



# **THE PEREZ-GUERRERO TRUST FUND FOR SOUTH-SOUTH COOPERATION**

## **FINAL REPORT**

### **Demonstration and Promotion of High-yield & High-quality Cultivation and Advanced Processing Technology of Spirulina in Developing Countries**

**Project Code:** INT/16/K06

**Name of submitting entity:** Fujian Provincial Science & Technology Exchange  
Center with Foreign Countries (FSTEC)

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## **I . Project Overview**

**1.Title of project:** Demonstration and Promotion of High-yield & High-quality Cultivation and Advanced Processing Technology of Spirulina in Developing Countries

**2.Abstract:** China possesses two of the four lakes in the world in which spirulina can grow naturally and has favorable research conditions for spirulina cultivation technology. With wide and further research and scientific experiments on spirulina in recent years, it proves that spirulina plays a positive role in decrease of cholesterol and blood fat, cancer resistance, nourishing stomach, liver protection and immunity enhancement. Therefore, with increasing exploitation and application of spirulina, its economic value is enhanced constantly. At present, many developing countries and regions have witnessed the trend for spirulina cultivation. However, the spirulina industry fails to develop effectively due to the limited economic and technological conditions. The project aims to share the experience and technology on high quality cultivation and advanced processing of spirulina with the developing countries, provide the advanced technology and train excellent talents for them so as to form spirulina industry with healthy development. Thus, the developing countries can not only improve the economic benefits through developing spirulina industry, but enhance the people's physical quality by consumption of spirulina on a large scale.

**3.Situation Analysis:** Spirulina, one of the first photosynthetic organisms on the earth, is the best natural protein food source discovered by human till now. According to scientific research and experiments at home and abroad, it proves that spirulina plays a positive role in decrease of cholesterol and blood fat, cancer resistance, weight loss, nourishing stomach, treatment of anemia and microelement deficiency, liver protection, immunity enhancement and adjusting metabolic function. It is recommended by United Nations Food and Agriculture Organization (FAO) as “the optimal food in the 21st century” and “the optimal nutrition source in the 21st century”.

Although the health care efficacy of spirulina has drawn extensive attention, the natural growing environment of spirulina is limited, which is mainly distributed in the Tchad Lake in Africa, Texcoco Lake in Mexico, Cheng Hai Lake (Lijiang, Yunnan) and Ha Matai Alkali Lake (Ordos, Inner Mongolia) in China. Therefore, artificial cultivation is needed to promote spirulina on a large scale. At present, Japan as well as other developed countries in Europe and America has witnessed quite mature spirulina cultivation and processing technologies, which not only brings good economic benefits, but improves the physical quality of their people. However, many developing countries are suffering from diseases and low physical quality, and the situation cannot be improved in the short run due to the limited economic and sanitary conditions. In terms of the nutrient value and health care efficacy of spirulina, if spirulina

cultivation and advanced processing technologies can be promoted in these developing countries, it can not only bring great economic benefits, but enhance people's physical quality effectively.

Nowadays, though the developing countries need to promote spirulina products on a large scale, the industry fails to develop effectively and promptly owing to the lagging cultivation and advanced processing technologies. Furthermore, it is costly to purchase the advanced spirulina cultivation and advanced processing technologies from the developed countries for it is beyond the affordability of many developing countries. Therefore, it requires the developing countries should make great efforts to work in close cooperation with mutual help, improve the spirulina cultivation and advanced processing technology for sustainable development.

China, as the largest developing country in the world, is always seeking for cooperation with Group of 77, endeavoring to help the developing countries within its capacity. What's more, with two of the four lakes suitable for natural growth of spirulina, China is endowed with the favorable research conditions for spirulina cultivation technologies. In recent years, with increasing research interest paid on spirulina, people have already had a fairly complete and exact theory basis of it. In addition, the cultivation and processing technology has improved by leaps and bounds, therefore, we are fully capable of offering technical assistance to the developing countries for their better economic benefits.

## **II. Implementation**

**1. Strategy:** On the basis of the economic benefits and health care efficacy of spirulina, it is very necessary to set spirulina cultivation and advanced processing industry as an important supplementary to the national agriculture. However, at present, most of the developing countries are incapable of developing and promoting spirulina industry widely due to their limited technologies which result in high cost but low output value in spirulina cultivation and advanced processing. Therefore, it is of great necessity to seek for a kind of efficient, independent and sustainable development pattern for spirulina industry and to promote it in developing countries that are in need. The project aims to summarize a series of spirulina cultivation technologies with high-yield, high-quality and sustainable development and advanced processing technology to improve the utilization rate of spirulina, and to demonstrate and promote them in many developing countries. The ultimate purpose is to develop spirulina industry into the one with low energy consumption and sustainable development, a competitive industry with increasing agricultural yield and farmer's income, and an emerging industry for improving people's physical quality in the developing countries.

**2. Implementation Phase:** The project can be divided into five phases, of which the first four phases need financial support from PEREZ-GUERRERO TRUST FUND within the scope of this project,

and the final phase aims to promote the spirulina industry in developing countries, and improve their economic benefits of agriculture as well as people's physical quality.

**Phase 1:** Organize the experts to survey and investigate the spirulina industry, which consists of two parts: 1) the current development of spirulina cultivation and advanced processing; 2) the distribution of spirulina industry and the geographic, climatic and other conditions of spirulina cultivation. Through the analysis of research results, experts summarize the method of improving the quantity and quality of spirulina cultivation and the utilization rate of advanced processing;

**Phase 2:** On the basis of the first phase, organize the seminar on the development of spirulina industry to share the cultivation, processing experience and advanced technology of spirulina with the relevant members of the developing countries; organize the exchange activity on spirulina health care and health maintenance culture to lay the foundation for promoting spirulina among the developing countries in the next phase.

**Phase 3:** According to the survey and exchange during the first two phases, a series of sustainable and efficient spirulina industry development pattern will be put forward, including the environment requirement and temperature control of spirulina cultivation in different regions, the processing method of spirulina diversification and high utilization etc. These patterns will be tested in China in advance and to

verify its feasibility in time.

**Phase 4:** Visit the developing countries involved in the project and have a field visit about the current development, geographic, climatic and other conditions of spirulina industry. Carry out demonstration cultivation in the local area according to the development pattern formed previously and provide comprehensive training for the local relevant staff about spirulina cultivation and advanced processing. Further improve the suitable development pattern in different areas through field cultivation, processing and market analysis.

**Phase 5:** Based on the four phases above, promote spirulina cultivation and processing in the developing countries, publicize the health care efficacy of spirulina and carry out further and deeper cooperation with developing countries to improve their agriculture economic benefits and benefit more people in developing countries.

### **3. Beneficiaries:**

**Direct beneficiary:** the direct participants from institutions, enterprises and departments involved in the project in each country. (Such as: the participants take part in surveys, seminars and trainings)

**Indirect beneficiary:** through the project, the practitioners from different countries involved in high-yield, high-quality cultivation and advanced processing technology for spirulina and the people from the participating countries who benefit from the spirulina health care project.

### **III. Project activities**

**Activity 1:** Seminar on Cultivation and Processing Technology and Industrialization of Spirulina

**Time:** 23-25 December, 2015

**Place:** Shunchang County, Fujian Province, China

**Participants:** More than 50 participants in spirulina industry and TCM field from 6 countries and regions

**Event:** The experts from Taiwan, Macau, Malaysia, Vietnam, Thailand and Fujian Province of China attended the seminar and delivered speeches respectively on topics of cultivation and processing technology of spirulina and industrialization of spirulina. The experts exchanged views on technology of space breeding, enriched minor elements of spirulina, membrane separation, polysaccharide extraction and detection and other application technologies for promotion of spirulina cultivation and processing level. In the meantime, the current situation and existing problems of spirulina industry development in different countries/ regions and latest development trend for spirulina industry were explored by the experts. After the seminar, the participants visited spirulina cultivation and processing base of Fujian Shenliu Health Food Company and provided on-site guidance.

**Effect:** The seminar as one of the activities of PGTF Project “The Demonstration and Promotion of High-yield & High-quality Cultivation



and Advanced Processing Technology of Spirulina in Developing Countries”, it was organized according to technology innovation and project promotion demand of the enterprise. The activity nearly reached the purpose of the project and achieved some effect. It not only provided guidance on technology innovation and industrial upgrading to the enterprise, but also brought new innovation and development concept to Shenliu Company and the developing countries in cooperation.

**Pictures:**



**Activity 2:** Participating the **UN Chinese Language Day** and Demonstration of Project Achievements and Technical Cooperation and Exchanges Activity in Vienna, Austria organized by FSTEC (the PGTF Project Team)

**Time:** 9-12 May, 2016

**Place:** Austria

**Participants:** More than 300 representatives including officials from the delegations of permanent missions to the United Nations in Vienna, UN officials, and relevant representatives from Vienna and China.

**Event:** Fujian Shenliu Health Food Company, the project member of PGTF project, was organized by Fujian Provincial Science and Technology Exchange Center (FSTEC) to attend the activity of **UN Chinese Language Day** and Demonstration of Project Achievements and Technical Cooperation and Exchanges in Vienna on 9-12 May, 2016.

**Main activities:**

**(1) Participation of the Opening Ceremony of UN Chinese Language Day**

The members of the project team participated the Opening Ceremony of UN Chinese Language Day. On behalf of the project team, Mr. Xie Xinci, the President of Fujian Shenliu Company, showed Chinese Calligraphy on the site with handwriting on ten-meter scroll paper while singing. Through the form of culture, the technical and project achievements were promoted.

## Pictures:



## (2) Meeting with Food and Agriculture Organization of the United Nations (FAO)

Director Zhang Yun and members of the project team had a meeting with Mr. Liang Qu, the representative of FAO. Through the meeting, the project team introduced 3 project achievements in spirulina breeding and deep processing, and the application in the rest part of China and other countries and regions. In the meantime, the project team expected their hope for more support from FAO to improve relevant technologies.

## Pictures:



### **(3) Meeting with the Promotion Association for Scientific and Technical Cooperation between Austria and China (PASCO)**

Director Zhang Yun and members of the project team met with the Chairman of the association, Dr. Fang Gangde and the other members from the association, and had a discussion on the issues for possible cooperation in the future. The Cooperation Memorandum for International Technology Transfer was signed between the two sides, PASCO and FSTEC.

#### **Pictures:**

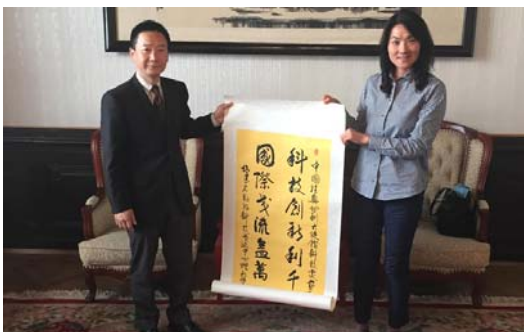


### **(4) Meeting with Department of Science and Technology of Chinese Embassy in Austria**

Director Zhang Yun and members of the project team went to the Chinese Embassy in Austria and had the meeting with Mr. Jiang Xiaowei, Counselor of Department of Science and Technology. Mr. Jiang made a general introduction of Austria with focus on the S&T development situation and competitive industries in Austria. Director Zhang hoped Mr. Jiang Xiaowei could recommend relevant local spirulina enterprises for

discussion and cooperation and invited them to attend the Projects Matching Activity of S&T Diplomats on 8 September in Xiamen, China.

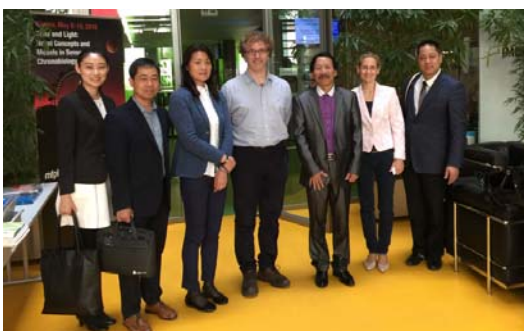
**Pictures:**



**(5) Visiting the Institute of Molecular Biotechnology of the Austria Academy of Sciences (IMBA)**

The members of the project team and Shenliu Company visited the IMBA and met the head of IMBA for a brief meeting. Through visit, the project members learned that the research institute was in a leading position in the field of molecular biotechnology research. Director Zhang expressed the hope that cooperation could be reached to apply molecular biotechnology to the field of spirulina cultivation.

**Pictures:**



## **(6) Meeting with LP Health Products GmbH**

The members of the project team and Shenliu Company had a meeting with Dr. Zhang Liqun, the CEO and Founder of LP Health Products GmbH. Through further discussion with Dr. Zhang, Shenliu expected technical guidance from Dr. Zhang and possible ways to explore the European market. LP is the company established in Austria for Lingzhi health products and Shenliu Company owns the cultivation, production and processing base of Lingzhi. Preliminary cooperation intention has been achieved between two sides.

### **Pictures:**

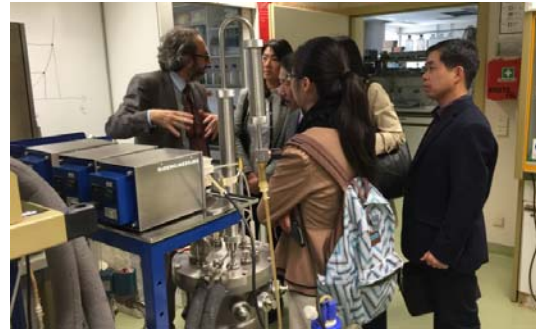


## **(7) Meeting with the Vienna Institute of Bio Technology (VIBT)**

The members of the project team and Shenliu Company had a meeting with the Vienna Institute of Bio Technology (VIBT) of BOKU University of Natural Resources and Life Sciences. They visited the lab of the institute and learned the breeding of trans-genetic plants and the equipments of the labs. After the visit, Shenliu Company had an in-depth discussion with Prof. Holubar of BOKU University. Shenliu introduced the general situation of their company with presentation of the company

profile, including the technology of cultivation, production, processing, R&D of spirulina and the equipments & instruments in the lab of Shenliu and the implementation progress of PGTF Project. Besides, the issues about R&D on spirulina were explored especially the topic on trans-genetic breeding of spirulina was discussed. The two sides will follow the progress of the issues discussed at this meeting to explore more R&D achievements.

**Pictures:**



**Effect:** Through this activity, for Fujian Shenliu Health Food Company, the preliminary cooperation intention between LP and Shenliu Company had been achieved and the cooperation with the VIBT of BOKU in the area of R&D on spirulina breeding was expected to be carried out. For the project team, through the meeting with FAO, Department of Science and Technology of Chinese Embassy in Austria and IMBA, more resources of project had been achieved and more possible cooperation areas was explored between Austria and Fujian Province. Further, the brand awareness of Shenliu Company had been promoted which could facilitate the implementation of the project in the future.

**Activity 3:** The 11<sup>th</sup> China International (Xiamen) Seafood Expo-2016  
Asia Pacific Aquaculture Expo

**Time:** 26 – 28 May, 2016

**Place:** Xiamen, China

**Participants:** More than 300 exhibiting companies from the United States, Japan, South Korea, Southeast Asia and Taiwan, Hong Kong and Macao

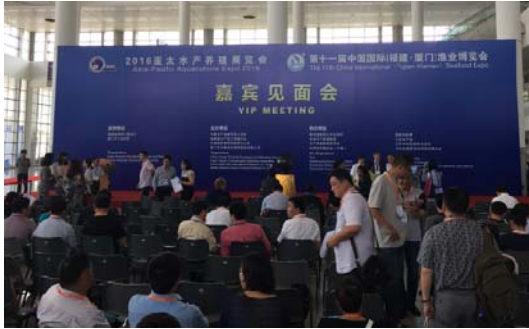
**Event:** On 26 – 28 May, 2016, Shenliu Company joined the 11<sup>th</sup> China International (Xiamen) Seafood Expo ·2016 Asia Pacific Aquaculture Expo in Xiamen which was held by China Aquatic Products Processing and Marketing Association and Fujian Provincial Aquatic Products Processing and Marketing Association. Shenliu Company invited the PGTF Project cooperation companies including the Angel life Co.,LTD., Hai-O Medicine Sdn Bhd , EnerGaia Co.,LTD. and cooperation companies in Africa.

**Effect:** Through the promotion activity, Shenliu Company exhibited and promoted the company's achievements and products in spirulina research in recent years. At the same time, it promoted the nutrition and health effects of spirulina, promoted consumers' awareness of spirulina, and enhanced the brand awareness of the company. At the same time, the event also promoted the further understanding and cooperation between Shenliu Company and its partners, and signed cooperation agreements



with many customers. It has laid a solid foundation for continuous implementation of the PGTF Project.

**Pictures:**



**Activity 4:** Training on learning the standard operating rules

**Time:** 28 December, 2016

**Place:** Shunchang County, Fujian Province, China

**Participants:** More than 60 employees from Shenliu Company and PGTF Project cooperation companies

**Event:** To further promote the implementation of PGTF Project, the technical training was organized for the employees of the project cooperation companies. The main topics were on precautions of GMP production, manufacturing instructions and standard operating rules.

**Effect:** Trough training, a unified scientific and technical norm and standardization operation was acquired by the employees, which allowed them to further understand the production process and the level of post operation and be more skillful in the production process. The activity was beneficial for the project participating countries to train technical backbones and promote development of spirulina industry in participating countries.

**Pictures:**



**Activity 5:** The 12<sup>th</sup> China (Fuzhou) International Fisheries Expo-2017  
Asia Pacific Aquaculture Expo

**Time:** 30 June - 2 July, 2017

**Place:** Fuzhou, Fujian Province, China

**Participants:** 528 associations and companies from 33 countries and regions

**Event:** Shenliu Company invited the project cooperation companies to participate in the 12<sup>th</sup> China (Fuzhou) International Fisheries Expo-2017 Asia Pacific Aquaculture Expo held in Fuzhou on 30 June - 2 July, 2017. The Expo was hosted by Fujian Provincial Department of Ocean and Fisheries, Taiwan Affairs Office of the Fujian Provincial People's Government, Fuzhou Municipal People's Government. Integrated with S&T seminar, culture exchange, exhibition, industrial finance cooperation, negotiation and goods order, the Expo is an important platform for trade activities and international fisheries exchange and cooperation of Fuzhou fishery industry, which plays an important role in motivating the world fishery trade and Fujian Provincial ocean and fishery career.

**Effect:** Through exhibition, more than 30 spirulina S&T products of Fujian Shenliu Health Food Company were displayed and also the R&D achievements of spirulina in recent years were demonstrated and promoted. Moreover, nutrition and health care efficacy of spirulina was disseminated, which was helpful for the consumers to know more about

spirulina. With successful implementation of this activity, the brand of Shenliu and the level of R&D in spirulina industry were more widely accepted and some cooperation agreements were also signed.

**Pictures:**



**Activity 6:** Training on spirulina cultivation and deep processing for management personnel

**Time:** 31 July, 2017

**Place:** Wuyishan City, Fujian Province, China

**Participants:** More than 20 management personnel from Shenliu Company and PGTF Project cooperation Companies

**Event:** In order to further strengthen the management of spirulina industry in the participating countries, the management personnel of the project cooperation companies were organized to carry out training on spirulina cultivation and deep processing industry management

**Effect:** Through training, the scientific and standardized management of all aspects of spirulina industry of the management personnel were strengthened. It facilitated the countries to develop and expand spirulina industry, and gradually produce good economic benefits.

**Pictures:**



**Activity 7:** The training on Standard on Spirulina Breeding Technology

**Time:** 20 Aug. 2017

**Place:** Shunchang County, Fujian Province, China

**Participants:** more than 60 technical staff from Shenliu Company and PGTF Project cooperation companies

**Event:** In order to further strengthen the level of spirulina cultivation in the participating countries, the technical staff of the project cooperation companies was organized to carry out training on Standard on Spirulina Breeding Technology. The main content of the training included “Preparation of Spirulina Nutrient Solution”, “Pest and Disease Control” and “Standard Specification for Harvesting”. The training was hosted by the President of Shenliu Company, Mr. Xie Xinci. He interpreted the “Standard on Spirulina Breeding Technology”. The experts from the Agricultural Bureau in Shunchang County were invited by Shenliu Company to provide the training courses to the technical staff of the project cooperation companies in the form of theory lecture as well as guidance on the practical operation. During the Q&A part, the experts answered the trainees’ questions and exchanged views with them, and the trainees were actively discussed on the problems and invited the experts to the production base for on-site demonstration.

**Effect:** Through this training, the technical staff mastered the basic technology of spirulina cultivation, and it is beneficial for them to apply

the acquired knowledge to the actual production in the future to improve spirulina cultivation level.

**Pictures:**



**Activity 8: Marketing Training Program for Sales Team**

**Time:** 22 Sept. 2017

**Place:** Wuyishan City, Fujian Province, China

**Participants:** More than 20 sales staff from Shenliu Company and the PGTF Project cooperation companies

**Event:** In order to strengthen the team effectiveness of the sales teams in project participating countries, to improve sales performance and promote the development of spirulina industry, the sales staff of project cooperation companies was organized to carry out intensive training to improve the construction of all aspects of spirulina industry in the project participating countries.

**Training content:**

- (1) To figure out the role and duty of the leader of the marketing team;
- (2) To learn the management by objectives and effectively design and separate the marketing objectives for the marketing team;
- (3) To establish a reasonable incentive mechanism;
- (4) To learn key skills of construction of marketing team;

**Effect:** Through this training, the sales staff effectively mastered the sales skills, effectively motivated the sales staff's ambition, encouraged the team morale, and improved the comprehensive level of the marketing team.



**Pictures:**



#### IV. Activities costs

Activities costs of this project were strictly based on the financial budget. FSTEC referred specialized accountants to manage the economic evaluation and review for this project. Project leaders were also responsible for monitoring of cost for each activities regarding to the project and required for submission of periodical report to the Director General of FSTEC for processing and stage of the project. Details are shown below:

<b>No.</b>	<b>Items</b>	<b>PGTF Fund</b>	<b>Xianzhilou Fund</b>	<b>Total</b>
1	International travel	8,200 USD	80,000 USD	88,200 USD
2	International consultants	9,000 USD	31,000 USD	40,000 USD
3	Training workshop	4,100 USD	23,000 USD	27,100 USD
4	Seminar	3,600 USD	21,000 USD	24,600 USD
5	Domestic travels	1,000 USD	5,500 USD	6,500 USD
6	Equipment	4,100 USD	9,500 USD	13,600 USD
	Total	30,000 USD	170,000 USD	200,000 USD

Therein, the unpaid 10% remaining fund of PGTF amounting to 3000 US dollars has been paid by the project implementation agency in advance.

## **V. Project management arrangements**

### **1.Management arrangements.**

Fujian Provincial Science & Technology Exchange Center with Foreign Countries (FSTEC) will be responsible for overall management of the project. The project will be implemented by FSTEC. FSTEC will appoint a project coordinator who will report to it. All project staff will be appointed by FSTEC and will not hold UNDP contracts. The UNDP Country Office will, on request by SU-TCDC, release an advance equivalent to 90 % of budget resources after project approval. FSTEC will produce a report to be submitted to the UNDP Country Office and forwarded to SU-TCDC. SU-TCDC will recommend release of the remaining 10% of the budget by the Country Office. The role of the Country Office will be to facilitate signature of project document, disbursement of 90 % of resources, forwarding the report to SU-TCDC and disbursing the final 10 % of project funds.

### **2.Execution Arrangements.**

The project will be executed under the National Execution modality (NEX) with Fujian Provincial Science & Technology Exchange Center with Foreign Countries as Executing Agent.

### **3.Monitoring and evaluation; lessons learned.**

Progress monitoring will be done by China International Center for

Economic and Technical Exchange, Ministry of Commerce. However, any staff from the UNDP or Perez-Guerrero Trust Fund may undertake monitoring activities in line with managerial roles above. The project may be audited by the Perez-Guerrero Trust Fund. The lessons learned will be written into a report after the project has been implemented.