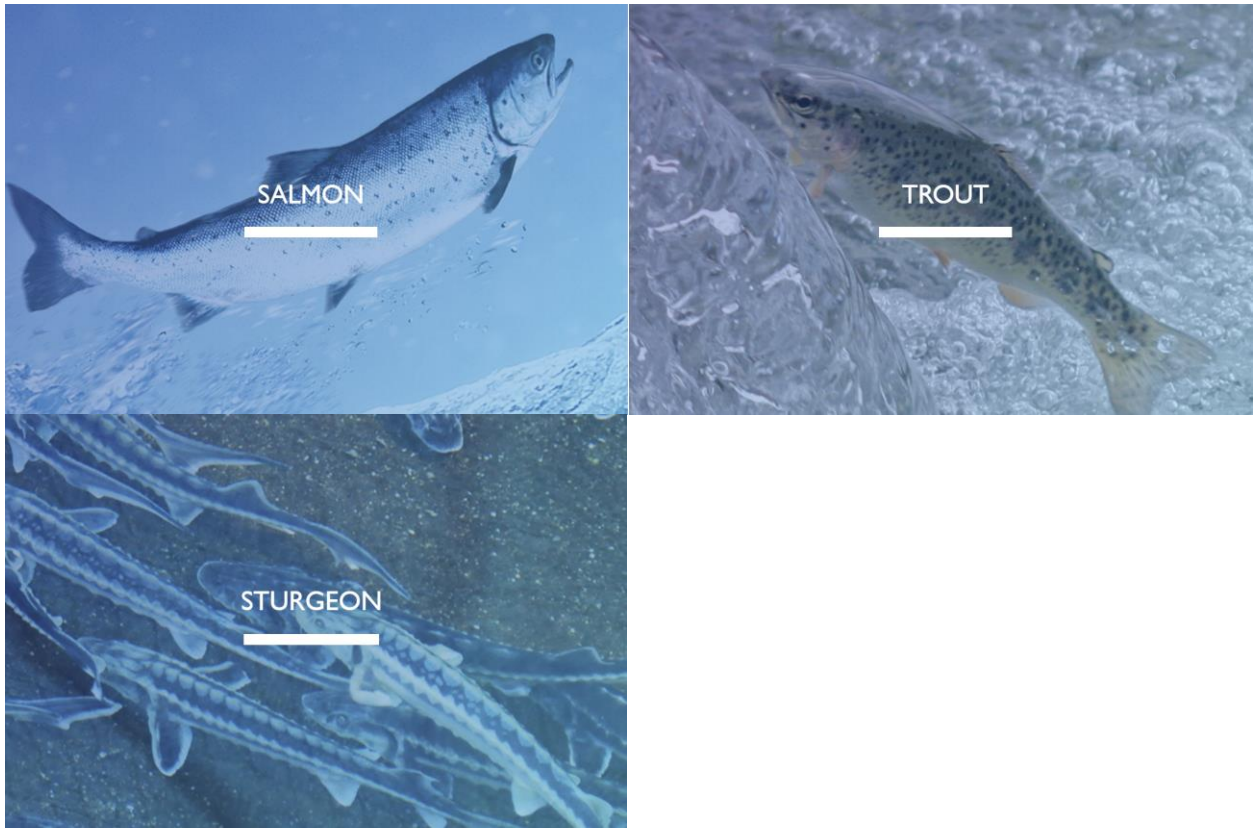


FAMSUN
Integrated Solution Provider

Integrated Solution Provider

Feed for Cold Water Fish (Trout & Salmon)

FAMSUN
缔造系统价值

Contents

1. Who is Famsun

2、Analysis of global cold water fish farming

3. Key points of cold water fish feed processing

FAMSUN 缔造系统价值 丰尚

FAMSUN CO.,LTD -- Intergrated Solution Provider

Famsun Sci Park
World-class agricultural and animal husbandry machinery production and research base

Main Business

FAMSUN 缔造系统价值 丰尚

Animal Feed & Farming

Silo Plant

Oil & Fats

Food Processing

Brand Honors

FAMSUN 缔造系统价值 丰尚

FAMSUN has won the second prize of National Science and Technology Progress Award for four times

China Feed Machinery Standardization Technical Committee established the secretariat in FAMSUN

International Organization for Standardization Technical Committee on Feed Machinery (ISO/TC293) Secretariat

FAMSUN was approved to establish a national enterprise technology center

Globalization of locations

1
Oversea
Manufaturing Base

6
R&D Center

5
Joint Venture

8
Branch Company

54个
Representative office

Danish R&D

German R&D

USA R&D

- Set up overseas production bases and research institutes, gather global resources, and attract top talents in the industry.
- Set up overseas offices, products are sold in more than 140 countries and regions, accounting for more than 60% of the national feed machinery exports for many years.
- Famsun has established research institutes in Asia, Europe and the United States, and has joint ventures and cooperation with 5 top technology companies in the industry including the United States and Spain.

Globalization of R&D

FAMSUN 缔造系统价值 丰尚

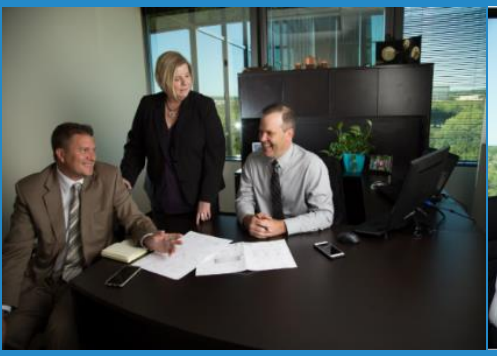
3000+ Staff

Provide you with timely and efficient service

1250 +	900 +	600 +	300 +
技术&研发	项目管理	生产制造	销售&服务

globalization

Talent system



Globalization of Sales & Service

FAMSUN
缔造系统价值

Domestic

Eastern Branch

Southern Branch

Western Branch

Northern Branch

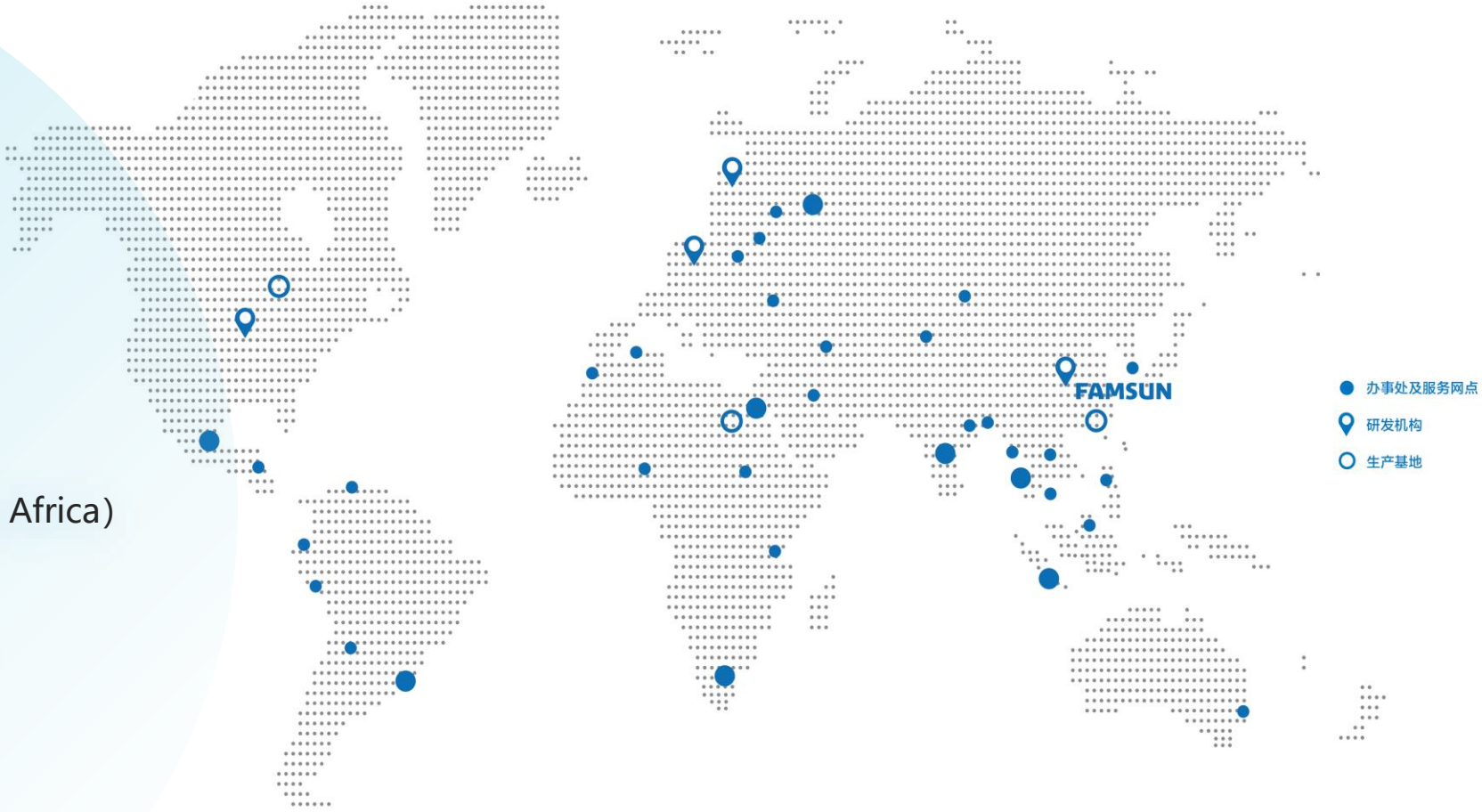
International

IBD1 (Middle east & Africa)

IBD2 (America)

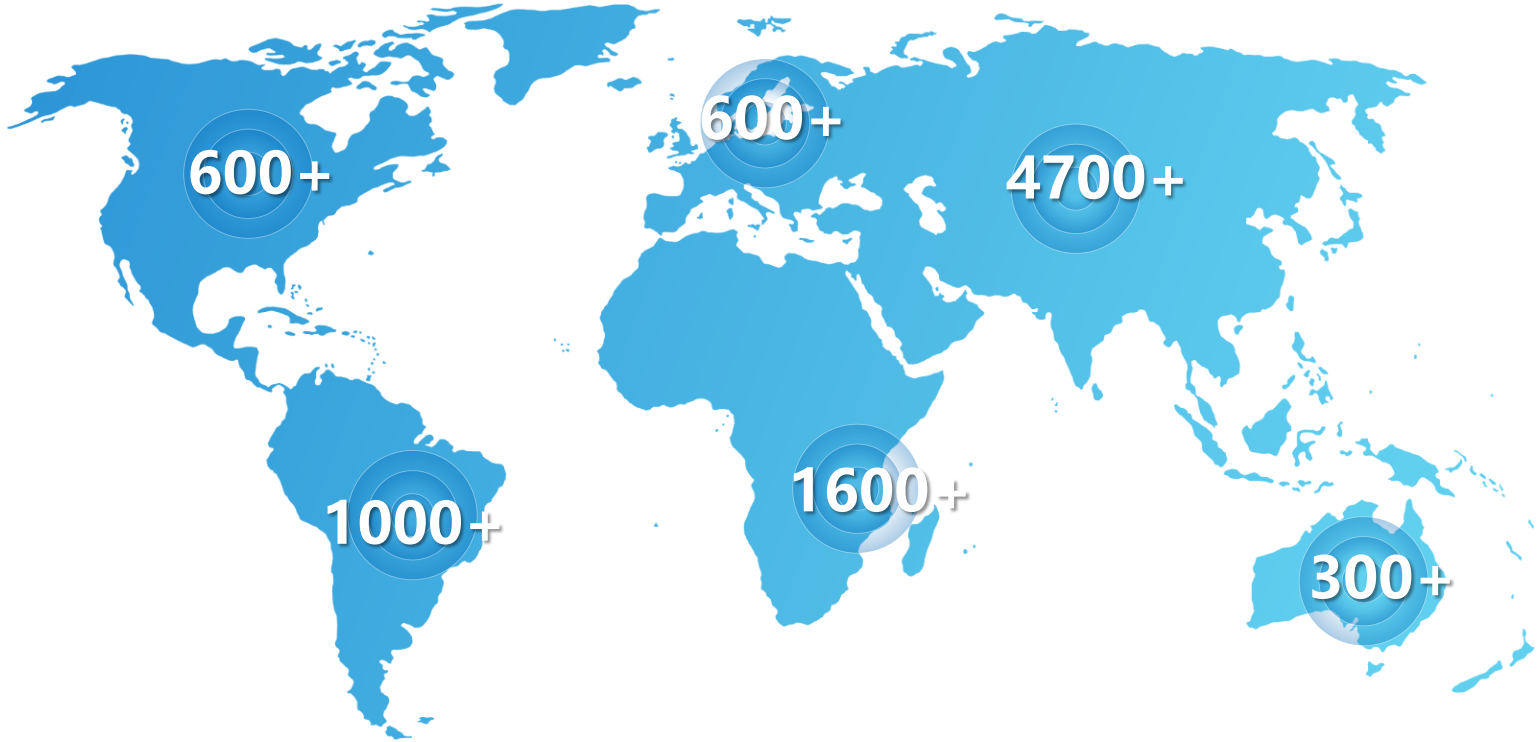
IBD3 (Asia Pacific)

IBD4 (CIS Region)



8800+ Projects Famsun Has Built Over the World

FAMSUN
缔造系统价值

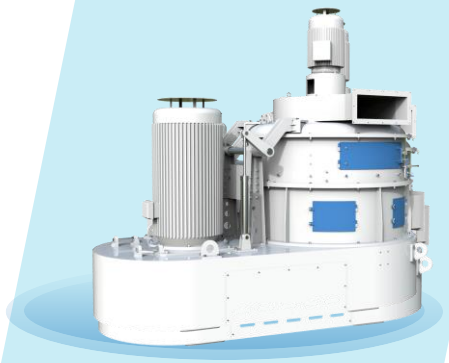


Key Machines

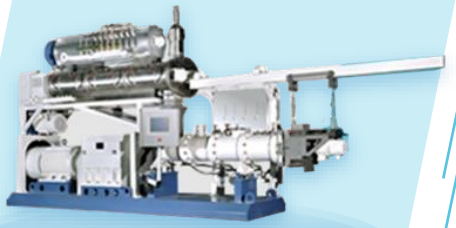
FAMSUN
缔造系统价值

Distributed in 140 Countries around the world

13400+	8000+	2000+	5000+
Hammer Mill	Mixer	Extruder	Pellet Mill

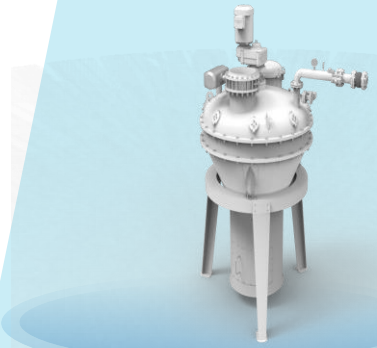


Pulverizer



Extruder

Dryer



Vaccum Coater

Precision Machining

FAMSUN 缔造系统价值 丰尚

Mazak turning and milling compound machining

FAMSUN Science and Technology Park introduces advanced production technology and world-leading control technology in the automotive industry, and is equipped with advanced processing equipment, full CNC parts processing center, and intelligent production lines to realize high-precision machining and assembly production processes for you and improve supply efficiency.

TRUMPF Laser Cutting Machine

Welding System

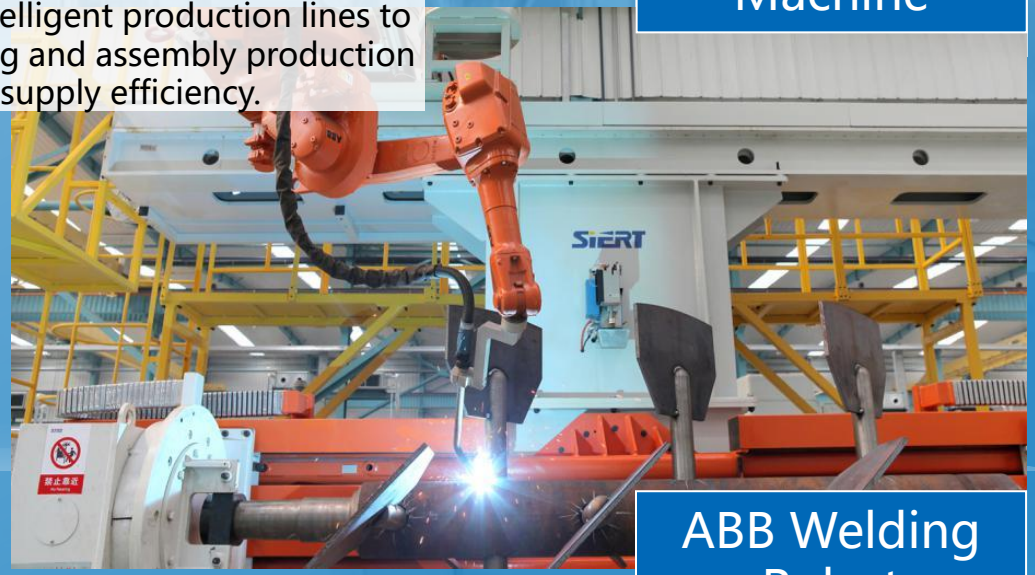


ABB Welding Robot

Testing Center

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缔造系统价值

The only large-scale test center in the industry integrating testing center, basic test platform and type test platform has been built

Among them, the testing center covers an area of 2,000 square meters, and the basic test and type test platform is about 4,000 square meters.

Basic experimental platform：

- Grinding
- Mixing
- Pelleting
- Expanding
- Twin-shaft Extruding
- Drying
- Conveyoring

Contents

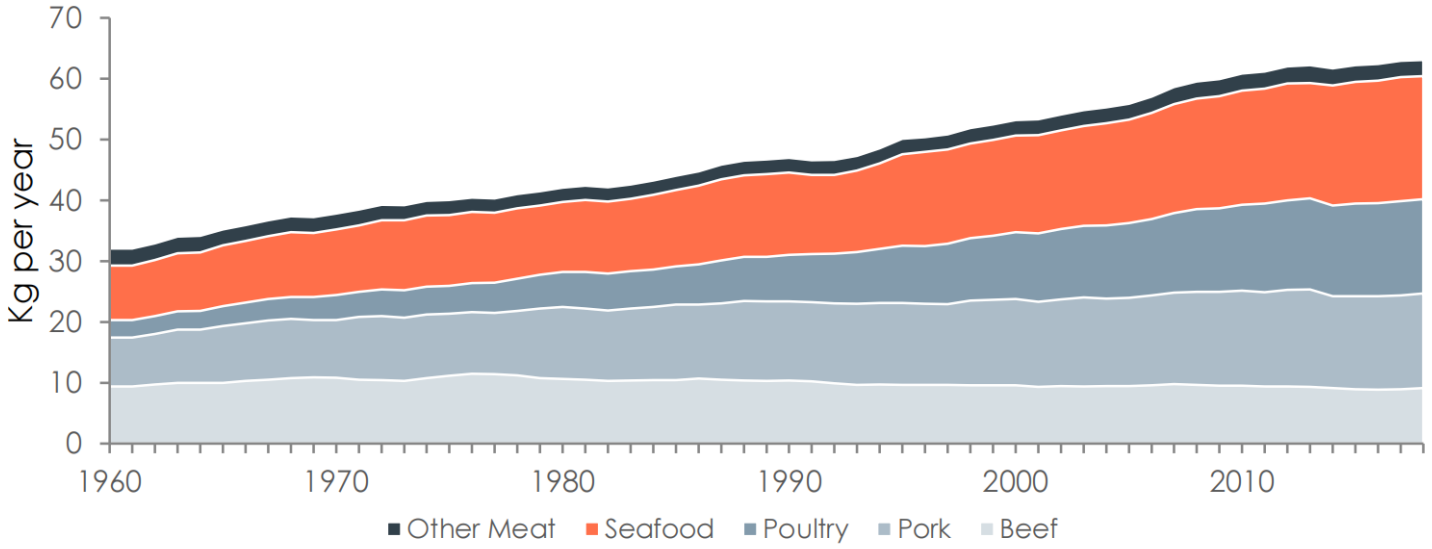
1. Who is Famsun

2、Analysis of global cold water fish farming

3. Key points of cold water fish feed processing

2. Global Cold Water fish Farming

- It can be analyzed that with the continuous improvement of human living standards, the demand for high-quality aquatic meat protein is increasing day by day, and the market demand growth rate is faster than that of traditional pork and beef.
- In comparison, aquatic protein has higher protein and energy levels, lower feed conversion rate and lower carbon emissions, which also shows that in order to meet the ever-increasing protein consumption upgrade of human beings, aquaculture will become impossible. It is also an important link in the process of sustainable human development.



Protein retention	28 %	37 %	21 %	13 %
Calorie retention	25 %	27 %	16 %	7 %
Edible Yield	73 %	74 %	73 %	57 %
Feed conversion Ratio (FCR)	1.3	1.9	3.9	8.0
Edible Meat per 100 kg fed	56 kg	39 kg	19 kg	7 kg

Carbon Footprint				
Kg CO2 / Kg edible meat	5.1 kg	8.4 kg	12.2 kg	39.0 kg
Water consumption				
Litre / Kg edible meat	2,000*	4,300	6,000	15,400

**Total water footprint for farmed salmonid fillets in Scotland, in relation to weight and content of calories, protein and fat.*

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缔造系统价值

2 Global aquaculture overview

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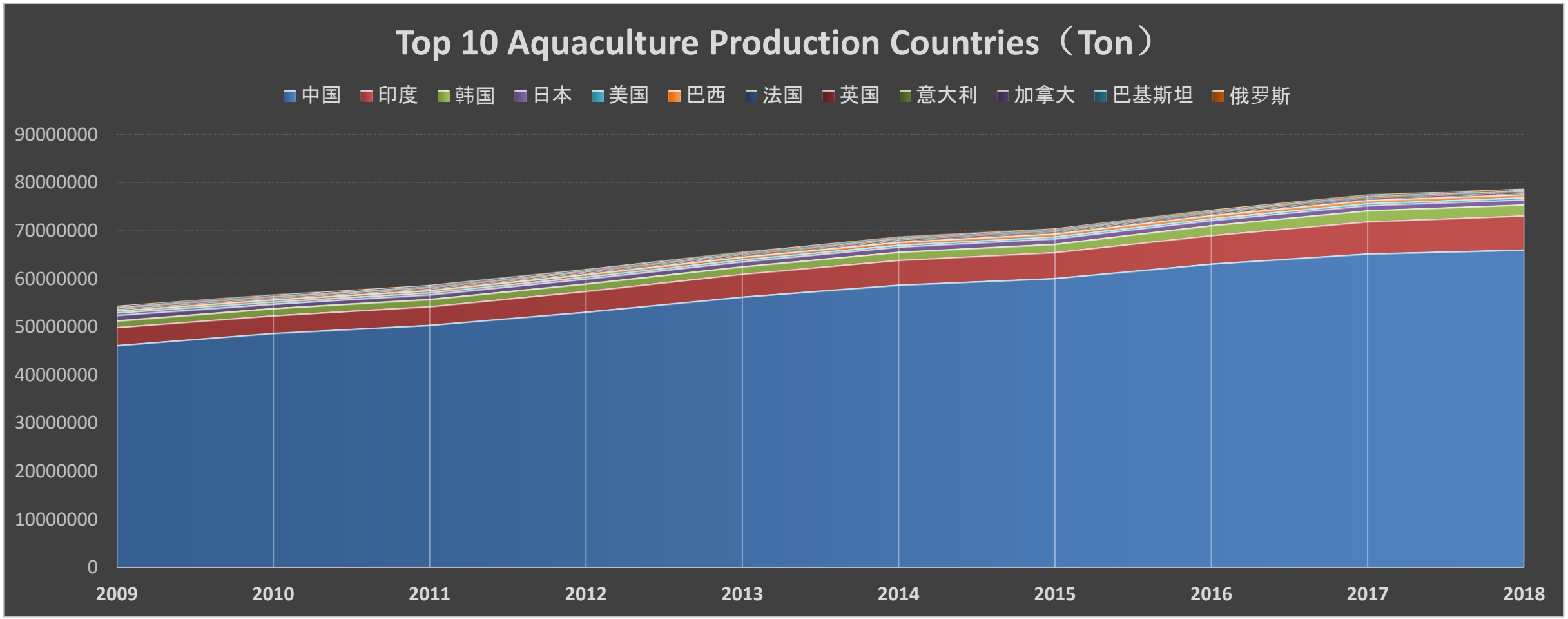
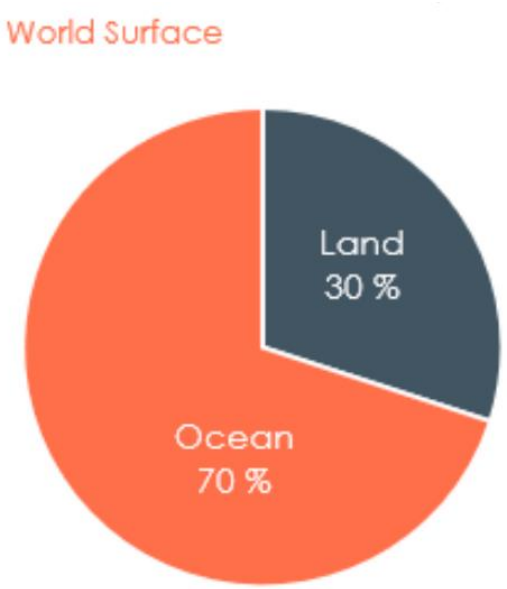
缔造系统价值

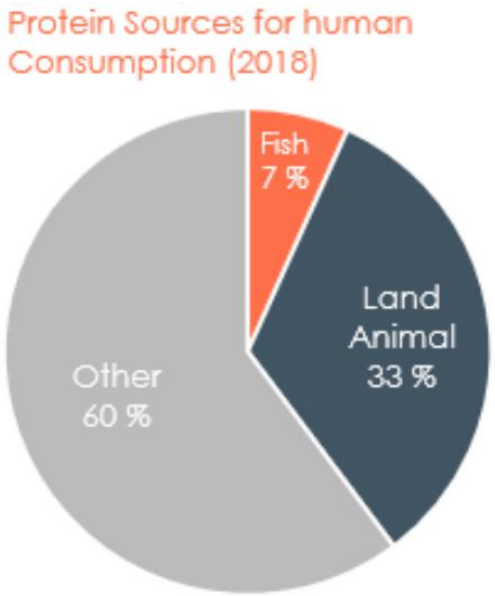


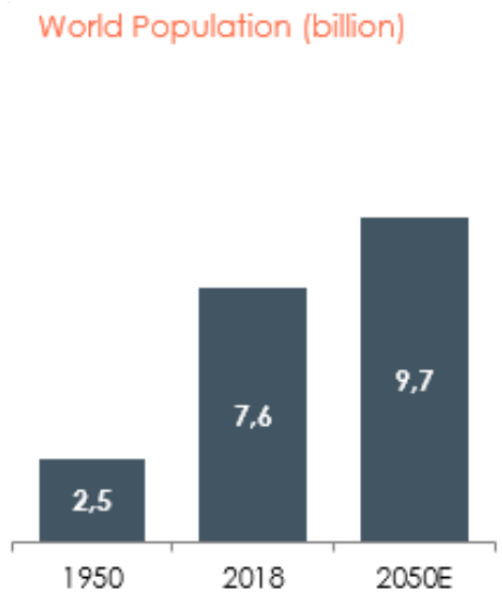
TOP 10 Aqua production Countries												
	China	India	Korea	Japan	USA	Brazil	French	UK	Italy	Canada	Pakistan	Russia
2009	84.91%	6.97%	2.45%	2.26%	0.89%	0.68%	0.42%	0.36%	0.30%	0.29%	0.25%	0.22%
2018	84.06%	8.99%	2.90%	1.31%	0.60%	0.77%	0.24%	0.25%	0.18%	0.24%	0.20%	0.26%

2. Global Cold Water fish Farming

- From the perspective of aquaculture area, marine resources account for 70% of the earth's area, but the use of fish protein only accounts for 7% of all protein sources. However, from the perspective of global population growth, it is expected that the global population will increase by more than 27% in 2050 compared with 2018. With the large-scale development of terrestrial resources, aquatic product aquaculture has a very broad space for development in the future.







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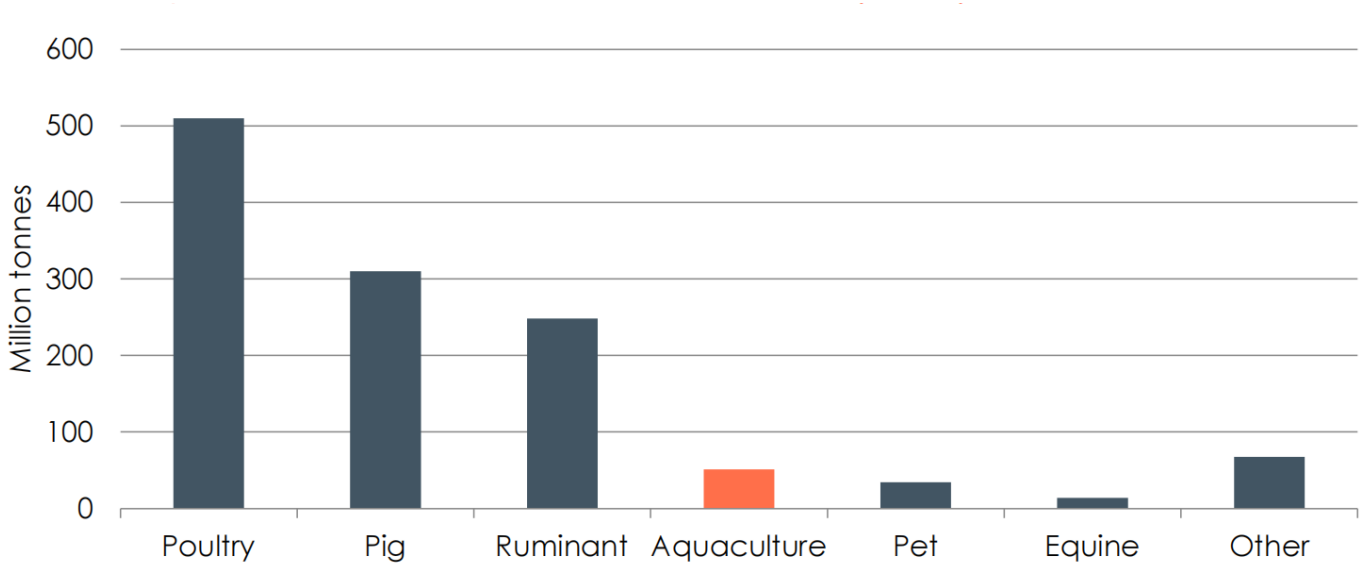
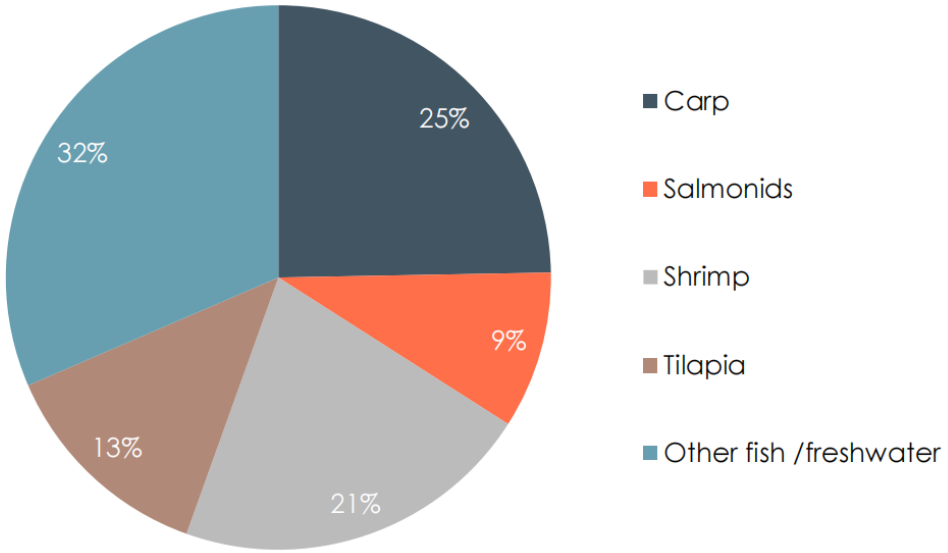
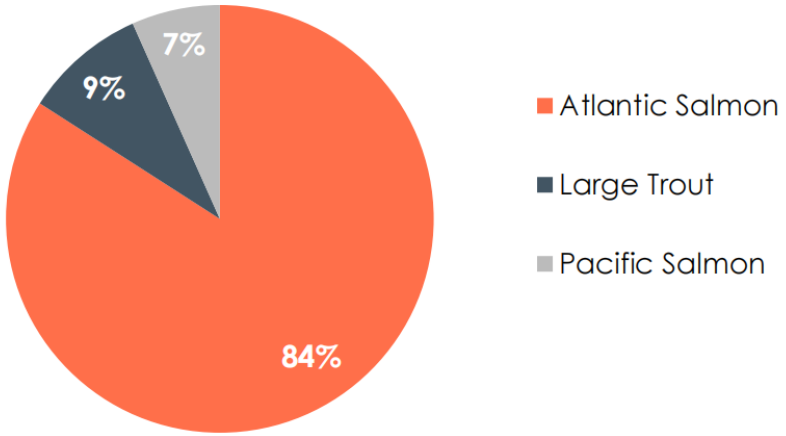
2. Global Cold Water fish Farming

- According to FAO statistics, the global aquafeed production in 2021 will be about 51 million tons, of which salmon feed accounts for 9%, and Atlantic salmon accounts for 85% of salmon feed, equivalent to nearly 3.85 million tons







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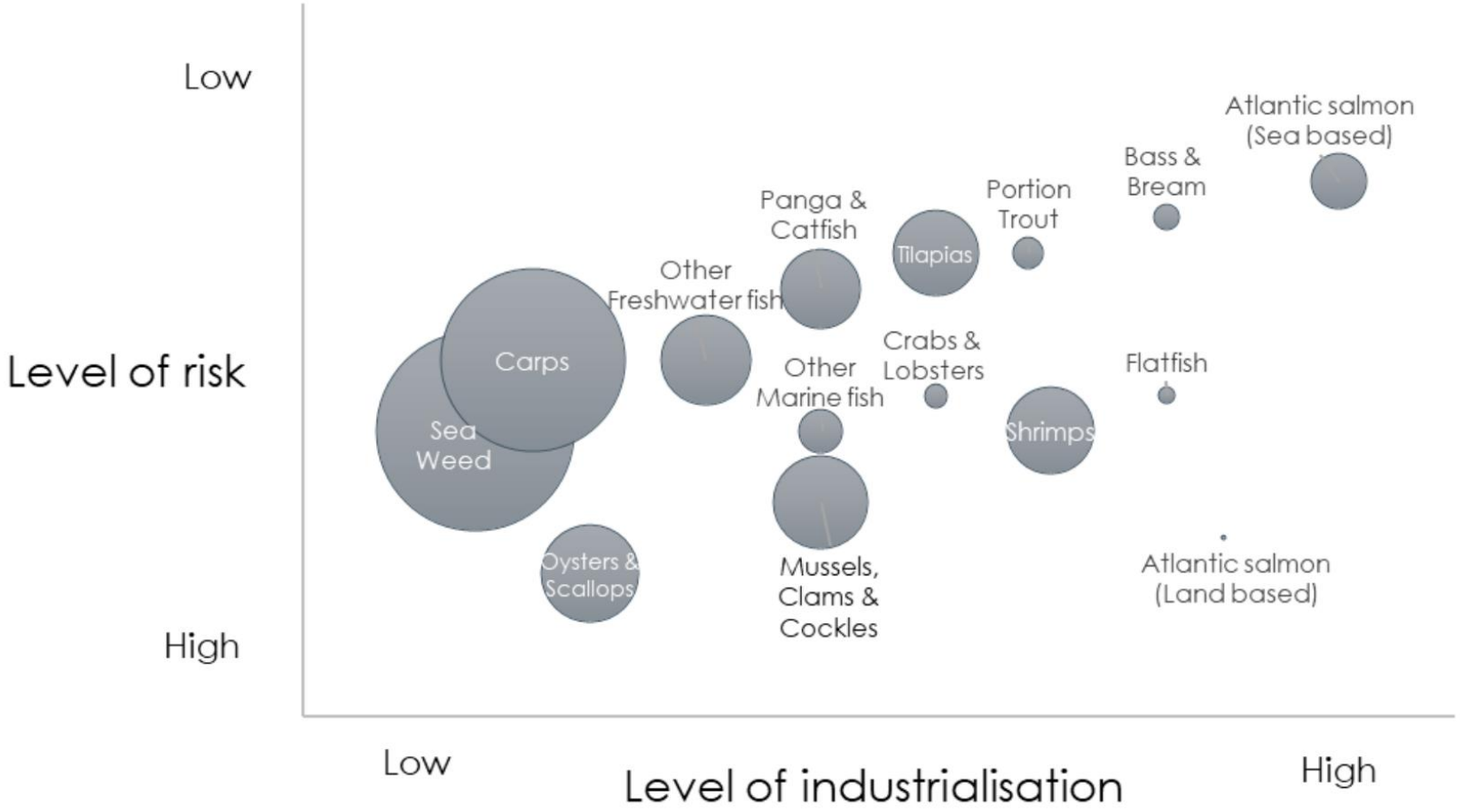
2. Global Cold Water fish Farming

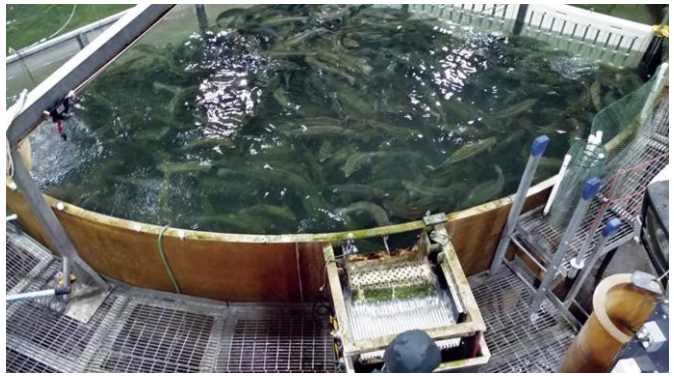
- Although Atlantic salmon is not very large, it still occupies an important position in the field of aquaculture due to its mature farming experience and high degree of industrialization;
- It can be seen that with the maturity of land-based aquaculture technology and the development of recirculating aquaculture, salmon roadbed aquaculture has gradually entered the field of vision.

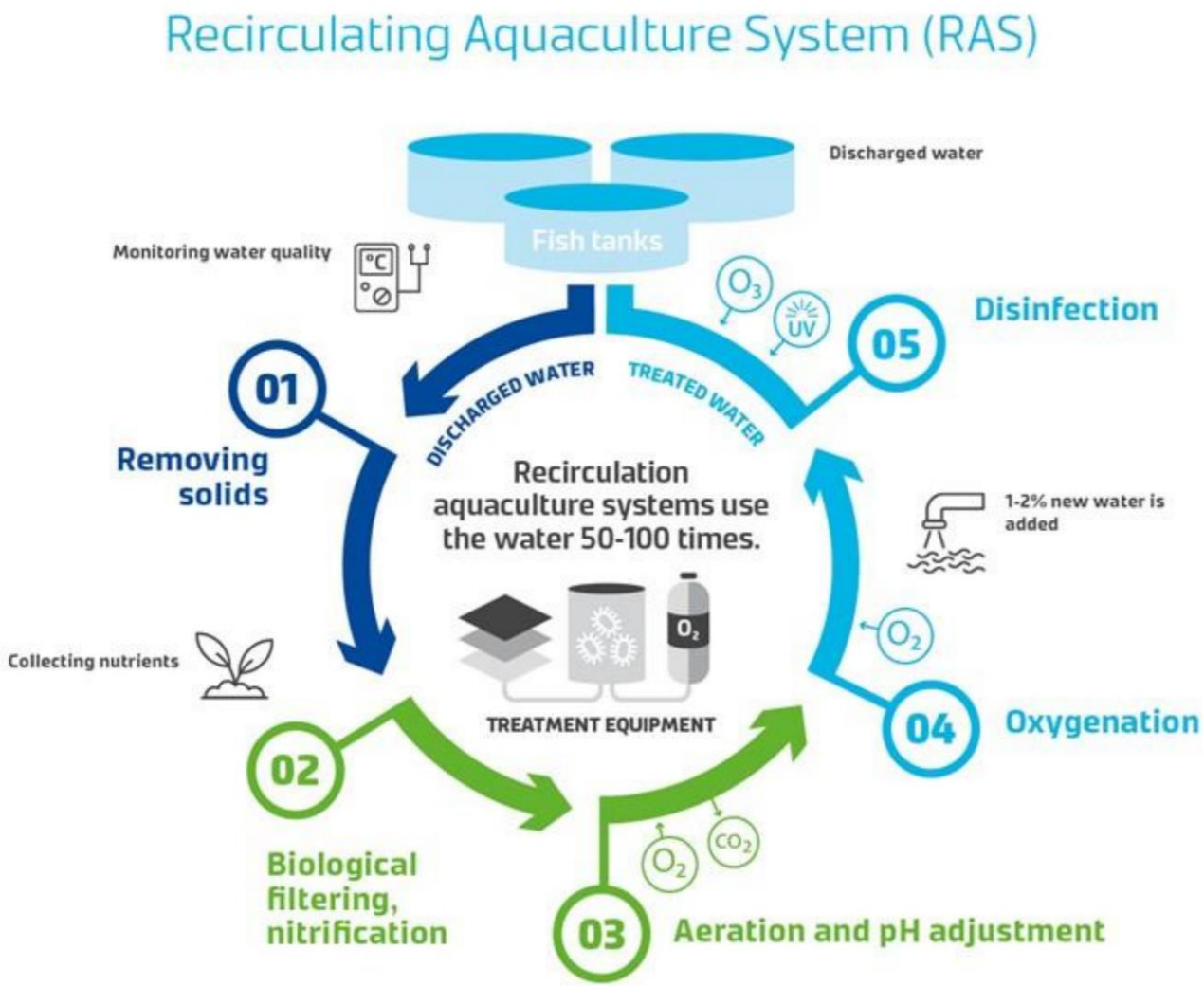


2. Global Cold Water fish Farming

- Large groups tend to have shorter cycles, higher technology and higher value juvenile fish farming
- Higher degree of industrialization, scientific management, higher yield and fish meat quality
- Reduce pollution and exhaust emissions, sustainable development

Recirculating Aquaculture





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缔造系统价值

2. Global Cold Water fish Farming

- The picture on the right shows the distribution of large-scale recirculating aquaculture plants in the world by 2021, mainly in Europe and North America
- Nutreco invests in Danish companies NAP and AKVA Group to develop RAS Atlantic salmon farming plant in Xiangshan County, Ningbo, China

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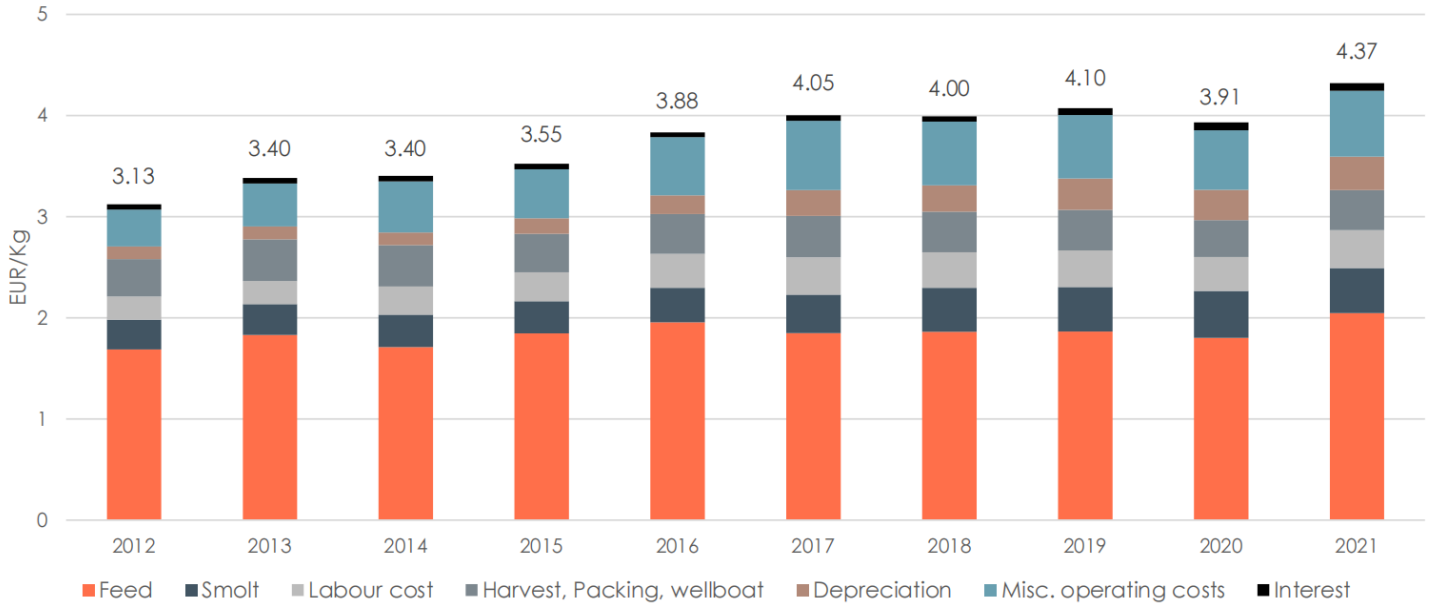
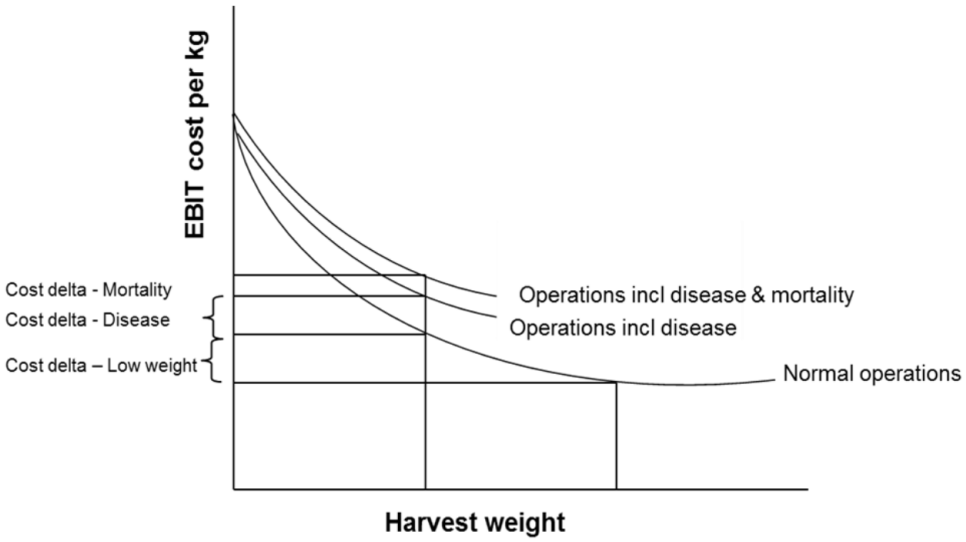
缔造系统价值

2. Global Cold Water fish Farming

- From the perspective of the entire process of salmon farming and production, feed cost is the bulk of the entire cost.
- The cost of purchasing juveniles is also relatively high, as juveniles are generally born in recirculating aquaculture systems
- Buying some disease-resistant nutrient solution will increase the input of the entire feed, but from the cost analysis model, the unit cost can be increased after the mortality rate is reduced





Contents

1. Who is Famsun

2、Analysis of global cold water fish farming

3. Key points of cold water fish feed processing

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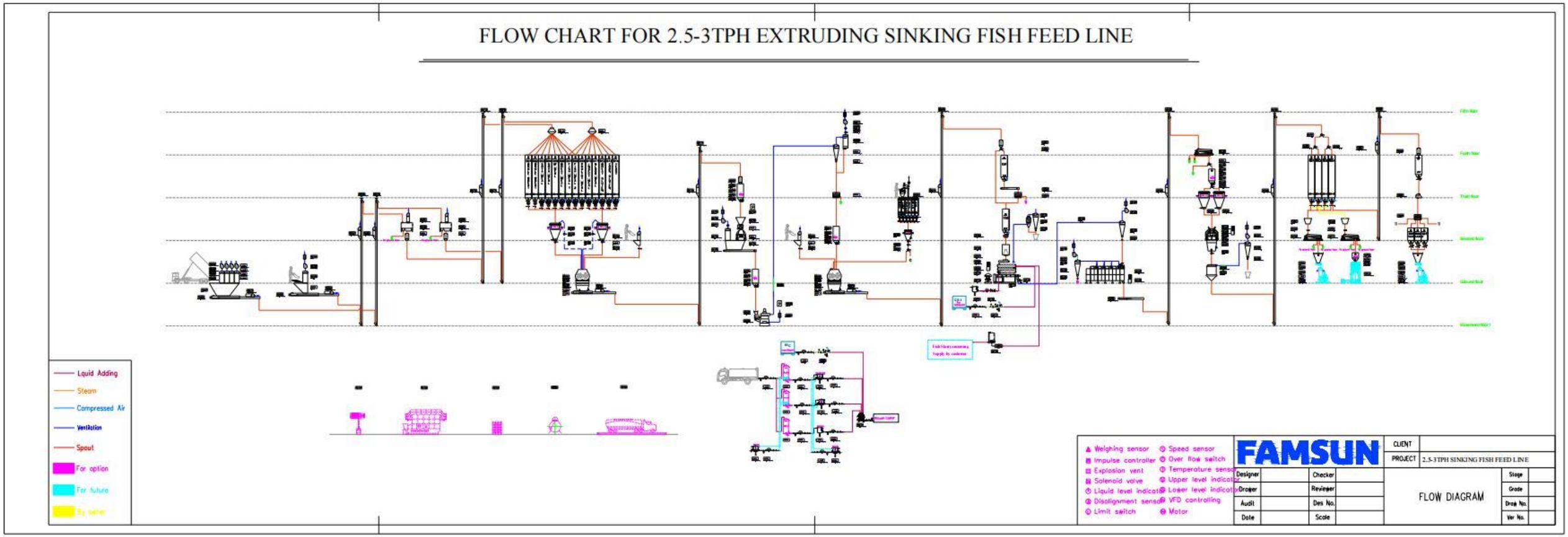

3. Key points of cold water fish feed processing

In view of the characteristics of salmon feed and the need for cost reduction and efficiency improvement in aquaculture systems, many challenges have been brought to the feed production process

- Production technology of extruded sedimentary material
- High water resistance and low dissolution rate solution for sinkable materials
- More than 20% grease addition solution
- Fragment-resistant for high-greasy processes

Targeted configuration and solutions of extruding section + drying section + coating section

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Anti-breakage solution - reasonable process layout

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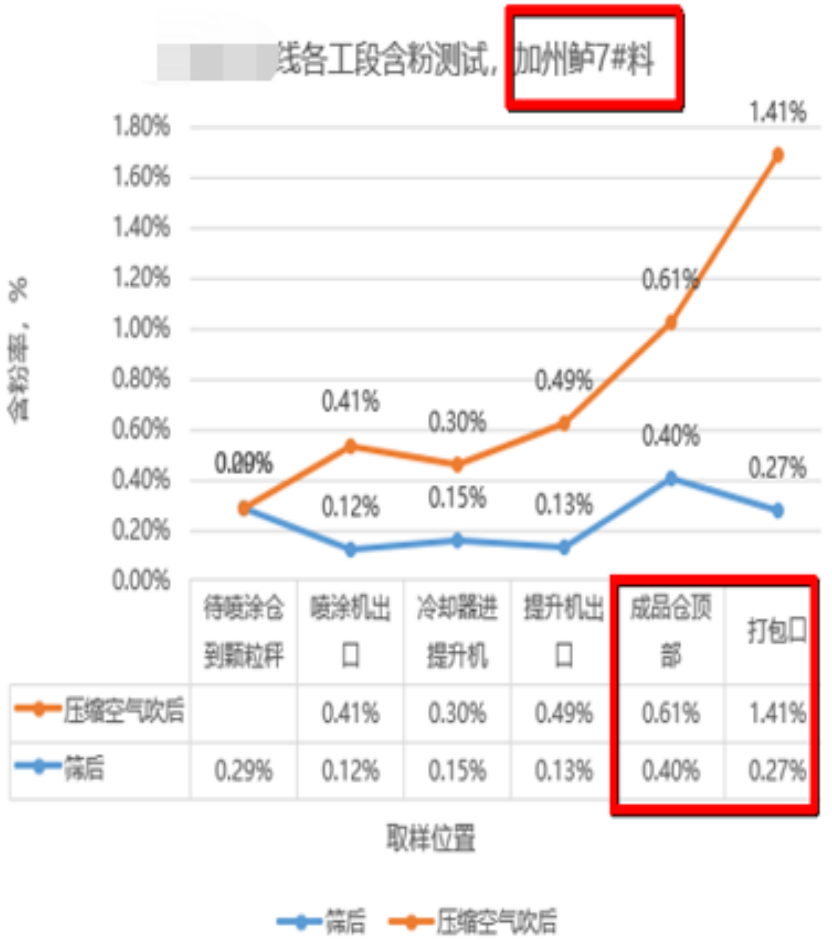
- Process design ideas:
  - short process;
  - low drop
  - Anti-fall
  - flow control
  - Optimize the feed direction

- Anti-shattering critical control points:
  - equipment;
  - transition bucket
  - chute
  - warehouse

测试数据对标:

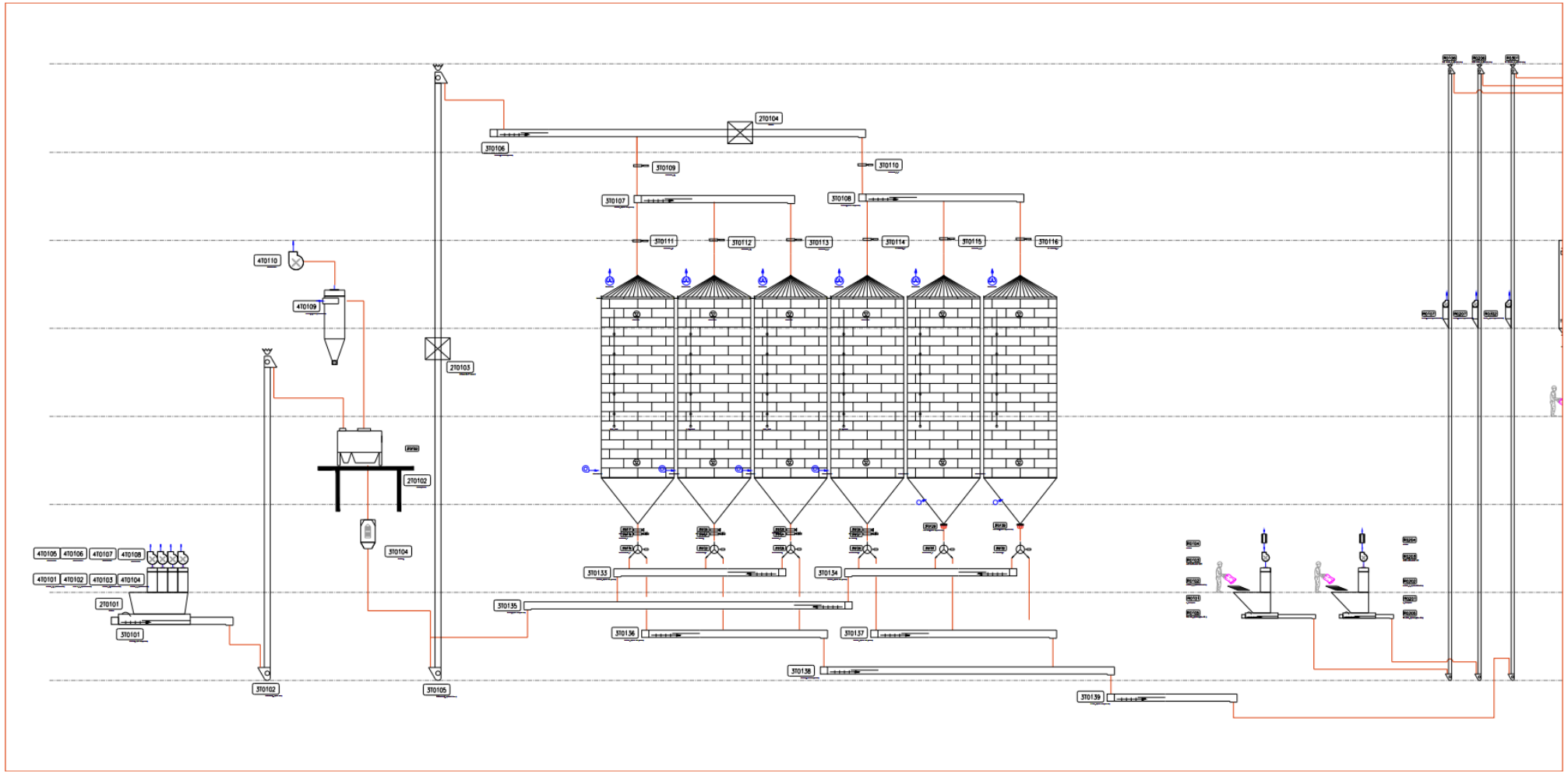


成品表面含粉多—1.41%

0.13%含粉率成品品质满足客户要求

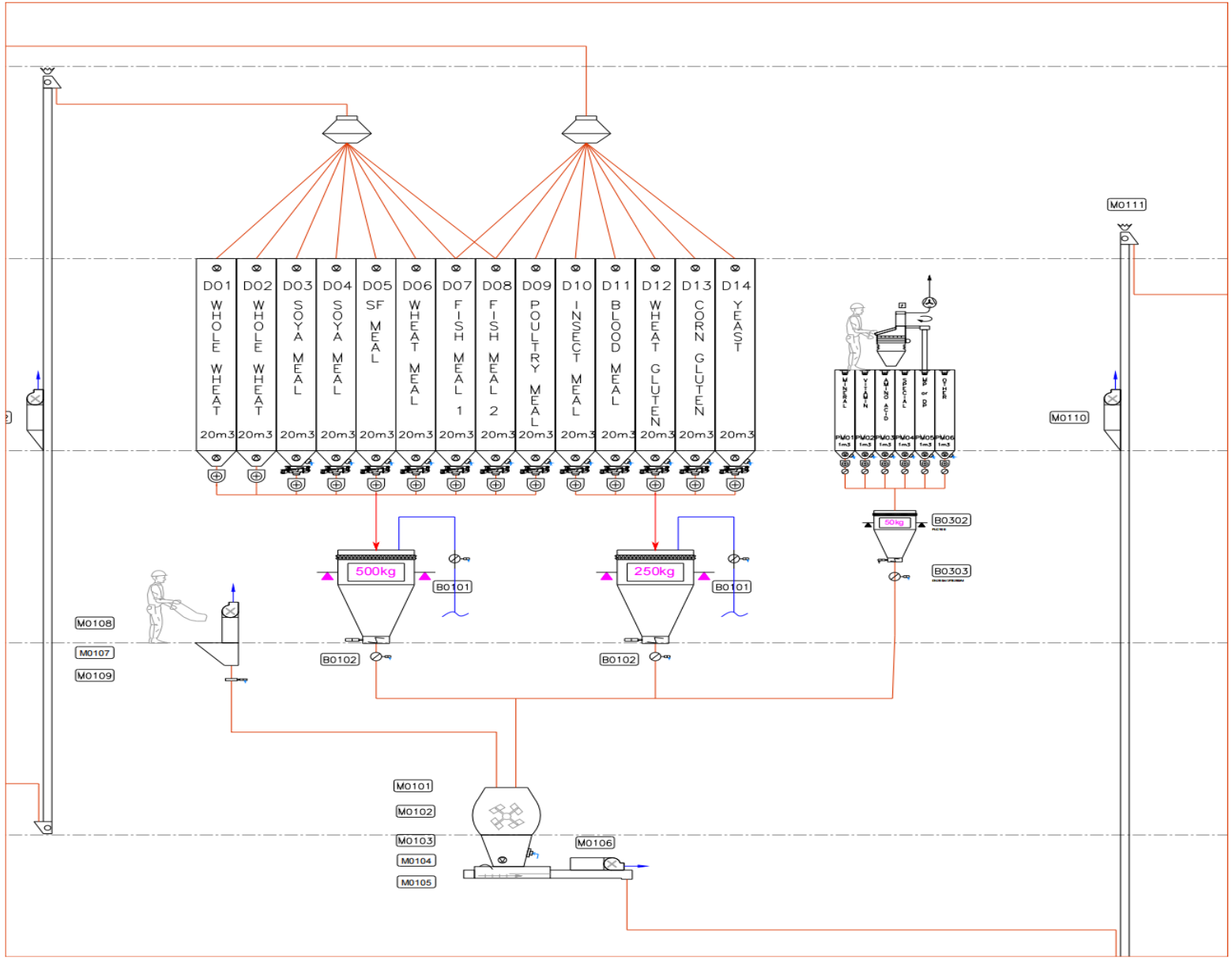
3. Key points of cold water fish feed processing

Intake Section



3. Key points of cold water fish feed processing

Batching Stage 1 Mixing Section



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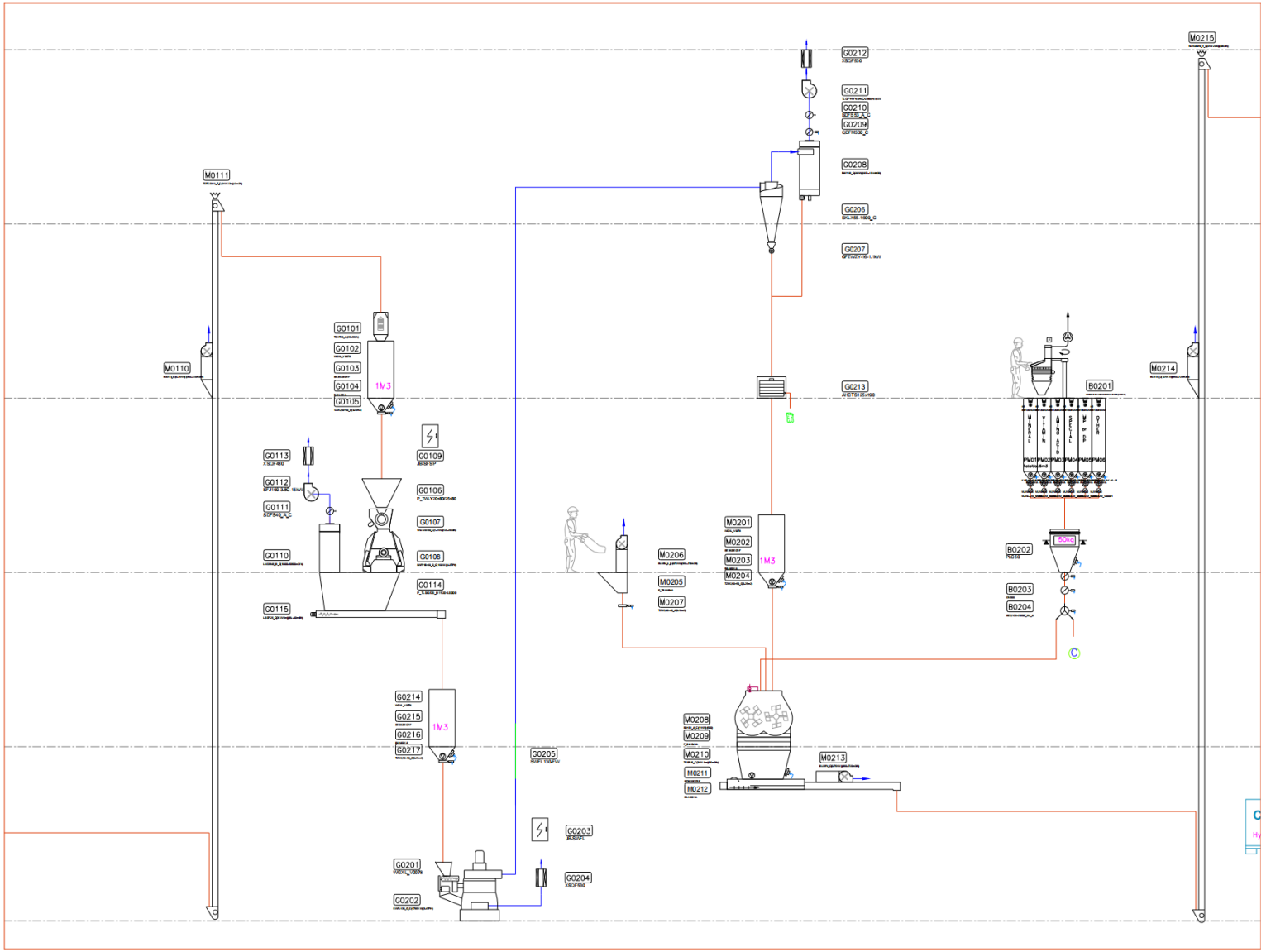
3. Key points of cold water fish feed processing

Stage 1&2 Grinding
Stage 2 Mixing
Section



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Water resistance, anti-breakage solution - granding equipment selection

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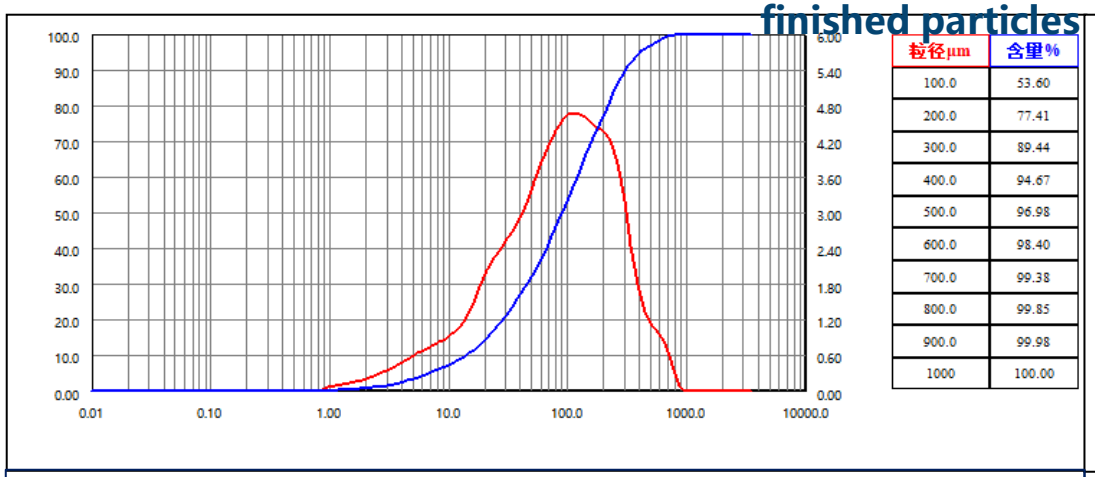
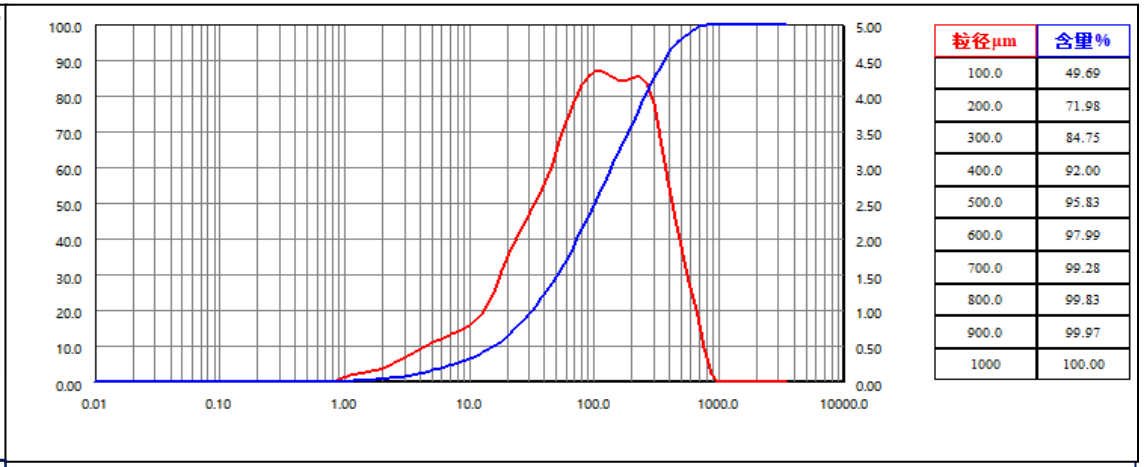
缔造系统价值

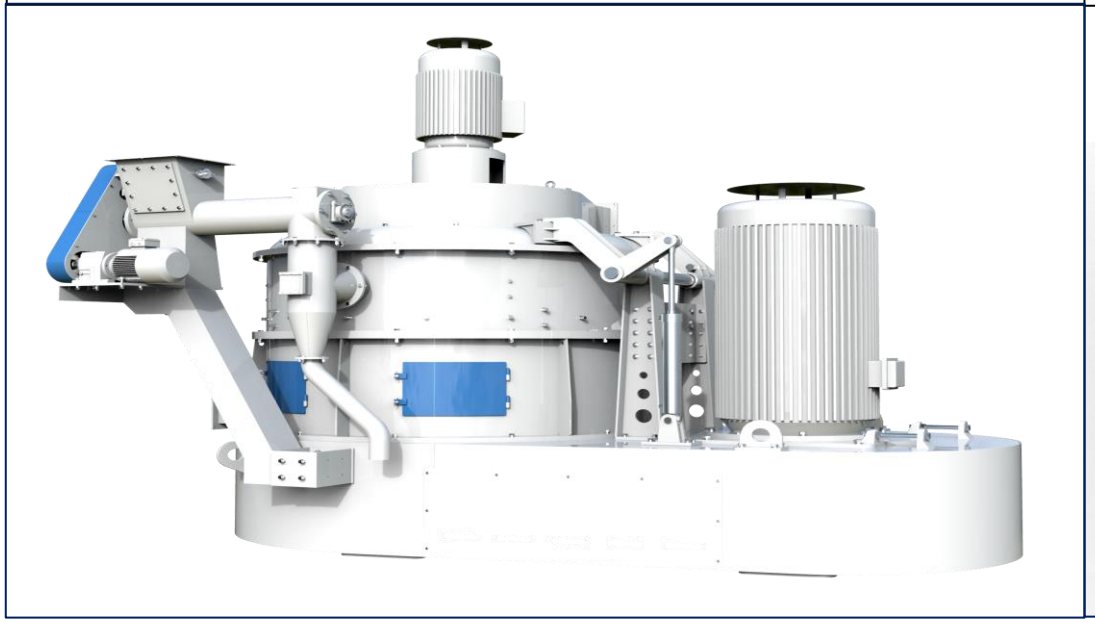
The particle size distribution of the ultrafine pulverizer is finer, which is conducive to the digestion and absorption of animals, and is also conducive to the water resistance of the finished particles



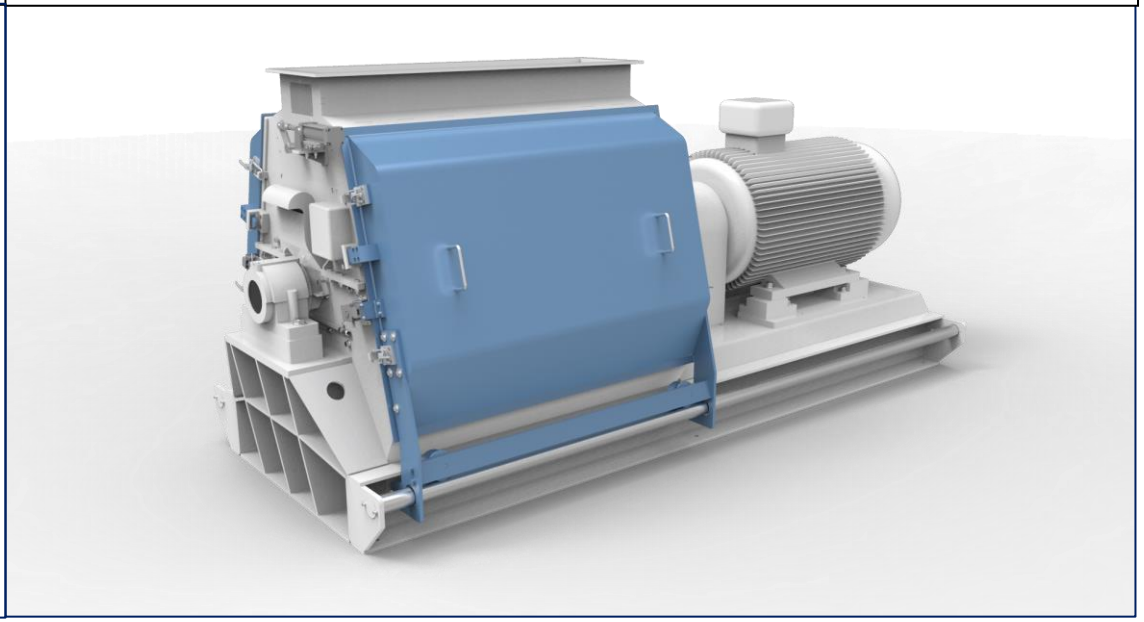
粒径μm	含量%
100.0	53.60
200.0	77.41
300.0	89.44
400.0	94.67
500.0	96.98
600.0	98.40
700.0	99.38
800.0	99.85
900.0	99.98
1000	100.00



粒径μm	含量%
100.0	49.69
200.0	71.98
300.0	84.75
400.0	92.00
500.0	95.83
600.0	97.99
700.0	99.28
800.0	99.83
900.0	99.97
1000	100.00



Particle size distribution of ultrafine pulverizer



Particle size distribution of Φ0.8mm mesh hammer mill

3. Key points of cold water fish feed processing

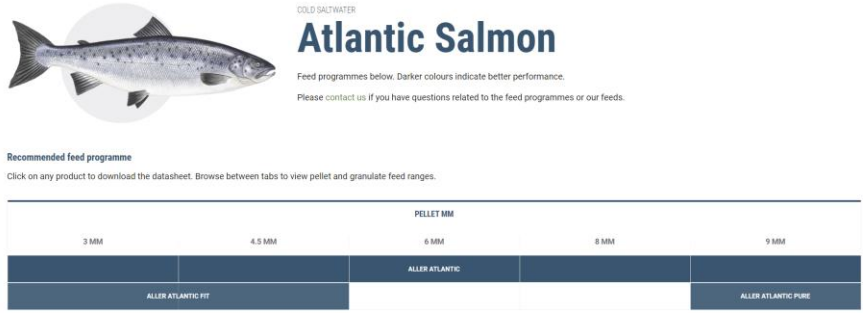
Salmon feed characteristics from the BioMar and AllerAqua feed structures:

1,Freshwater aquaculture pellet size from 1mm-10mm, mariculture pellet size from 3mm - 12mm

2,The protein content is higher by 40%-50%, the smaller the particles, the higher the protein content and the higher the animal protein content

3,High oil content > 20%

4,Carbohydrate content is around 10%-15%



ORBIT

BioMar 43853

ORBIT Intro+		SALMON	
Declaration		**2 mm**	**3 mm**
Crude protein	%	47-50	46-49
Crude lipid	%	24-27	24-27
Carbohydrates (NFE)	%	9,1-15,1	10,1-16,1
Crude cellulose	%	0,5-1,4	0,6-1,7
Ash	%	7-9	6,8-8,8
Total phosphorus (P)	%	1,6	1,5
Gross Energy	MJ/kg	22,6-24,6	22,6-24,6
BioMar's digestible energy*	MJ/kg	20,3	20,1
Classical digestible energy**	MJ/kg	21,5	21,5
Typical content of nitrogen (N)	%	7,8	7,6
Number of pellets per kg - indicative***		138000	48700

*BioMar digestible energy calculated on proteins, lipids and starch only
**Classical digestible energy calculated on proteins, lipids and NFE
***Figures are ± 10% depending on batches and based on available figures

Efico enviro

BioMar 44426

EFICO Enviro 940		SALMON				
Declaration		**3 mm**	**4,5 mm**	**6 mm**	**8 mm**	**10 mm**
Crude protein	%	44-47	44-47	38-41	37-40	37-40
Crude lipid	%	23-26	24-27	33-36	31-34	31-34
Carbohydrates (NFE)	%	12,2-18,2	11,4-17,4	10,7-16,7	13-19	13-19
Crude cellulose	%	1,2-3,2	1,8-3,8	1-3	0,7-2,2	0,7-2,2
Ash	%	6,8-8,8	6,4-8,4	5,3-7,3	4,5-6,5	4,5-6,5
Total phosphorus (P)	%	1,2	1,1	1,0	0,8	0,8
Gross Energy	MJ/kg	22,2-24,2	22,9-24,9	24,2-26,2	24,1-26,1	24,1-26,1
BioMar's digestible energy*	MJ/kg	19,2	19,8	21,0	21,0	21,0
Classical digestible energy**	MJ/kg	20,6	21,2	22,7	22,7	22,7
Typical content of nitrogen (N)	%	7,3	7,3	6,3	6,2	6,2
Number of pellets per kg - indicative***		48700	14800	6050	2600	700

*BioMar digestible energy calculated on proteins, lipids and starch only
**Classical digestible energy calculated on proteins, lipids and NFE
***Figures are ± 10% depending on batches and based on available figures

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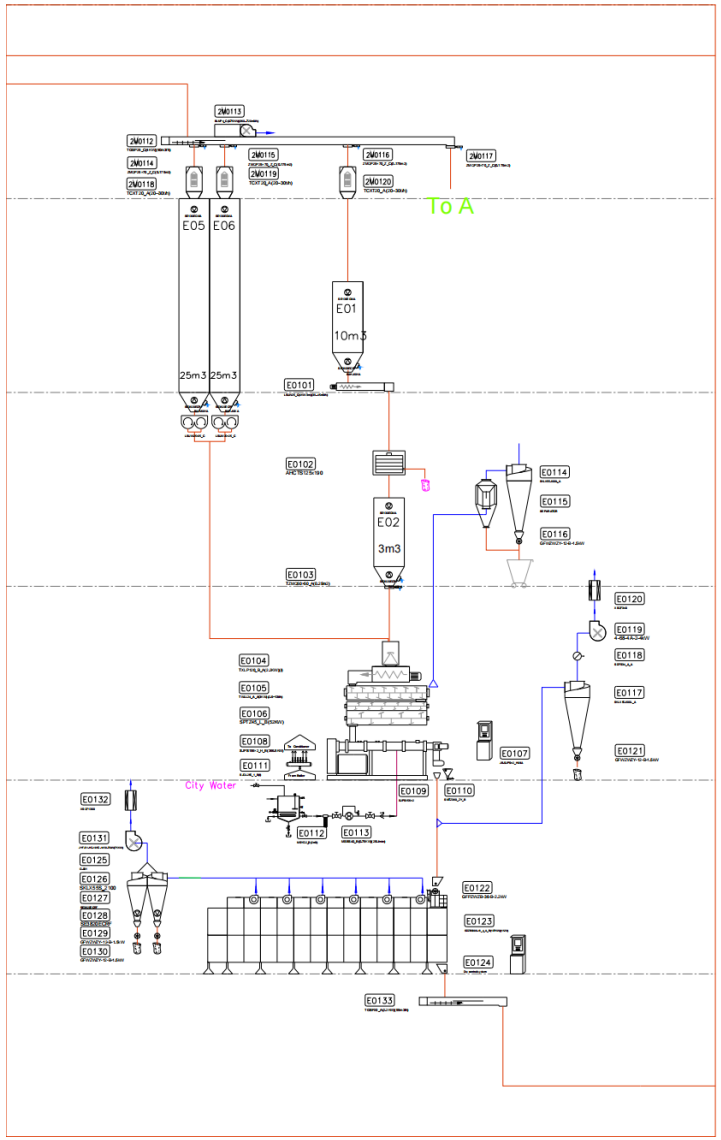
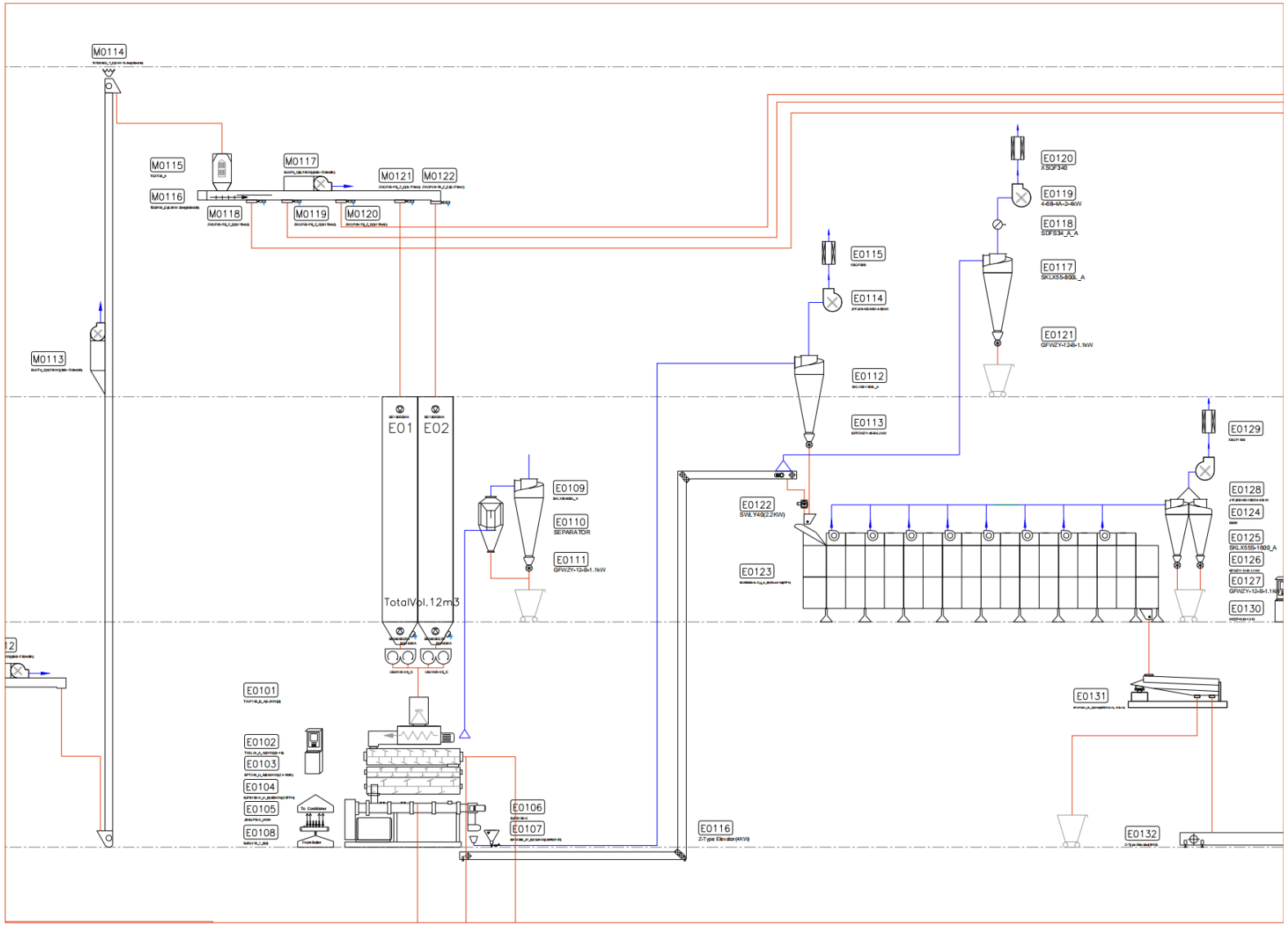
缔造系统价值

3. Key points of cold water fish feed processing

Extruding & Drying Section





Water resistance, anti-breakage solution - conditioning equipment

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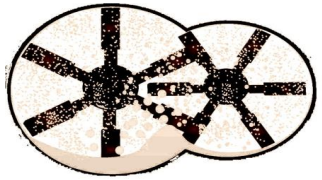
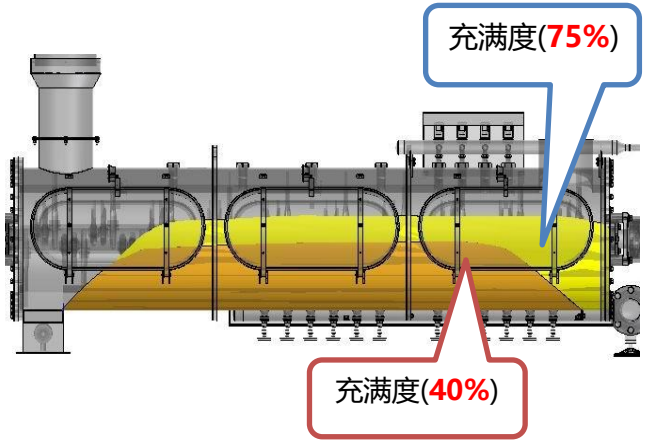
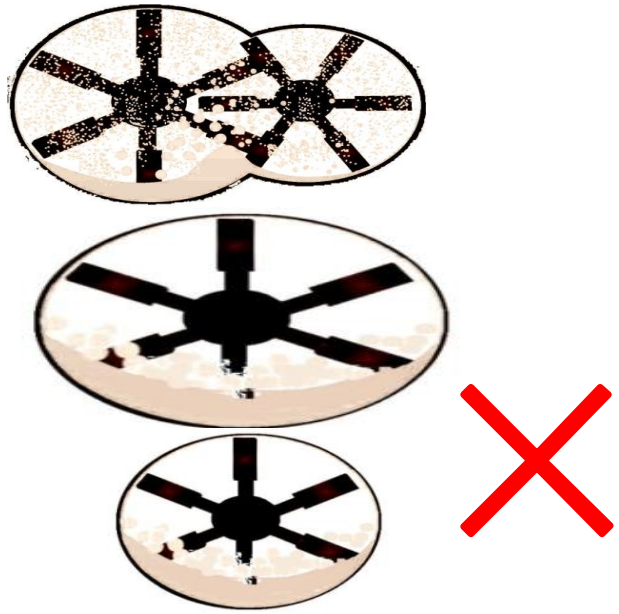
- Upper conditioner: If using DDC is a waste of resources, a low-cost uniaxial conditioner should be used
- Although DDC is mixed well, when it is placed on the first layer, the filling degree of the material cannot reach more than 70%, because the first layer conditioner needs to add water and steam. If the filling degree is too high, there will be no mixing space.

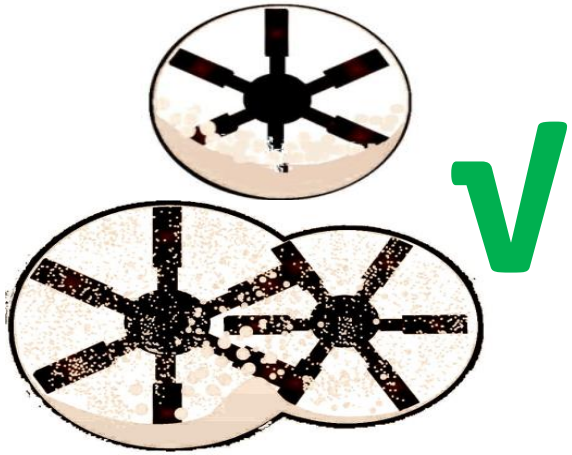




Therefore, water and steam are added to the DDC of the first layer. In order to ensure the mixing space, the filling degree of the material is only within 40%, which wastes the volume resources of the equipment.

The high-speed mixing uniaxial conditioner can also achieve good mixing and strong shearing effects;





Water resistance, anti-breakage solution - conditioning equipment

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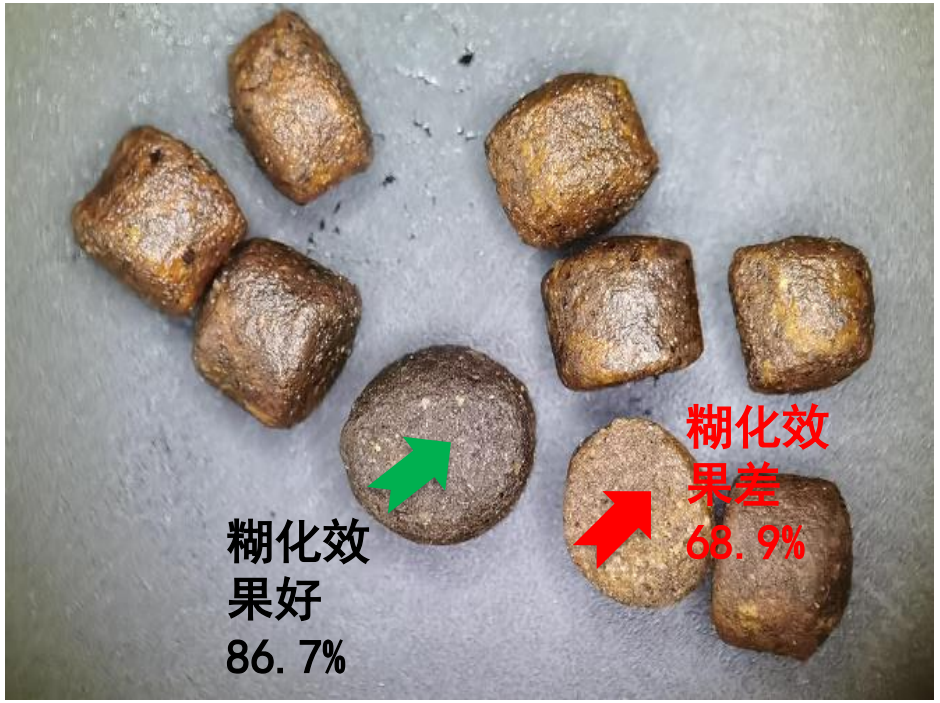
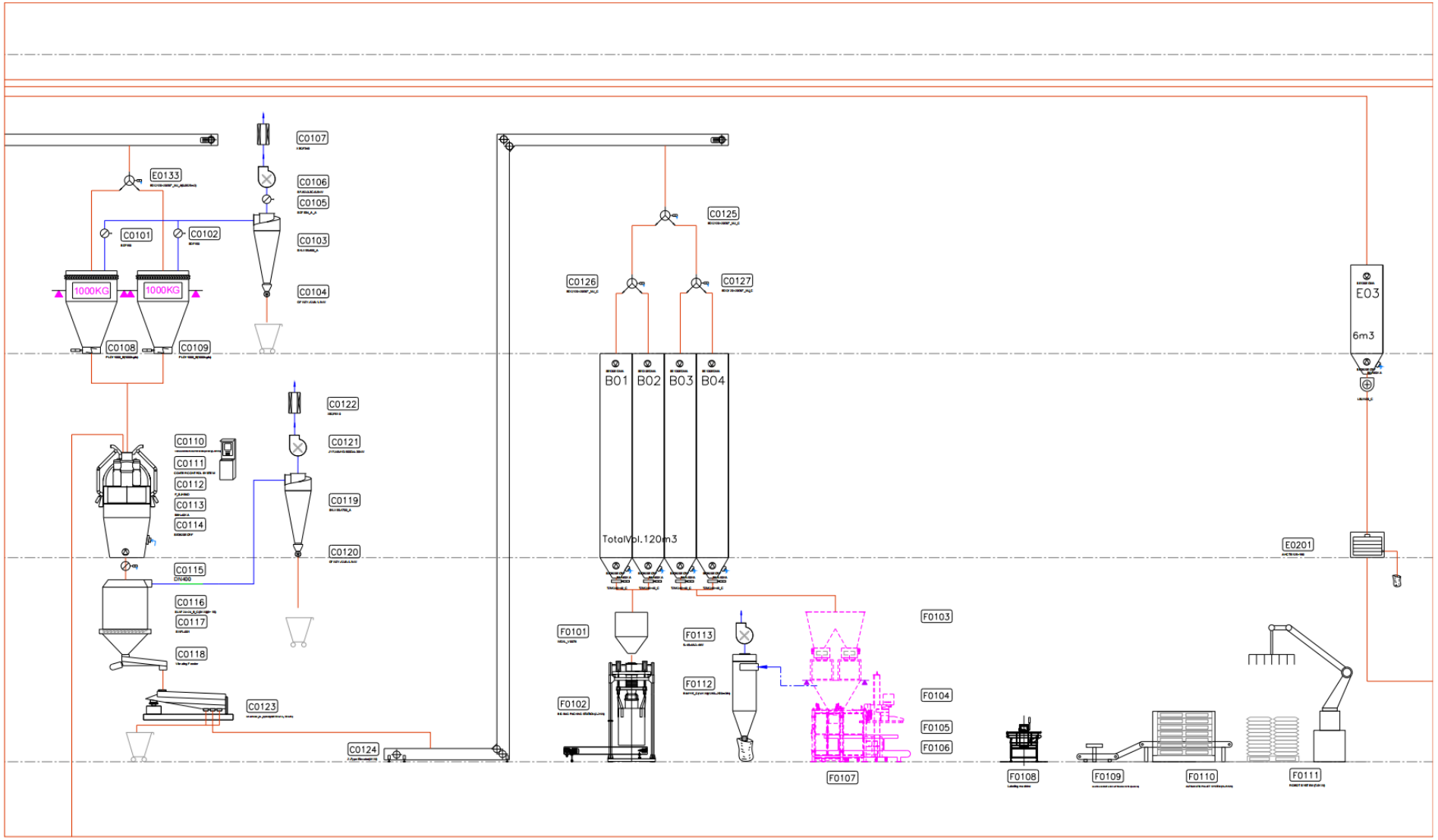
- Unevenly conditioned, water resistance failure rate of 24%

- Evenly conditioned, the water resistance failure rate of the finished product after soaking in water is 6%, and the water resistance quality index of the finished product is increased by 3 times



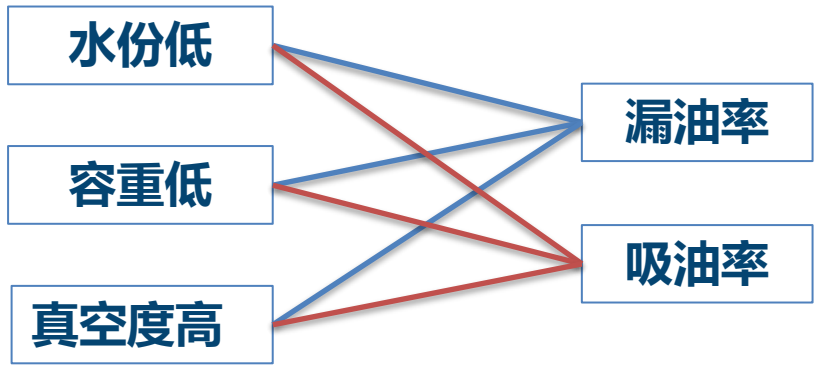
3. Key points of cold water fish feed processing

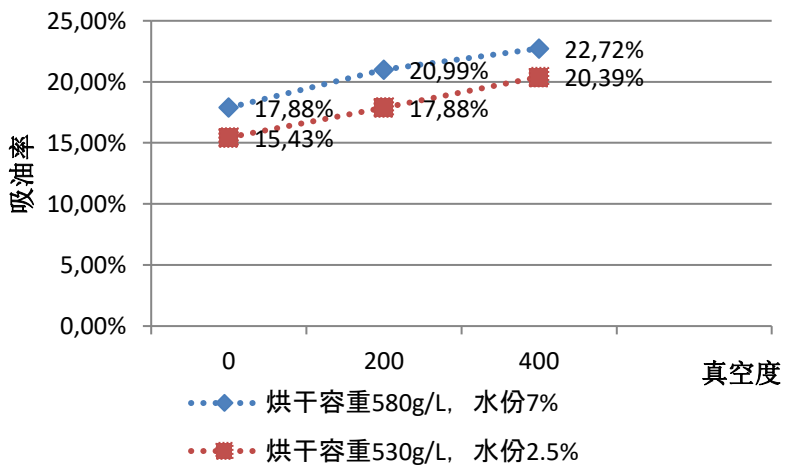
Coating & Packing Section

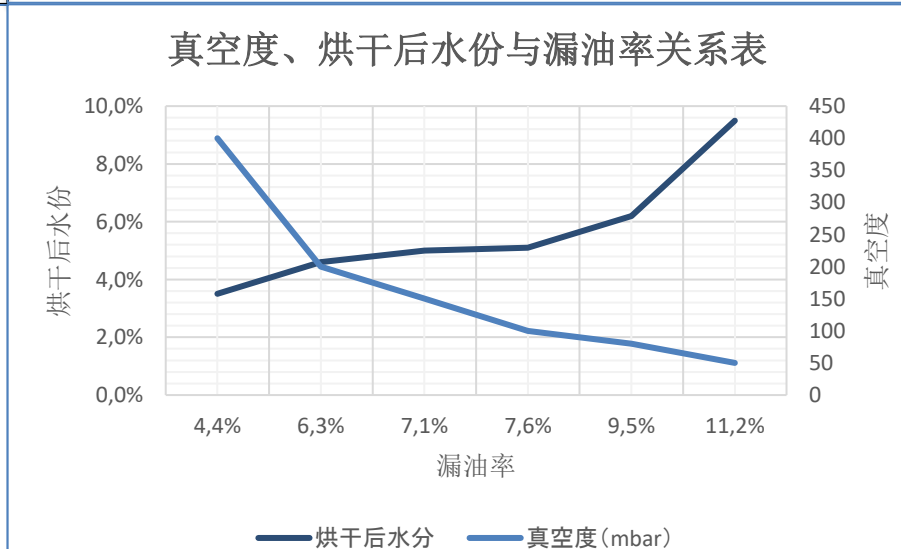


High grease spraying solution - focus of coating equipment

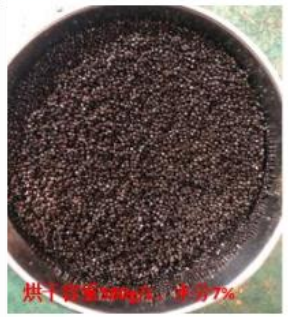
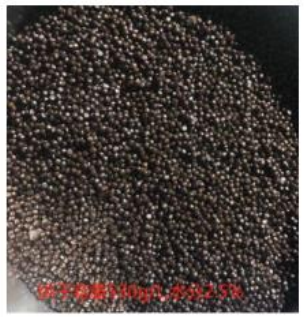
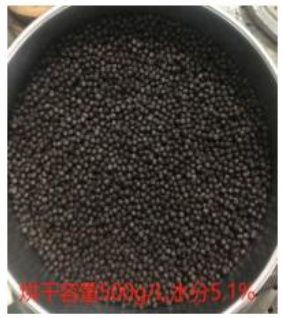
高油脂喷涂实验数据					
基本参数	实验批次	A	B	C	D
	膨化后容重g/L	609	546	528	566
	烘干后容重g/L	560	520	538	536
	烘干后水分	3.50%	6.20%	3.60%	6.50%
	批次量（kg）	152.3	122.5	146.85	142.65
	喷涂比例	**19%**	**19%**	**19%**	**19%**
喷涂机参数设置	真空度（mbar）	200	200	100	100
	抽真空时间（s）	80	80	120	120
	喷油时间（s）	70	80	80	80
	真空释放阀开度	70%	70%	100%	100%
	喷涂周期（s）	250	260	290	290
喷涂后物料参数	喷涂后容重g/L	654	640	653	682
	喷涂后漏油率	2.43%	10.08%	6.38%	8.85%
	残留质量（kg）	0.5			
	残留率	0.25%（按照批次质量200kg计算）			







High grease spraying solution - focus of coating equipment

型号	喷涂效果		喷涂参数
GZ83-ϕ3.0			油脂喷涂量21.5%， 每批600kg（干物料471kg） 真空度-850mbar， 进料时间20s， 抽真空时间70s， 喷油时间120s， 释放真空时间206s， 排料时间40s， 喷涂周期480s（包含各阶段系统判断反应时间）
GZ84-ϕ4.5			油脂喷涂量22%， 每批600kg（干物料468kg） 真空度-800mbar， 进料时间20s， 抽真空时间62s， 喷油时间140s， 释放真空时间156s， 排料时间40s， 喷涂周期450s（包含各阶段系统判断反应时间）

型号	喷涂效果		喷涂参数
GZ85-ϕ6.0			油脂喷涂量26%， 每批630kg（干物料466kg） 真空度-850mbar， 进料时间20s， 抽真空时间68s， 喷油时间125s， 释放真空时间140s， 排料时间40s， 喷涂周期405s（包含各阶段系统判断反应时间）
GZ86-ϕ8.0			油脂喷涂量24%， 每批700kg（干物料532kg） 真空度-850mbar， 进料时间20s， 抽真空时间68s， 喷油时间125s， 释放真空时间160s， 排料时间40s， 喷涂周期420s（包含各阶段系统判断反应时间）

➢ **When the material below Φ3.0 is sprayed with high grease (above 21.5%), the bulk density and moisture have a great influence on the spraying effect;**

➢ **The bulk density and water content of Φ3.0, Φ4.5 and Φ6.0 materials have obvious effects on spraying. The smaller the bulk density and the lower the moisture, the better the spraying effect.;**

➢ **The bulk density of Φ8.0 material and the influence of moisture are relatively small, the finished product has a bulk density of 688-700g/L, and the moisture content of 9% can still meet customer needs**

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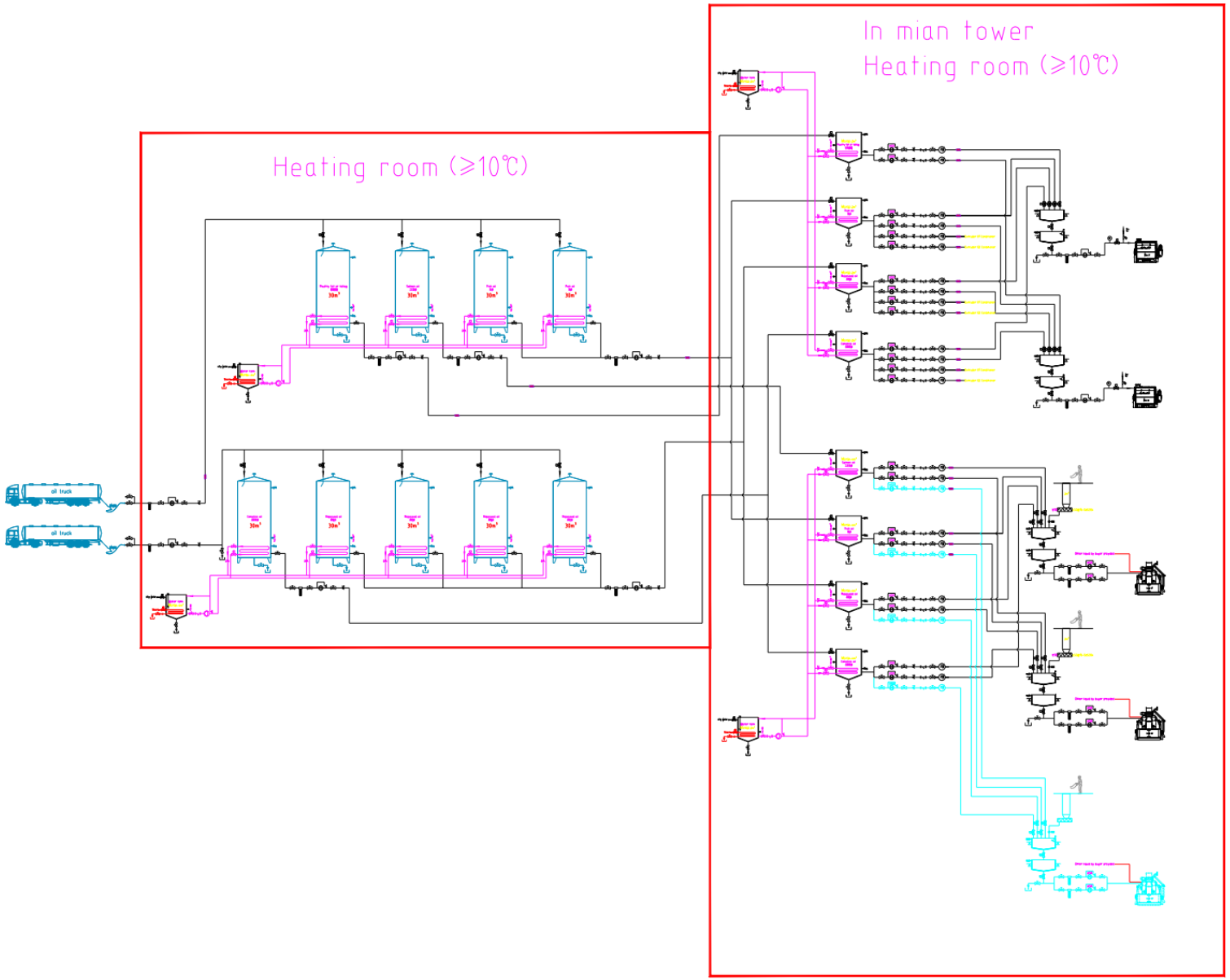
3. Key points of cold water fish feed processing

Liquid Adding Section



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3. Key points of cold water fish feed processing

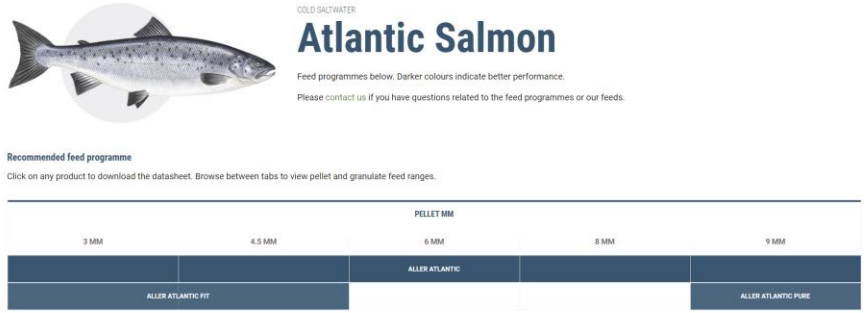
Salmon feed characteristics from the BioMar and AllerAqua feed structures:

1,Freshwater aquaculture pellet size from 1mm-10mm, mariculture pellet size from 3mm - 12mm

2,The protein content is higher by 40%-50%, the smaller the particles, the higher the protein content and the higher the animal protein content

3,High oil content > 20%

4,Carbohydrate content is around 10%-15%



ORBIT

43853

ORBIT Intro+		SALMON	
Declaration		**2 mm**	**3 mm**
Crude protein	%	47-50	46-49
Crude lipid	%	24-27	24-27
Carbohydrates (NFE)	%	9,1-15,1	10,1-16,1
Crude cellulose	%	0,5-1,4	0,6-1,7
Ash	%	7-9	6,8-8,8
Total phosphorus (P)	%	1,6	1,5
Gross Energy	MJ/kg	22,6-24,6	22,6-24,6
BioMar's digestible energy*	MJ/kg	20,3	20,1
Classical digestible energy**	MJ/kg	21,5	21,5
Typical content of nitrogen (N)	%	7,8	7,6
Number of pellets per kg - indicative***		138000	48700

*BioMar digestible energy calculated on proteins, lipids and starch only
**Classical digestible energy calculated on proteins, lipids and NFE
***Figures are ± 10% depending on batches and based on available figures

Efico enviro

44426

EFICO Enviro 940		SALMON				
Declaration		**3 mm**	**4,5 mm**	**6 mm**	**8 mm**	**10 mm**
Crude protein	%	44-47	44-47	38-41	37-40	37-40
Crude lipid	%	23-26	24-27	33-36	31-34	31-34
Carbohydrates (NFE)	%	12,2-18,2	11,4-17,4	10,7-16,7	13-19	13-19
Crude cellulose	%	1,2-3,2	1,8-3,8	1-3	0,7-2,2	0,7-2,2
Ash	%	6,8-8,8	6,4-8,4	5,3-7,3	4,5-6,5	4,5-6,5
Total phosphorus (P)	%	1,2	1,1	1,0	0,8	0,8
Gross Energy	MJ/kg	22,2-24,2	22,9-24,9	24,2-26,2	24,1-26,1	24,1-26,1
BioMar's digestible energy*	MJ/kg	19,2	19,8	21,0	21,0	21,0
Classical digestible energy**	MJ/kg	20,6	21,2	22,7	22,7	22,7
Typical content of nitrogen (N)	%	7,3	7,3	6,3	6,2	6,2
Number of pellets per kg - indicative***		48700	14800	6050	2600	700

*BioMar digestible energy calculated on proteins, lipids and starch only
**Classical digestible energy calculated on proteins, lipids and NFE
***Figures are ± 10% depending on batches and based on available figures

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缔造系统价值