



PIGMENT SOURCE DIFFERENCES

Aquasta® is distinctly different from other commercial pigment sources and can be traced back in the filets of fish fed with this product. Therefore, fish producers can prove the use of the correct pigment source in the final product.

Aquasta®, like synthetic astaxanthin sources, exhibits 100% free, non-esterified astaxanthin, which is considered advantageous because it is readily absorbable and need not be hydrolysed in the digestive tract of the fish. In contrast to synthetic and bacteria sources of astaxanthin, Aquasta® consists virtually all in 3R, 3'R form, an important astaxanthin source in nature. Finally, the geometrical isomer, all-E, is higher in Aquasta®, as compared to synthetic sources. This contributes to greater efficacy because the all-E (*trans*) isomer has greater bio-availability than the *cis* isomer.

STABILITY IN FEED PREPARATION

The stability of astaxanthin used in feed is of great importance to the aquaculture industry. It is critical that astaxanthin remains stable in the fish flesh over time under normal conditions in fresh, frozen, and smoked fish. Studies performed by Akvaforsk have shown that naturally-sourced Aquasta® has equal or better stability compared to synthetic astaxanthin.

For each field trial, extruded feed from the fish farms' ordinary feed plants was prepared according to their normal feed and feeding procedures. Naturally-sourced Aquasta® or synthetic astaxanthin was added to the mixer together with the meals, vitamins and minerals. For this type of application, there is an estimated loss of pigment of about 5 to 15%. These losses vary from feed plant to feed plant, but are also dependent on the size of pellets, fat content, etc.

AQUASTA® VS. OTHER PIGMENTS

	Derivation	Optical isomers (%)			Geometrical isomers (%)	
		3R, 3'R	3R, 3'S	3S, 3'S	All-E	cis
Aquasta® phaffia astaxanthin	100% free	100	—	—	90	10
Synthetic sources	100% free	25	50	25	65-75	25-30
Bacteria sources	100% free	—	—	> 99	95.5	4.5
Algae sources	Esterified	—	—	~100		
Krill sources	Mainly esterified	70	10	20		



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STABILITY IN THE FEED MANUFACTURING PROCESS

Samples from different stages in the feed manufacturing process (including the conditioner, extruder, dryer and coater) were taken to determine how each step influences the content of the pigment in the finished feed. Such samples and tests were made in all feed plants involved in the pigmentation trial. Duplicate sampling and testing was done in all cases. All samples were taken randomly from different lots in order to keep track of the real pigment losses. The key steps, in terms of losses, were the conditioner and the dryer. From the obtained data, there is a significant difference between feed plants.

Fig. 1: Stability in the Feed Manufacturing Process

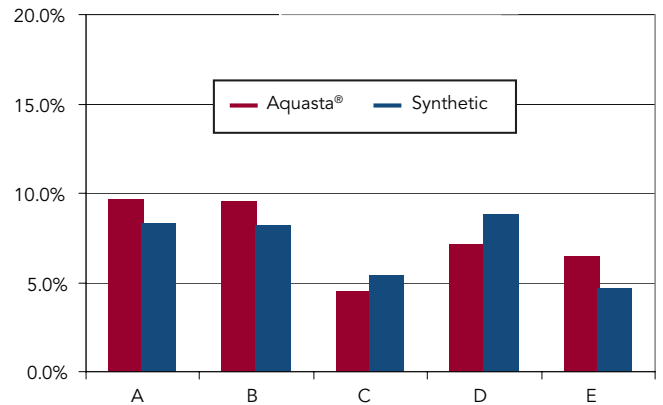


Fig. 1. Graphs of astaxanthin loss from the feed after the feed manufacturing process, which includes the conditioner, extruder, dryer, and coater. A, B, C, D and E are different feed plants.

STABILITY IN THE FINISHED FEED

A stability comparison between naturally-sourced Aquasta® and synthetic astaxanthin in a comparable diet. Both feeds were stored under controlled conditions at 20 and 35°C for 180 days. At the end of the test, there was no significant difference between the two pigment sources. Both pigments demonstrated an immediate reduction after 20 days (stored at 35°C) and another reduction of pigment content after 90 days.

Fig. 2: Stability in Extruded Feed

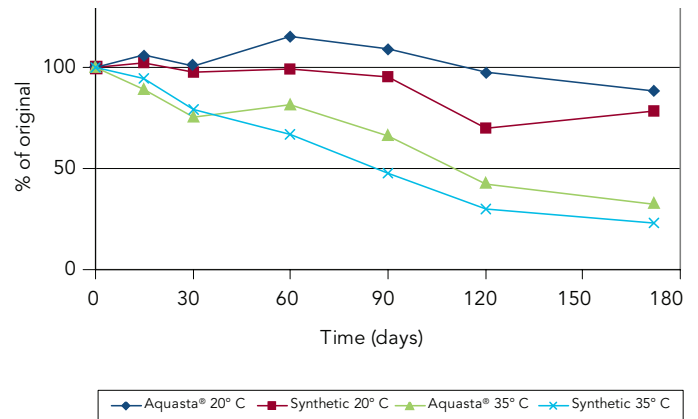


Fig. 2. Graph of stability of astaxanthin from two sources: naturally-sourced Aquasta® and synthetic astaxanthin, in feed stored at two temperatures, 20 and 35°C for 180 days.