

R E F E R E N C E T E R M S

TECHNOLOGIES TO PRODUCE SULPHUR IN LARGE SCALE

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1.- OBJECTIVE OF THE STUDY

Chile has important reserves of sulphur caliches. However, the geographic situation of said reserves, in the mountains is one of the facts that have influenced significantly the scarce development of the National Sulphur Industry.

The existing processing plants are of low capacity and efficiency, restricting the supply of refined sulphur to the internal market.

To develop the National Sulphur Industry will require the implementation of new processes of greater capacity and efficiency that can competitive conditions in the next years.

Suchs processes related to continous flotation and purification of sulphur caliches; made up of different individual operations some of which are the conminution and flotation processes that are essential as they represent a high percentage of the global costs of investment (around 70 percent).

The central objective of the study is to determine the feasibility of introducing improvements in the efficiency of the extraction process of sulphur caliches by the adaptation of technologies that allow the development of process of greater capacity of treatment.

The advantages derived from this application of a flotation process of the sulphur caliches of low grade in combination with a continous purification process will allow substantial increased in the production levels of refined sulphur.

2.- GENERAL METHODOLOGY

The methoddology used in the development of the proposed study contemplates a first stage of chemical physical and metallurgic characterization, of representative samples of caliches of low and high grade (5-10 percent, 30-32 percent respectively), this is in order to define the conditions of the flotation and purification samples that will have an effect at the semipilot stage in the second part of the study.

The second part of the project, consideres the realization of the tests at the semipilot scale, under conditions determined in the previous stage of conminution flotation, fusion and refinement.

The results obtained in the second stage will be the basis the preliminary of one treatment plant of a predefined capacity with the corresponding equipment.

A preliminary economical evaluation will allow the establishment of characteristics and projections of the technological alternative that is proposed as a result of the study.

3.-WORK PLAN

3.1 Samples Obtained

The sponsor and INTEC-CHILE will determine the means of obtaining representative samples of different grades of sulphur which will come from the deposit.

3.2 Background summary.

a) Bibliographic search. This will be based on periodic publications relating to technological information of processes and/or market and commerce production.

b) Analysis of the actual situation of the National Sulphur Industry. It will include the revision of technical statements elaborated for different National Institutions in order to evaluate the actual situation of the National Sulphur Industry and its perspective developments.

c) Visit to different production plants of refined sulphur.

3.3 Experimental Development at the laboratory scale.

The experimental development created to obtain the proposed objectives in this study is based on the next stage:

- Chemical and physical characterization of samples. This includes a chemical analysis of head samples in relation to the contents of sulphur and impurities granulometric analysis and liberation curves of sulphur.

- Comminution tests. The results of the chemical and physical characterization will effect the studies of grinding and milling necessary to obtain the background that allows the educated design of the comminution stage.

- Flotation studies at the laboratory scale with be performed in order to determine the operational conditions and the fasibility of applying said technology in the processing of the following materials:

i) Flotation of caliches of 30-32 percent sulphur that produce concentrates of 85-90 percent sulphur suitable for the fusion and refinement.

ii) Flotation of caliches of low grade (5-10 percent sulphur) as a pre stage of concentration of this material at levels of 30-32 percent sulphur.

iii) Flotation of wastes proceeding from the concentrated fusion of sulphur.

- Characterization of the fusion stage of autoclave flotation concentrates relating to the coalescence phenomenon and the elimination of impurities.

3.4 SEMIPILOT TEST.-

The following tests under predefined conditions at the laboratory stage will be performed.

- Semipilot comminution test the conventional process of grinding, milling, classification in continuous and eventual tests in a impactgrinder will be evaluated.

- Continuous flotation at the semipilot scale in order to obtain criteria of scaling and verifying to the flotation of sulphur caliches.

- Test of continuous fusion geared to obtain the necessary background to estimate the investment and operational costs.

- Refinement tests using the pressurized filter of concentrates from fused sulphur and washed in a continuous process in order to test prototypes of industrial filters and to obtain technical and economical data of this operation.

3.5 Advance Report

The results of the different tests made including the main conclusions will be reported.

3.6 Preliminary of the Proposed process.

Based on the results of the first stage the preliminary design of one plant of a predetermined capacity with the corresponding metallurgic material balance will be made. This will give a description of the main characteristics of design and operation of the considered equipment.

3.7 Preliminary Economical Evaluation

The proposed process will be the basis of the preliminary economical evaluation (calculation of economic indicators)

3.8 Last Report

The results and the respective analysis will be discussed in relation to the projections of the alternative proposed technological.

SCHEDULE OF ACTIVITIES

The description of the stages and activities of the project are in table 3.1

The sequence of activities is indicated in the GANTT LETTER annexed.

TABLE 3.1 SCHEDULE OF ACTIVITIES

No. ACT.	DURATION (WEEEEKS)	GOALS	ACTIVITIES
1	4	Obtaining samples	<ul style="list-style-type: none">- Visit to the terrain- Definition of sampling system.- Definition of sample size.- Reception, identification and preparation of samples.
2	4	Background Summary	<ul style="list-style-type: none">- Bibliographic search.- Analysis of technical background- Visit to the terrain.
3	8	Laboratory Tests	<ul style="list-style-type: none">- Chemical and physical characterization.- Comminution test- Flotation test- Fusion test
4	12	Semipilot Tests	<ul style="list-style-type: none">- Comminution test- Flotation test- Continuous test fusion- refinement test.
5	4	Elaboration of Advanced Report	<ul style="list-style-type: none">- Analysis of the results of the characterization stage and Laboratory test.- Definition of alternatives to implement at the semipilot scale.
6	4	Preliminary design Process	<ul style="list-style-type: none">- Results and background Analysis.- Definition Flowchart- Materials and metallurgical balance- Selection of equipment.

7	4	Economical Evaluation	Cost Estimation of: <ul style="list-style-type: none"> - Investment and Operation. - Parameter calculations VAN and TIR. - Analysis of sensitivity in relation to main variables. - Market profile.
8	4	Final Report	<ul style="list-style-type: none"> - Presentation and Analysis of results of different tests. - Analysis of economical projections of the proposed process and conclusions.
