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SEPULVEDA Y CIA. LTDA.

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Parlamento de Tapihue 79 Villa San Pedro Concepción

Final Report

of the proyect

"CLEAN TECHNOLOGY IN THE FISHERIES INDUSTRY"

Proyect No. : US/CHI/93/120
Purchase Order No. 15-6-1205
Activity Code No. : 0720A0

CONTRACT No. 97/ 053

Contents

1.- Introduction

2.- Objectives

3.- Methodology

4.- Result

5.-Reference

1.- INTRODUCTION

The final report of "Partial modification in the pilot plant piping of anaerobic digestion of liquid residuals in the fishing industry". Contract N° 97/ 053 is presented.

One of the activities of the Project "Primary Treatment of Water Discharge of the Liquid Effluents of the Fishing Procesing Industry" (US Project/ CHI/ 90/ 284), is the operation and start-up of a pilot plant of anaerobic treatment, for waste water treatment fishing meal process Some of the activities of the putting into, it is to carry out hydraulic tests to the system in operation. In these tests it operate with water,so it is observed the possible presence of flights in the lines and equipements. The discharge and recycle operation flow was measured.
The start-up of the anaerobic stage of the pilot plant has considered modifications in the original design of the plant, exposed in the technical report (Annex A) of the Dr. Adalberto Noyola (1)

2.- OBJECTIVES

The general objective of the carried out work permited an operation but simplified of the anaerobic system, for this purpose the following modifications are planned:

- operate the reactor in atmospheric pressure.
- avoid the accumulation of liquid in the top of the reactor.
- increase the rate of elimination of the gases emitted by the reactor.
- autonomy of the pilot plant in respect to the fishing process.

3.- METHODOLOGY

The activities carried out by the SEPULVEDA Y CIA., LTDA in the anaerobic stage of the pilot plant are the following ones:

1. Modify the recycling line of the anaerobic reactor.
2. Modify the reactor discharge .
3. Modify the gases line in the top of the reactor.
4. Install a water supply for the pilot plant.

In each one of these activities, the contractor company carried out the purchase of the needed materials. It was considered a 5 days term for the total execution of the work. The manual labor utilized by the SEPCOM and CIA. LTDA. company correspond to specialized personnel in carrying out welds in stainless steel.

During the realization of the work, the personnel of the University of Conception carried out two visits to land:

- Initiate the work.
- Finishes of the work.

4.- RESULTS

In the following table the results of the carried out work are presented.

Table N°1

Activity	Resulted
Modify the recycling line of the anaerobic reactor.	It was installed a new 3 m long piping (1"diameter) from the discharge of the reactor to the tank T-105.
Modify the line of the current of discharge of the reactor.	It was installed a new 12 m long stainless steel piping (1"diameter), from the discharge of the reactor to the tank T-103.
Modify the gases elimination line in the top of the reactor.	It was installed a new stainless steel piping (1" diameter) for the gases elimination.
Carry out the installation of a of drinkable water supply for the pilot plant.	It was installed a 4 m long piping (diameter 1/ 2,") that connected the water supply from the canned plant to the pilot plant.

In the following table the result of the two visits to land, done during the execution of the works in pilot plant, are presented.

Table N°2

N° Visits	Difference with him solicited	Carried out activity
First (3 days after beginning the work)	1. A control valve is missing in the circuit. 2. The manual valve wasn´t installed in the gases line pipping.	The corresponding corrections were solicited.
Second (concluded the work)	Any	Hydraulic test to the new pipes.

Flights were found when the hydraulic test were done and it was solicited the corresponding correction, what was done after a week..

5.- REFERENCES

1. Noyola, A., "Technical Report" Expert mission to the research on clean technologies for the fishing industry, Universidad de Concepción, Chile, (1997)

ANEXO A

January 7, 1997

TECHNICAL REPORT

EXPERT MISSION TO THE RESEARCH GROUP ON CLEAN TECHNOLOGIES FOR THE FISHING INDUSTRY, UNIVERSIDAD DE CONCEPCION, CHILE (US/CHI/93/120)

Mission expert: Dr. Adalberto Noyola
Institute of Engineering
National University o f Mexico (UNAM)
(96-1142/HH)

Period: 10 to 20 December 1996

Content

I INTRODUCTION

II ACTIVITIES

A. Laboratory level
B. Pilot level
Inoculum
Pilot plant design and construction
Start up, operation and control
Technology transfer

III CONCLUSIONS

ANNEX: Recommendations on the design of the pilot plant for effluent treatment from the fishing industry (in Spanish)

I INTRODUCTION

The research group on cleaner technologies in the fishing industry of the Department of Chemical Engineering, Universidad de Concepción, Chile has been working for several years with the local industry.

This group has a research contract with ONUDI (US/CHI/93/120) for the 1994-1998 period. One of the main activities of this project is to design, built and operate a pilot plant in a fishing industry. This is a very important task for the project, as one of the objectives of the pilot plant is to demonstrate, in a suitable size, the feasibility of the wastewater treatment process to the local fishing industries.

The research group has a limited experience in pilot plant design and operation, so an expert mission on that subject was necessary, under the scope of the ONUDI project.

This report is written in order to describe the activities performed during the mission (10 to 20 December 1995) under the terms of the Contract of Special Services (E666600, PPRB/APP/No 96-1142/HH).

The objectives of the expert mission were:

- To discuss with the group the experimental results already obtained as well as research strategies for the rest of the project.
- To revise the process design and basic engineering of the wastewater treatment pilot plant.
- To propose start up procedures as well as operation and control strategies for the pilot plant.

The above objectives were attained during the mission.

II ACTIVITIES

The mission started with a general visit to the different laboratories involved in the ONUDI project, as well as with related research groups (forestry industry, fuels from carbon). A meeting with the Dean of the Faculty of Engineering also took place.

As a parallel activity, a short course of 6 hours was given to graduate and undergraduate students of the Department of Chemical Engineering. The subject was Anaerobic Treatment of Industrial Wastewaters.

A. Laboratory level

The discussion of research activities took place according with a program of meetings prepared by the Project Director (Marlene Roeckel).

A critical review of drafts of two papers written by two graduate students was done. Most of the experimental results obtained by the research group are relevant and should be published in international journals. The Project Director is encouraging the graduate students of the research group in this activity. In this context, discussion of the manuscript with other researchers not directly linked with the group is highly beneficial.

Thorough discussions of the revised papers were done with the participation of the main authors (the students), the Project Director and the mission expert. Several corrections and additions were identified, in order to improve the scientific level of the manuscript. Some suggestions were also made about the more suitable journals for submission.

Another activity was the definition of the research program of a doctoral student on denitrification of pretreated wastewater of the fishing industry. This subject is an important step on the integration of the treatment process, as nitrogen removal should be accomplished, according to the expected effluent standards in Chile.

The research group has a limited experience in wastewater denitrification. The discussion was focused to identify the critical parameters in denitrification, according with the specific wastewater (very high salinity, high nitrate content, low COD content) and to sketch the research program, with the different experiments to be carried out.

B. Pilot plant level

Most of the time of the mission was spent in discussing aspects related to the pilot plant, from the experimental results obtained during the preparation of the inoculum to the strategies of operation and control of the process.

Inoculum. A description of the procedure for inoculum selection and aclimation was presented by the research group, both at laboratory and pilot scale. As a result, a discussion on the adaptation made from the original lab-scale procedure to the pilot scale was done. Several recommendations were proposed in order to increase the aclimation of the biomass to the raw effluent and to shorten this period. Also, indications were given for the seeding of the anaerobic reactor and the strategies of start-up and loading increases. This subject was thoroughly revised, considering its importance to the success of the pilot plant.

Pilot plant design and construction. The process flow sheet and the pipe and instrumentation diagram were carefully revised and discussed. Suggestions were made in order to simplify feeding control to the plant.

The visit to the pilot plant located in a fishing industry (Compañía Pesquera San Pedro, in Coronel) was very useful, as some problems were identified and suggestions to solve them were made.

In general, the pilot plants as been well design and built, with high quality materials and instruments. The arrangement in a container frame will allow its easy transportation to new locations when necessary.

The main problems were found in the hydraulic design and final arrangement of some tanks. In particular, the evacuation of the anaerobic reactor was not well solved, as a high pressure drop developed, due to the small diameter of the pipes (0.5 inches).

The list of recommendation for a better operation of the pilot plant can be found in the annex (in Spanish). This document was discuss in detail, in order to answer to any doubt or to find additional ways to overcome the design problems.

Start up, operation and control. As already mentioned, indications and suggestions were made for the seeding and start-up of the anaerobic reactor. This discussion was very fruitful, as the group only had experience on laboratory reactors.

Recommendations were given to stablish the start-up and control strategies for the reactor. The main parameter to monitor is the alkalinity ratio, for its easy and cheap determination, both at lab and pilot scale.

Also, practical recommendations were done for the logistic support to the operation of the pilot plant. Operation personnel profiles were identified, with a specific suggestion to write detailed operation manual for the plant.

Technology transfer. Finally, a meeting was held with an academic group of the Universidad de Concepción that is working in setting the ways to transfer technology from the University to the users. This is of particular importance for the research project, as its success will be measured in a good extent with the acceptance and applications of the results in the fishing industries. The experience of the mission expert were presented and discussed, trying to find similarities between Mexico and Chile, in order to anticipate the trends in the Chilean environmental market.

III CONCLUSIONS

The research group on cleaner technologies for the fishing industry from the Universidad de Concepción is well integrated, with clear objectives on research and technology development. In this context, the good relationship with the fishing industry is of great importance, and should be increased.

The research activities at laboratory scale are well integrated and focused to the project objectives. The existing links with other research groups, both in Chile and in other countries, should be encouraged, particularly in those subjects where limited experience has been obtained to date (denitrification, pilot plant design and operation, technology transfer).

A special attention should be put on the operation of the pilot plant. The distance to the laboratory and the limited technical support from the fishing industry should be seriously considered when establishing the responsibilities of each member of the operation group. All the economic and technical support should be assured to this activity, as a good pilot plant may fail for "minor" logistic and operations details.

Finally, a strategy has to be set out for approaching the fishing industries in order to transfer the technology developed by the group, with a well documented package, technical support and intellectual property protected.

A N E X O

RECOMENDACIONES SOBRE EL DISEÑO DE LA PLANTA PILOTO DE TRATAMIENTO DE EFLUENTES DE LA INDUSTRIA PESQUERA

- Sistema de control de flujos (alimentación, recirculación, evacuación) relativamente complicado debido a la presurización de la salida del reactor anaerobio. Dificultad en mantener presión interna constante con variación en la producción de gas.

R: Simplificar diseño (ver esquema)

- El diseño de la parte superior del filtro anaerobio es atípico. Normalmente no se construyen filtros anaerobios con separadores gas-líquido sólido, propios de reactores tipo UASB. Con ello, se tiene un vertedor perimetral, que debería operar no ahogado. Sin embargo, el diseño de la evacuación del líquido hacia un tanque cerrado y la presurización de la atmósfera del reactor hacen muy incierta la operación adecuada del vertedor.

R: Operar el reactor a presión atmosférica en la zona del vertedor mediante la apertura de la válvula existente. Hacer el arreglo del esquema anexo.

- Tuberías en mayoría de diámetro 0.5 pulg. Si bien pueden cumplir con las condiciones recomendadas para velocidades de flujo en tuberías, la naturaleza del agua y la variabilidad de caudales que se aplicarán, hacen secundario a ese criterio de diseño. Ese diámetro se considera pequeño para una planta piloto de tales dimensiones.

  En relación a esto, se identificó un problema de resistencia al flujo por pérdida de carga en la tubería de 0.5 pulg que comunica el tanque sello a la salida del reactor anaerobio, con el tanque de mezcla alimentación-recirculación (T-105). Este hecho provocó que el agua alimentada al reactor fuera en parte evacuada por la tubería de salida del gas.

R: Ampliar tubería indicada, a diámetro 1 pulgada o modificar el arreglo de evacuación de agua del reactor anaerobio de acuerdo con esquema anexo.

- Evitar todo riesgo de taponamiento en intercambiador de calor y en sistema distribuidor de flujo en la base del reactor anaerobio.

R: Introducir un tamiz de alrededor 1 mm, en lo posible al inicio de las líneas de succión de las bombas de alimentación y recirculación.

- Evitar pérdidas de calor en las tuberías que llegan al intercambiador y salen de él.

R: Aislar térmicamente esas líneas.

- Se debe evitar el incremento de la temperatura en el reactor más allá de 40°C.

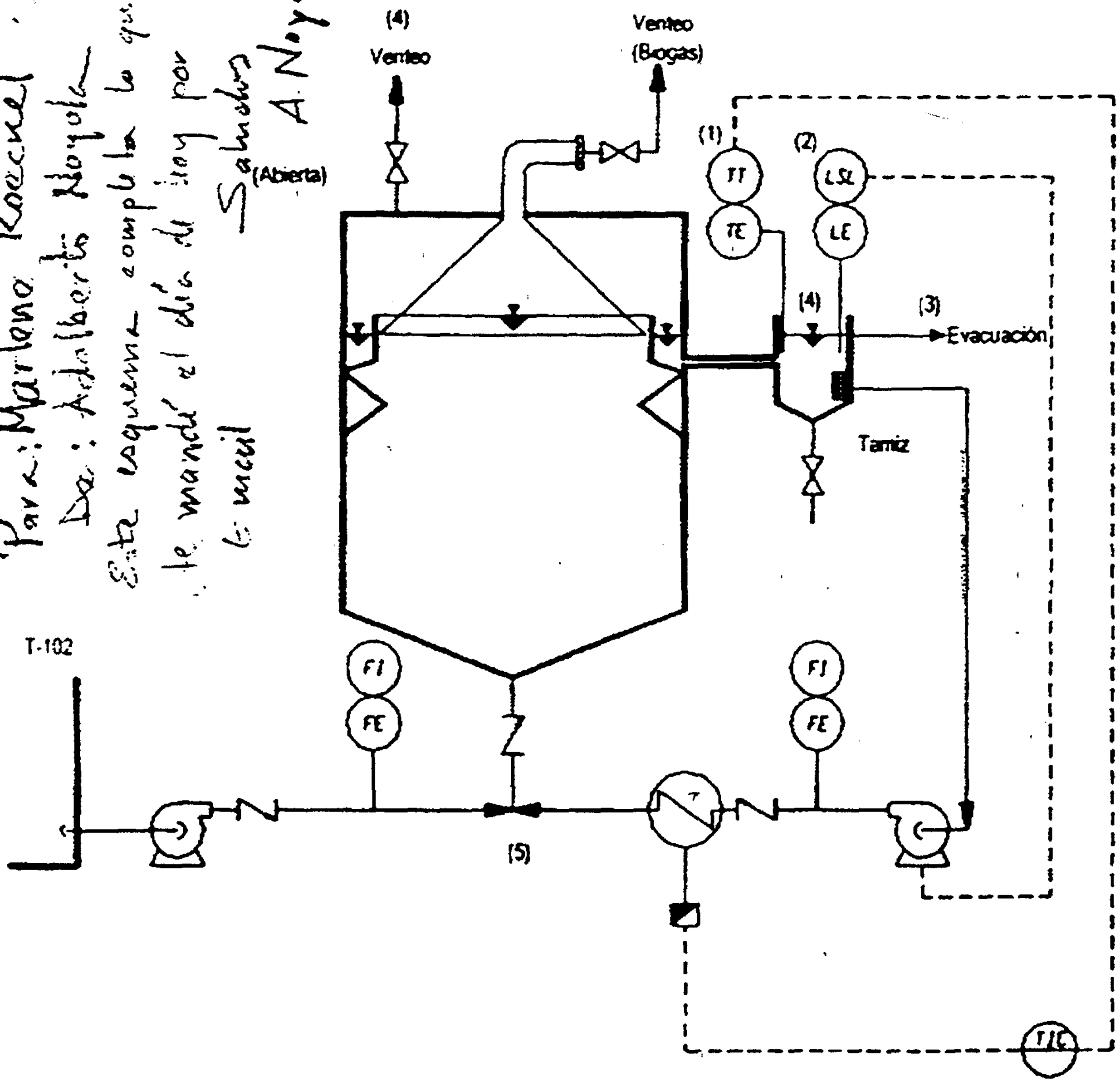
R: Introducir control apropiado. Un sensor de temperatura en el reactor asociado con el interruptor eléctrico del calefactor sería lo más simple. En el esquema se propone ubicar el sensor en el tanque de salida.

- El diámetro de la tubería de evacuación de gas del reactor está excedido considerablemente. Es posible reducirlo con el fin de instalar una válvula de menor costo, ¾ a 1 pulgada, en PVC, por ejemplo.

R: Modificar de acuerdo con esquema anexo

- La operación del reactor con la zona de evacuación abierta a la atmósfera puede provocar el crecimiento de bacterias oxidadoras de sulfuros a azufre elemental en la interfase líquido-atmósfera, debido a la presencia de oxígeno del aire. Otra posibilidad es la generación de condiciones corrosivas por bacterias oxidadoras de sulfuro a sulfatos. Es recomendable evitar esto y para ello se debe asegurar el sello hidráulico indicado en el esquema por medio del tanque de evacuación. El venteo de la zona de decantación se debe dirigir por medio de una manguera a un recipiente con agua, de manera que descargue siempre bajo un tirante de agua (tirante semejante al de evacuación).

Para: Marlene Roeckel
Da: Adalberto Noyola
Este esquema completa lo que te mandé el día de hoy por e-mail
Saludos
A. Noyola



NOTAS:

1. Control de temperatura para paro de calentador.
2. Control de nivel (paro bomba recirculación).
3. Observar si el diámetro de 0.5" es suficiente para la correcta evacuación del efluente
4. Para fines de control de olores, eventualmente cubrir tanque salida anaerobio y sustraer su fase gaseosa, unida a la del venteo de la zona de vertedero del reactor y conducirla con un soplador al sistema control de olores.
5. Eventualmente introducir en este punto el T-105 pero totalmente cerrado a la atmósfera (fines de mezclado y muestreo)

TT Transmisor de temperatura
TE Elemento de medición de temperatura
TIC Indicador controlador de temperatura
LE Elemento de medición de nivel
LSL Interruptor de nivel
FE Elemento de medición de flujo
FIC Indicador de flujo

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Final Report

of the project

"CLEAN TECHNOLOGY IN THE FISHERIES INDUSTRY"

Project No. : US/CHI/93/120
Purchase Order No. 15-7-1053X
Activity Code No. : 0720A0

CONTRACT No. 97/ 053

Contenido

1.- Introducción

2.- Objetivos

3.- Metodología

4.- Resultados

5.- Bibliografía

1.- INTRODUCCIÓN

Se presenta el reporte final la actividad de "Modificación parcial de cañerías en planta piloto de digestión anaeróbica de residuos líquidos de la industria pesquera". Contrato N° 97/ 053

Una de las actividades del Proyecto "Tratamiento Primario de las Aguas de Descarga de los Efluentes Líquidos de la Industria Procesadora de Pescado" (*Proyecto US/CHI/90/284*), es la operación y puesta en marcha de una planta piloto de tratamiento anaeróbico, para vertidos pesqueros. Parte de las actividades de puesta en marcha, es realizar pruebas hidráulicas al sistema en operación. En estas pruebas se opera con agua se observa la posible presencia de fugas en las líneas y equipos, se mide el caudal de operación en las corrientes de alimentación, descarga y reciclo del sistema.
La puesta en operación de la etapa anaeróbica de la planta piloto, ha considerado modificaciones en el diseño original de la planta, expuestas en el reporte técnico (Anexo A) del Dr. Adalberto Noyola (1)

2.- OBJETIVOS

El objetivo general del trabajo realizado, fue permitir una operación mas simplificada del sistema anaeróbico, para este fin se planifican las siguientes modificaciones :

- operar el reactor a presión atmosférica.
- evitar la acumulación de líquido en el tope del reactor.
- aumentar velocidad de eliminación de los gases emitidos por el reactor.
- autonomía de la planta piloto con respecto al proceso pesquero.

3.- METODOLOGÍA

Las actividades realizadas por la empresa SEPCOM Y CIA. LTDA. en la etapa Anaeróbica de planta piloto, son la que se presentan a continuación :

Actividades
1. Modificar línea de recirculación del reactor anaeróbico.
2. Modificar la corriente de descarga del reactor.
3. Modificar línea de eliminación de gases en el tope del reactor.
4. Realizar la instalación de un suministro de agua potable para la planta piloto.

En cada una de estas actividades, la empresa contratista realizó la compra de los materiales involucrados. Se consideró un plazo de 5 días para la ejecución de la obra total.
La mano de obra utilizada por la empresa SEPCOM Y CIA. LTDA. correspondió a personal especializado en realizar soldaduras en acero inoxidable

Durante la realización del trabajo, el personal de la Universidad de Concepción realizó dos visitas a terreno:
- la primera iniciada la obra.
- termino de la obra.

4.- RESULTADOS

En la siguiente tabla se presentan los resultados del trabajo realizado

Tabla N°1

Actividad	Resultado
Modificar línea de recirculación del reactor anaeróbico	Se instaló un nuevo tendido de 3 m de largo con cañería de 1" de diámetro, desde la descarga del reactor hasta el estanque T-105
Modificar línea de la corriente de descarga del reactor.	Se instaló un nuevo tendido de 12 m de largo con cañería inoxidable de 1" de diámetro, desde la descarga del reactor hasta el estanque T-103
Modificar línea de eliminación de gases en el tope del reactor.	Se instaló una nueva cañería en acero inoxidable con diámetro de 1", para la eliminación de gases.
Realizar la instalación de un suministro de agua potable para la planta piloto	Se instaló una cañería de 4 m de largo con diámetro de 1/2", que conectó el suministro normal de agua a la planta de conserva con la planta piloto

En la siguiente tabla se presenta el resultados de las dos visitas a terreno, realizadas durante la ejecución de los trabajos en planta piloto.

Tabla N°2

N° Visita	Diferencia con lo solicitado	Actividad realizada
Primera (3 días luego de iniciado el trabajo)	1. Falta una válvula de control dentro del circuito. 2. No se instaló una válvula de corte manual, en la línea de eliminación de gases.	Se solicitaron las correcciones correspondientes
Segunda (finalizado el trabajo)	Ninguna	Prueba hidráulica a las nuevas cañerías

Se encontraron fugas de líquido al realizar las pruebas hidráulicas y se solicitaron las correcciones correspondientes, lo que al cabo de una semana fue realizado.

5.- BIBLIOGRAFÍA

1. Noyola, A., "Technical Report" Expert mission to the research on clean technologies for the fishing industry, Universidad de Concepción, Chile, (1997)