimp *Penaeus vannamei* was introduced in Asia several years and production is increasing significantly. It is now becoming a very serious competitor to products from Latin America. Presently, the major shrimp producers export to the European Union, which is the second largest market (33% of the world market) after the United States (40%) and followed by Japan (27%).

The two principal European shrimp markets, Spain and France imported more than 85,000 tonnes and 50,000 tonnes of whole head-on tropical penaeid shrimp, respectively. In France, the market has special requirements because consumers buy mainly shrimp head-on shell-on (HOSO). Most of the white shrimp are marketed as cooked and chilled. Annual volumes total approximately 30,000 tonnes. In contrast, black tiger shrimp *P. monodon* are marketed principally in the frozen raw state. An exception is farmed tiger shrimps from Madagascar and from some farms in Indonesia.

In Spain, shrimp are mostly sold as raw frozen product. However, the amounts of cooked and chilled shrimp have been increasing in recent years and reached 30,000 tonnes in 2005. However, this increase in demand resulted in slight price increases. Consumption in Europe was affected immediately. This showed that the price/kg has an immediate yet negative impact on the consumption of the consumers. This is the main reason that the European market prefers smaller sizes of *Penaeus vannamei* shrimp, namely 60/80 pcs/kg in Spain and 80/100 pcs/kg in France. It is also a method to moderate pricing by downgrading size.

Accordingly, once the raw whole product reaches Europe, it is transformed through a cooking process ready for the market. Here, the frozen shrimp is thawed progressively, the amount of which is determined by market demand. It is then cooked, chilled, packed and supplied to distributors where they are sold within a maximum of 5 days. In France, the shrimp is sold as loose "fresh cooked" chilled product, through various outlets such as supermarkets (65%), specialty fish shops (30%) and the remaining 5% in restaurants.

This industrial operation must be carried out quickly given the instantaneous market demand. Strict sanitary codes are implemented and enforced by food health authorities in these countries. These demand that companies must implement very rigorous sanitary procedures. The raw material used therefore, must be of impeccable quality with regards to importers' specifications and that this quality must be constant.

The main quality points are that weight and grade must be in accordance with the submitted specifications. In addition, there is also a wide range of organoleptic criteria which are often subjective. These are:

- good flavour and taste
- constant reddish colour after cooking,
- firmness of carapace and head,
- absence of morphological defects such as necrosis and/or physical defects
- absence of melanosis

In most cases, the way in which the shrimp are farmed and then harvested is of extreme importance in order to produce a top quality product. The production process can be divided up into the following steps:

- Farming and harvesting method
- Preliminary sampling
- Leaving the pond
- Chill killing, treatment, processing
- Transport to the packing plant

Influence of farming method on the final quality of shrimp

The farming method has a direct influence on the two important quality criterion- flavour and colouration.

## Off flavour

In some pond conditions the shrimp could have off flavour such as a grassy or soil-like taste and odour called 'corn smell' (or 'olor a chocho' in Ecuador). This type of problem will cause customers to react immediately.

The 'off flavour' is the result of an excess of certain types of blue green algae or cyanobacteria in the pond, of which 'lab-lab' is an example. In frozen shrimp, this off flavour tends to be accentuated in the shrimp over long periods of time. This then becomes a frequent reason for major quality claims. A very light taste in fresh shrimp can become very strong when it is defrosted several weeks later. (This effect of the *Cyanobacteria* is well documented, as the same phenomenon is observed in wine in when grapes are covered with this algae)

The presence of *Cyanobacteria* can be observed in two specific cases. When inputs of fresh water are intermittent but greater than evaporation, there is decreased salinity. This effect is generally observed during the rainy season in tropical areas, in farms pumping water from river estuaries. The reverse is when evaporation is higher than fresh water intake into a pond and salinity increases. This could be observed in farm localized in desert area, in Middle East, for example. In both situations, the general effect is an almost total colonisation of the water by blue green algae or in the sediment as lab-lab.

The problem can be detected by tasting cooked shrimp during sampling. Corrective measures would be to increase the water exchange or increase aeration. Water movement is very important. Generally lab-lab problems originate in pond corners with low water movements and there is little water exchange. Another possible measure would be to alter the fertilization of the ponds with algae promoters and allow them to compete against the *Cyanobacteria*.

When the problems of *Cyanobacteria* are solved, it can be a few days before the off flavour is mitigated. Nevertheless, if the problem is well established and has persisted for a long time, it is more difficult to remove it. Therefore it is imperative that the problem is detected during the early stages via weekly sampling.

The use of an algae promoter in the ponds such as Water Oligo manufactured by Aqua Techna can help to reduce the quantity of the *Cyanobacteria* in the pond and thus reduce the problem of off flavours in shrimp.

## Colour

The visual aspect of shrimp is one of the first criteria on which a decision is made by consumers when buying shrimp. Colouration of cooked product is one of the most important criteria attributed to quality. For most consumers, the red-orange colour of cooked shrimp is the most attractive component of the product. Unfortunately, due to dietary limitations, farmed shrimp is sometimes slightly under-pigmented.

Colour is one of the major factors considered in the determination of price. Buyers place importance on this criterion, both in sourcing as well as in pricing. Given the large amount of shrimp in world markets



Cooking the shrimp

and the product offered to Europe, it is conceivable that the buyers would reject shrimp based on colour alone.

Astaxanthin is responsible for the reddish-orange colour in cooked shrimp. Most crustaceans are able to metabolize various pigments through different biochemical pathways to synthesize astaxanthin which is widely found in prawns from wild catch as well as in farmed shrimps.

The possibility to induce colour enhancement in the final product form through additives in the shrimp feed has undeniable economic advantages for the majority of the European markets. Several natural products rich in carotenoids such as *Spirulina* or paprika for example, or a synthetic form astaxanthin, have been tested in various commercial feeds with erratic, inconsistent results. Frequently the cost of such substances is so high than their use is economically prohibitive. (See next article on shrimp colouration).

**Next issue: Part 2 of this article will discuss processing methods influencing shrimp quality and the control of melanosis.**



**Hervé Lucien-Brun** is the General Manager of Aqua Techna. He has technical and commercial expertise in shrimp farming as well as shrimp processing units and commercialisation procedures. His experiences in shrimp farming were mainly in Ecuador where he worked for a large shrimp farm and hatchery. Hervé's expertise in quality control is mainly focused on the processing of whole shrimp for the European market. His experiences also cover lobster, shellfish and tilapia farming. Email: hlb@aquatechna.com



**Frédéric Vidal** is a technical expert in aquaculture, freshwater fish and tropical shrimp farming and is in charge of R&D of innovative products at Aqua Techna. His core expertise is in aquatic pathology. Between 1990 and 2000 he worked for various health organizations, large farms and shrimp incubation facilities. He also manages his own freshwater fish farm in Brittany since 1997, producing carp, roach, pike, pike-perch, sturgeon and silurids.