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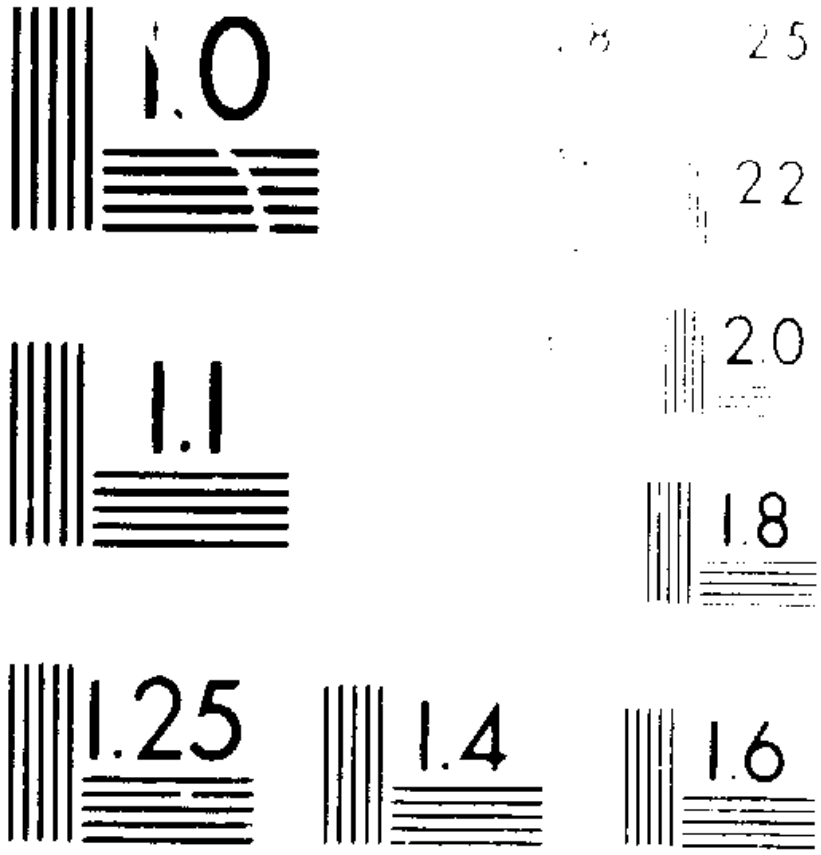
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CERAMICS INDUSTRY DEVELOPMENT

DP/BGD/77/055

BANGLADESH

Terminal report*

Prepared for the Government of Bangladesh
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of M.M. Morsi Tantawy
Quality Control Adviser

United Nations Industrial Development Organization

Vienna

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INTRODUCTION

This final report covers the activities of the Quality Control Adviser, Mr. M.M. Morsi Tantawy. The assignment started on 08.09.1980 for one year extended to two years. After the second year, and after the departure of the Team Leader, Fine Ceramic Adviser, Mr. Hans G. Felbier, and on the request of the Ministry of Education and Ceramic Enterprises the adviser has been granted one more year extension as Ceramic Adviser in addition to Quality Control. A second phase of the project started after the second year during which more direct assistance has been focused to the industry. A project revision "H" has been designed to serve this purpose. The activities of the adviser have been revised also to comply with the new trend of the project revision but still, for the whole project, within the main immediate objectives.

This report is covering the whole assignment from 08.09.1980 till 07.09.1983.

I - DEVELOPMENT OBJECTIVES

The project's primary development objective is to contribute to the saving of foreign exchange through import substitution. This project will contribute to the achievement of this goal by improving the quality of ceramic and glass products and diversifying the product range. The project is also aimed at encouraging the utilization of locally avaialable raw materials and the generation of employment of relatively unskilled labour.

II - IMMEDIATE OBJECTIVES

1 - To enable the Ceramic Institute to assist the Ceramic Industry in reducing losses due to defective quality of moulds and other quality defects of final production and in introducing selected new products in these enterprises, and to assist the glass ware industry in removing quality defects due to poor mixing of raw materials, kiln design and firing, and to introduce selected new products in the enterprises. This will be achieved through :

a) Improved quality of products in the ceramic common service facility in the Institute and provision to the Institute of the technical knowledge necessary to increase output in these facilities.

b) Establishment of common service facilities at the Institute for glass ware so that the Institute is able to assist in the improvement of the quality of production of glass in Bangladesh and to start up production of selected new items at the common service facilities.

c) Improved consultancy services by the Institute to the Ceramics and Glass Industries in order to enable the ceramics and glass industries to remove such defects as poor composition of bodies and glazing defects in selected ceramic industries, and such defects as poor composition of raw materials and inadequate firing in selected glass industries and in order to enable selected ceramics and glass ware industries to start up production of selected new products.

d) Increased skills of Technical Personnel in the Ceramics Institute in gypsum mould making so that the Institute is able to assist the

industry in preparing moulds for specialized items such as, sanitary ware, large dinner ware items and insulators and improve the quality of the gypsum moulds produced so that their life increases from three months to nine months.

e) Expanded facilities of the Institute to carry out physical and chemical tests for the ceramics industry in the following field : determination of efficient and durable sagger mix from various refractory materials, glaze matching and corrections to avoid crazing and green strength of bodies and clays. In addition the project will provide the ceramics institute with new testing facilities in the following fields. Impact strength testing, measurement of thermal expansion of glazes, determination of particle size and durability of glazes.

2 - To enable the Institute to prepare glazes using as many locally available materials and fuels for the purpose of firing and glazing pottery.

III - ACTIVITIES

Within the project activities, the expert activities are :-

I First Phase

1 - Visit factories to identify productions problems.

2 - Preparation of recommendations for the solution of production problems in selected enterprises

3 - Implementation of training programme at the institute

4 - Ordering of required additional testing and quality control equipment

5 - Delivery of equipment

6 - Training of staff of Ceramics Institute in standard physical and chemical lists of ceramics and glass ware including sanitary ware and electrical ware.

7 - Organization of short term on the job training courses at the institute for staff of selected factories in testing and quality control.

II Second Phase

8 - Take part in lecturing in the Ceramics Institute

9 - Start activities in the pilot plant on the availability of gas

10 - Follow up visit to Shah Jalal Brick Factory

11 - Organization of Ceramic Technology Training Courses in cooperation with BSCIC.

12 - Cooperation with Ceramic UNV attached to BSCIC to upgrade Ceramic Cottage Industries.

13 - Further assistance to Dhaka Ceramics & Sanitary Ware Co. and Dhaka Refractories Ltd.

14 - Ad-hoc consultancy service

IV - ACHIEVEMENT OF IMMEDIATE OBJECTIVES

1 - Immediately after arrival of the Quality Control Adviser and assessment of the laboratories and equipment, the expert has ordered additional equipment and chemicals some of them were needed to run the already present equipment and laboratories, others as additional tools for quality control.

2 - After the assignment of a full-time principal for the institute the international team tried to overcome the problems hampering the implementation of the project activities mainly : gas connections, water supply and electrical lay-out. The problems of electricity, and water have been solved. The gas connection has been solved only at the last end of the assignment.

3 - Running the laboratory equipment and training of the counterparts and the students on the use of the equipment and assessment of the results.

4 - The adviser produced a series of guide lines on different aspects of Quality Control and Ceramics, these guide lines are listed in annex III.

5 - The adviser, alongwith the team leader during his presence and also the glass adviser, visited most of ceramic and glass factories all around the country and advisedon the ways to solve the production problems. Samples of the raw materials, semi-finished and finished products have been brought to the Institute for analysis and testing to solve the production problems, control the quality of products and also to demonstrate the facilities of the Institute to the industry enterprises. This procedure has created a good cooperation between the Institute and the industry and improved the image of the Institute as a consultancy centre. In the same time this series of visits could upgrade the talent of the factories technicians to tackle thier production problems.

6 - The adviser could convince two of the ceramic factories to build a Quality Control Centres in the factories. Unfortunately most of the ceramic and glass factories are too small to afford the costs of a private laboratory. These factories are depending now on the service facilities and consultancy centre of the Institute.

7 - Organization of Ceramic Technology Training Course for some ceramic trainees from BCSIC. Unfortunately this program could not materialized for certain reasons beyond the control of the adviser .

8 - Design of a Down-Draft Kiln for the refractory industry. This kiln is expected to produce higher quality product, increase the productivity by reducing rejects, save fuel through good insulation, and lasts longer. This kiln can be used also for firing other ceramic materials.

9 - The adviser assisted in the feasibility study of new ceramic factories and assessment of new raw materials. These studies helped the newly errected factories in choosing the right raw materials, using the right production machinery which produce smoothly without bottle necks and save fuel which is highly expensive here.

10 - Assessment of the washing plant for dressing of Mymensingh clay, the most widely used clay in ceramic industry here. This are dressing plant will help in improving the quality of the clay on one hand and stabilize it's physical and chemical properties on the otherhand.

11 - The adviser shared the standerization of Glass globes for Hurricane Lanterns. The aim was to design a simple but effective methods to control only the crucial characters so that it could be run in a simple laboratory without the need of sophisticated equipment or much skilled personnel.

12 - During the last year the adviser, due to lack of lecturs, was lecturing ceramic technology to the 3rd class students of the Diploma Course.

13 - Despite the fact that the gas is not connected to the Institute till the end of the assignment, the expert used the available facilities and the electric kiln to train counterparts on ceramic technology, formulation of bodies, glazes and colours for different firing temperatures and methods of testing the parameters of the semi-finished and finished ceramic products. Ceramics potts have been produced for use in glass and first trials. "See Annexes"

14 - The refractory materials which is one of the main problems in glass and and ceramics industry has received special attention of the expert. Some selected factories have been given technical advise to improve the quality of products, a down draft kiln was designed, and new products could be produced like refractory blocks for glass industry and cordiesite refractories for thermal shock resistant purposes. The refractories used by the glass adviser to build glass furnaces have been tested for it's thermal resistance to choose the best of it.

15 - The adviser assisted the Bangladesh Insulator and Sanitary Ware Factory in overcoming the production problems they faced after the departure of the czech team of experts. The adviser produced a guide line for sanitary ware defects and how to avoid it. In the mean time the adviser produced a glaze frit to be blended with local raw material to produce wall tile glaze for the wall tile section under construction.

16 - The adviser could solve the problem of glaze crowling in BISF which was affecting more than 30 % of the production.

17 - The adviser changed the mould of cistern produced by BISF and the way of casting which was causing 40-50 % breakage.

18 - The adviser could persue one enterprise to start the production of over glass stains for the first time in Bangladesh. This type of production has good market and it is now-a-days imported from abroad. The adviser gave advise on the method of production and different recipies for different temperatures. See Annex VIII. The adviser designed a down-draft kiln for this factory. Unfortunately only the draft of this design could be produced as it started only on the last month of the mission.

V - UTILIZATION OF THE PROJECT RESULTS

1 - The Institute :

A common service facility has been established in the institute by upgrading the chemical laboratory present, standardizing the chemical analysis and physical tests and erection of the new testing equipment. The institute is now in a position to render its services to the industry by testing and analysing the glass and ceramic raw materials, semi finished and finished products to assist the industry in solving the technical problems and controlling the quality of products. On the other hand the industrialists have now more convidence on the institute and more assistance is requested now. The last order of equipment requested for the 2nd phase of the project has been the result of the request of the industry and after noticing the trend of the tests requested frequently.

Due to the lack of sufficient counterpart a consultancy service could not be built to the extent planned. However the few number of counterpart are now well trained and can continue this service after the departure of the adviser.

The teaching the institute is suffering of lack of lecturers and this suffering will increase after the departure of the adviser.

In general the Institute has benefited much from this project and this benefit will be the start to upgrade the institute as a reputed advisory centre.

2 - The Industry :

The glass and ceramic industry in Bangladesh generally of small scale which can not afford building a good quality control system and developed laboratories. The industry depends largely on the common service facility of the institute which they can rely on now in rendering ceramic tests effectively. During the several visits of the international team much experience has been gained by the industry men as how to solve the production problems on the spot. Much of the problems which is facing the industry has been met with and solved during the presence of the international team and the industrial technicians are familiar with it now.

New products have been introduced also during this period and its production started or about to start which gives the industry a wider scope of production and reduce the dependance on the import of these products.

The down draft kiln designed for the refractory industry will be of great help in the future not only for refractory industry but also for other ceramic industries which, due to its small scale, uses such type of kilns.

The guideline produced for BISF titled " Defects in Sanitary Ware Production " will be of much help in trouble shooting and avoidance of the production problems. The fritt produced for BISF will be the basis for blending thier own wall tile glaze instead of importing it. This frit can be produced either locally if they build a fritting plant or in any of the enamel factories in the country. Even if it is not possible to produce it, it can be imported but it will be not more than 15-20 % of the glaze consuption.

The guideline produced by the adviser " Production of Fritted Glazes " could persuade some of the ceramic enterprises to build a fritt plant which will be the first of this kind in the country. This will decrease the dangerous and hazardous effect of lead oxide widely used in glaze production by the small scale and cottage industry.

3 - The Cottage Industry :

The visits paid to some cottage industries centres will be of use to them utilizing the advise on ways of production and kiln designs.

Despite the fact that the cottage industry ceramists are very conservative and are inheriting this craftsmanship through many generations with no change, some glaze formulations with low lead content and also colours have been recommended and accepted by some of them. The successful use of these formulation will persuade the others to follow.

VI - FINDINGS

The Bangladesh Glass and Ceramic Institute is founded in the 1957 and acting since then to help the glass and ceramic industries in Bangladesh in 2 ways.

- By granting a 3 year diploma course in glass and ceramics technology for up to twenty students, thus providing the industry by the skilled personnel. Also a one year artisan course is run by the institute.
- By providing the technical advice to glass and ceramic factories to solve production problems.

The Institute has a chemical laboratory for testing ceramic and glass raw materials and products, a pilot plants for testing new ceramic and glass formulaes and a production unit to help the industry by rendering production facilites for industries with shortage in some kind of production machinery. All these units act in the same time as a training media for the students during the practical courses.

This project was designed to upgrade the institute to serve better the industry. This upgrading is done by

- Delivery of testing equipment for the laboratory to increase the ability for testing ceramic and glass raw material and products.
- Additional ball mills for grining raw materials and testing new formulations for glazes and bodies.
- Upgrading the production workshop by building a new gas fired kiln instead of the old coal fired one.
- Provide the services of experts for installing and running these equipment, advise on the day to day work in the institute and provide consultancy service to the industry.

There is a big shortage in the high skilled personnel in the institute from the start of the project which is even widened by the absconding of one lecturer during his fellowship mission, the expiry of another and the transfer of a third lecturer to another post outside the institute. The recruitment of new lecturers is not easy due to the low pay scale on one hand and the difficiency of ceramics graduates in the country on the other hand.

The utilities, gas, electricity lay out, water connection, was in a poor state and it was one of the problems the experts faced at the begining of the project. Some trials from the local counterparts have been done to overcome these problems. The electric lay out has been improved which helped to use the equipment delivered. Also water connection hass been partially restored to the chemical laboratory. The only problem left is the gas connection which could be solved just before the expiry of the project. This lack of gas hintered the full use of the production workshop which, however, has been utilised partially using the electric kiln available.

Other than 2 big ceramic factories, the ceramic industry in Bangladesh is in an early stage of development. The main items produced are dinnerware, sanitary ware and insulators. There are also 2 medium scaled factories for the production of refractory materials to serve the glass and ceramic industries in addition to other industries. There is no tile production in the country till now, however the Bangladesh Insulator and Sanitary Ware Factory is building now a new section for tile industry. In the same time another facotory "Dhaka Refractories" is studying, with the assistance of the project, the feasibility of tile production.

A huge number of factories belonging to cottage industries are scattered around the country producing mainly simple unglazed containers for water and flood storage. Some glazed art ware are produced also for domestic use and for tourists interests.

The main problems facing the ceramic industry here are :

1 - The raw materials : Use is made mainly of local raw material of which only one clay has white colour after firing. These clays cannot give white coloured bodies suitable for export and this one white clay has low plasticity which limits its use as main raw material. The use of better clays from abroad is hampered by the high custom duties imposed on import.

2 - Fuel : The ceramic industry here is gathered around the locations where the gas, relatively cheap, is available. Other than that other fuels like wood and straw are used by cottage industry. This fuel can hardly reache sufficient temperative for quality products.

3 - Labour Power : The cottage industries employes skilled workers where skills are handed down from generation to generation without any inovation or modernisation of production technique. Other bigger industries give on the job taining in the factories for the new workers which is mainly practical without any scientific or technical background. In addition to that the productivity of the workers are much lower than the international figures.

4 - Machinery : Most of the ceramics factories use primitive methods and machinery which can no doubt do the job but with low productivity, this will not affect the quality. The adviser is against the trend of using the very sophisticated machinery as it needs highly skilled mechanics for repair and maintenance. There are very little recording or controlling equipment without which no quality could be reached.

5 - Marketing : Despite the heavy population of the country the consumption of ceramic ware is quite limited to urban areas. Even then the consumers are mostly looking for the cheap price rather than the quality. The external market is also hard due to the strong competition from the neighbouring countries. Due to the above mentioned reasons the price of Bangladeshi ceramic products are not competitive in the external market.

VII - RECOMMENDATIONS

1 - After careful observation of the ceramic and glass industry in Bangladesh, the adviser recommends the formulation of 2 projects to serve these industries. The details are attached in annex I & II.

Project A : Development of Sanitary Ware Production

To enable the Bangladesh Insulator and Sanitary Ware Factory BISF to start its production of wall tiles and update sanitary ware production, improving its management, engineering and quality control sector so as to overcome the production problems, to up grade the quality of products to the international standards to facilitate export. This can be achieved through :

a - Training of the management and technical staff in developed countries.

b - Up-grading the quality control section by supplying more research and testing equipment and training of the counterparts of the use of it.

c - Use of as much as possible of the local raw materials to cut the cost of foreign raw materials.

d - Developing of new designs for sanitary ware production suitable for export.

Project B : Development of Ceramics and Glass Research

The Bangladesh Council for Scientific and Industrial Research "BCSIR" has a ceramic and glass section. This section has to be developed to improve the glass and ceramics industries by exploring new clay deposits, running research work on the optimum use of the local raw materials in glass and ceramics, and designing better furnaces for glass and ceramics.

2 - The adviser recommends the reduction of custom duties on raw materials, production and control equipments and increase it on the ceramics and glass products to help theindustry to compete with the foreign products both in the domestic and the international market.

3 - The adviser emphasizesthe importance of technical on the job training in the developed countries. The presence of sufficient trainees, in a project, is a great help to the expert and can shorten the duration of the projects. The presence of well trained persons in a factory can even replaces the presence of experts. The training programs have to be well designed to

motivate the trainees to get the most of the training program by correlating the salary or daily allowance of the trainee to his productivity.

To solve the problem of the low productivity of the labours the adviser recommends the introduction of incentives in the production units. This system is as yet not used except in one glass factory. The incentive system should be well and fair designed to really persue the labours to increase their productivity. In the meantime a strong quality control system should be used otherwise the quality will drop due to this rise of quantity.

4 - To solve the problems of investment capital and export market the country has to look for joint venture investment with developed countries where they can find easily the technical know-how, training and, through those foreign parties, export can be easier. This is applicable to all industries.

5 - The exploration of new ceramic raw material can widen the range of production and improve the quality. This can be done through the geological survey office or the BCSIR as will be mentioned afterwards.

ANNEX I

DEVELOPMENT OF SANITARY WARE PRODUCTION

Background and Justifications :

The BISF has been erected in July 1977 and started its production in August 1981. The factory is planned to produce 400 metric tons sanitary ware and 2400 metric tones insulators per year. The production of 1500 metric ton per year of wall and floor tiles is expected to start in April 1984. It is the largest ceramics complex in Bangladesh. Due to the difficulties in export the production is cut to half the capacity and still the local market could not consume the whole production.

By improving the quality and designs of the production the BISF could compete with the other countries in the international market. The use of higher percentage of local raw material, cutting the losses during production and stream lining of the production can reduce the cost and render the prices competitive.

Immediate Objectives :

1 - Training of some of the management and technical staff in developed countries.
2 - Upgrading the quality control section by supplying more research and testing equipment and training of the counterparts on the use of it.
3 - Use of as much as possible of the local raw materials to cut the cost of the foreign raw material.
4 - Developing of new designs suitable for export.

Input :

1 -	Quality Control Adviser/Chief Technical Adviser	24 m/m
2 -	Mould Making Adviser	24 m/m
3 -	Fellowships	50 m/m

ANNEX II

DEVELOPMENT OF GLASS AND CERAMIC RESEARCH

Background and Justifications :

The glass and ceramic industry in Bangladesh is an early stage of development. The main items produced now are sanitary ware, insulators, dinner ware and glass drinking vessels and food container. There is no tile industry till now. The majority of the production is much below the international standard. Therefore considerable import of ceramic and glass items mainly dinner ware and tiles. The government has banned the import of sanitary ware to protect its production which is at a fairly good quality.

The major difficulty facing these industries inter-alia is the lack of local raw material of quality suitable to produce high quality products. The other main difficulty is the inferior machinery used especially the kilns. Furthermore the lack of know-how in the management, body preparation, mould making, glazing and firing.

The BCSIR is trying through the glass and ceramic sectors to overcome some of these problems by running researches on the local raw materials and its utilization in different aspects of production. However the lack of scientific equipment and skilled researcher are bottle necks to these researches. The lack of sufficient funds is also a big problem as the industry is not in a financial position to support these researches because of the lost confidence between the research and industry parties on one hand and the financial difficulties the industrial enterprises are facing on the other hand.

Supporting these researches by both personnel and finance will enable this research centre to improve the quality of products and reduce the production costs. This will in term help to save the foreign exchange spend for import and can also add by incrasing the export when a reasonable quality products are reached.

Immediate Objectives :

- The project will survey and explore the availability of ceramic and glass raw materials and assess it's suitability for the production of ceramic and glass products.

- The project will supervise the researches aiming to use as much as possible local raw materials for the production of different glass and ceramic products including refractory products which serves other industries in addtion to the glass and ceramic industries.
- The project will assist the industry by designing glass and ceramic kilns, also will help in upgrading and improving the present kilns.
- The project will produce leadless frit for the use in cottage industries which is at the moment using the health hazardous lead glazes.
- The project will run reseraches to develope ceramic stain for the production of colours ceramic items. These stains are imported now at high cost.

Activities :

1 - Survey of the ceramic raw materials "clays, felsper, quartz, limestone, delomite etc."

2 - Assessment of the local ceramic raw materials "Chemical and Physical Analysis".

3 - Preparation of high alumina refractories "Mullite 45-70 Al_2O_3, mullite correndum 70-78 % Al_2O_3 and correndum 795 % Al_2O_3.

4 - Preparation of white ware bodies "Sanitary ware, Dinner Ware and Tiles" with optimum percentage of local raw materials.

5 - Preparation of low temperature frits "lead bearing and leadless "

6 - Preparation of raw glazes for high temperature firing (above 1200°C.) both transparent and opaque.

7 - Preparation of glaze stains and over glaze colours "for both ceramics and glass".

8- Design ceramic and glass furnaces.

9 - Preparation of glass compositions "amber, soda lim e, neutral, crystal etc." with optimum percentage of local raw materials.

International Input :

1 - Ceramic Adviser	48 m/m
2 - Geologist	12 m/m
3 - Quality Control Adviser	24 m/m
4 - Glass Adviser	24 m/m
5 - Furnace Designer	12 m/m
6 - Electronic Engineer	24 m/m

Time Schedule

Part No.	I Year	II Year	III Year	IV Year
1				
2				
3				
4				
5				
6				

ANNEX III

REPORTS AND GUIDELINES PRODUCED

1 -	Preliminary Report	September 1980
2 -	Physical tests on ceramic materials	December 1980
3 -	Production achievement in Dhaka Ceramics and Sanitary Ware Co.	January 1981
4 -	Selected Methods of Quantitative Chemical Analysis.	March 1981
5 -	Six Months Progress Report	March 1981
6 -	Guidelines for Qualitative Analysis	March 1982
7 -	Training Course on Ceramic Technology	May 1982
8 -	Ceramic Technology	May 1982
9 -	Guidelines for Rational Analysis	November 1982
10 -	Guidelines for Operating the Dilatometer, DTA	December 1982
11 -	Defects in Sanitary Ware Production	May 1983
12 -	Rheological Properties of Mymensingh Clay in comparison with English Ball Clay	May 1983
13 -	Production of Fritted Glazes	June 1983

ANNEX IV

COLOURED GLAZES

1000°C.

	Black Colour I	Black Colour II	Ivory Colour	Brown Colour	Blue Colour
Lead Oxide	35	40	40	40	40
Quartz	20	15	15	15	15
Borax	20	25	25	25	25
Felsper	10	5	5	5	5
Limestone	9	10	10	10	10
Kaolin	6	5	5	5	5
Iron Oxide	3	3	-	2	-
Manganese Oxide	2	2	-	-	-
Cobalt Oxide	1	1	-	-	1
Iron Dichromate	-	-	-	2	-
Titanium Oxide	-	-	2	-	-

ANNEX V

PINK GLAZE STAINS

	I	II	VI	IV
Tin Oxide	50	47	50	-
Felspar	25	8	-	-
Qurtz	24	22	3	-
Barium Chromate	1	3	-	-
Limestone	-	20	20	-
Flurspar	-	-	20	-
Potassium Dichromate	-	-	7	-
Iron Oxide	-	-	-	13
Chromium Oxide	-	-	-	13
Zinc Oxide	-	-	-	55
Kaolin	-	-	-	19

Calcining temperature 1300°C in oxidizing atmosphere.

ANNEX VI

PORCELAIN GLAZE COMPOSITION

1250°C.

	I	II	III
Felspar	60	38	40
Limestone	10	14	16
Zinc Oxide	7	-	3
Quartz	18	23	28
Barium Carbonate	-	18	6
China Clay	5	7	7
Zicon	6	6	6

ANNEX VII

SANITARY GLAZES FOR BISF

	1/28	2/28	3/30	4/30
Sand				
Felspar	45	43	43	45
China Clay	6	7	5	4
$BaCO_3$	2	4	4	3
ZnO	4	3	3	3
Limestone	10	8	8	8
Dolomite	5	7	7	7
Zircon	12	12	12	12

ANNEX VIII

FLUXES FOR OVER GLASS STAINS

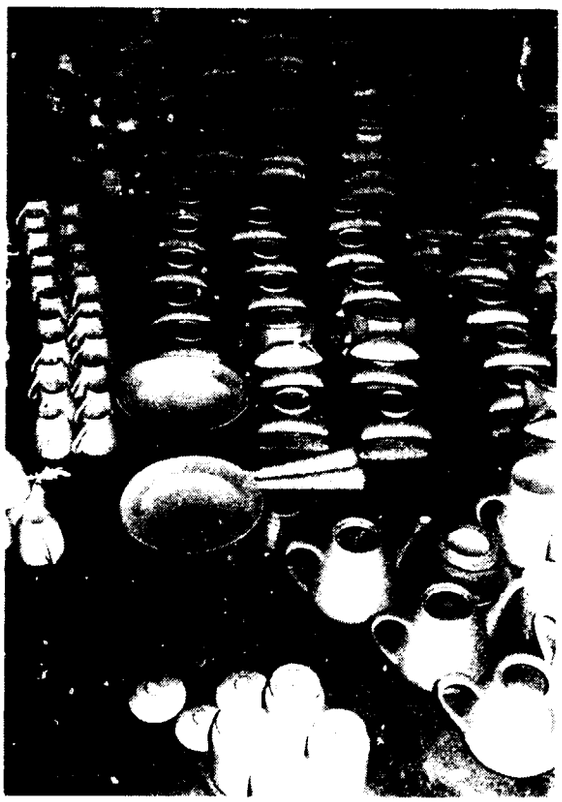
	1	2	3	4	5
Glass Powder	100	100	100	100	100
Lead Oxide	5	10	-	-	5
Borax	-	-	5	10	5

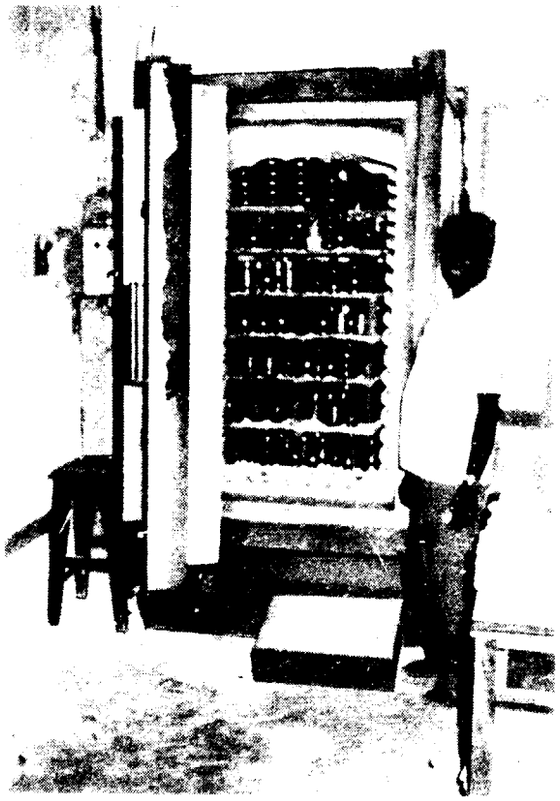
COLOURS FOR OVER GLASS STAINS

White Colour	5 % Zircon
Brown Colour	3 % Iron Oxide
Black Colour	3 % Iron Oxide 2 % Cobalt Oxide 1 % Manganese Oxide
Blue Colour	1 % Cobalt Oxide
Green Colour	2 % Chromium Oxide 1 % Cobalt Oxide
Yellow Colour	5 % Titanium Oxide

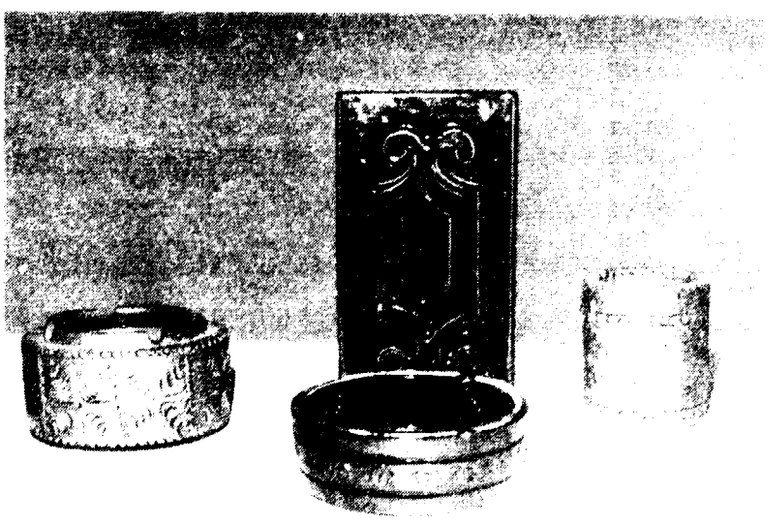
ANNEX IX

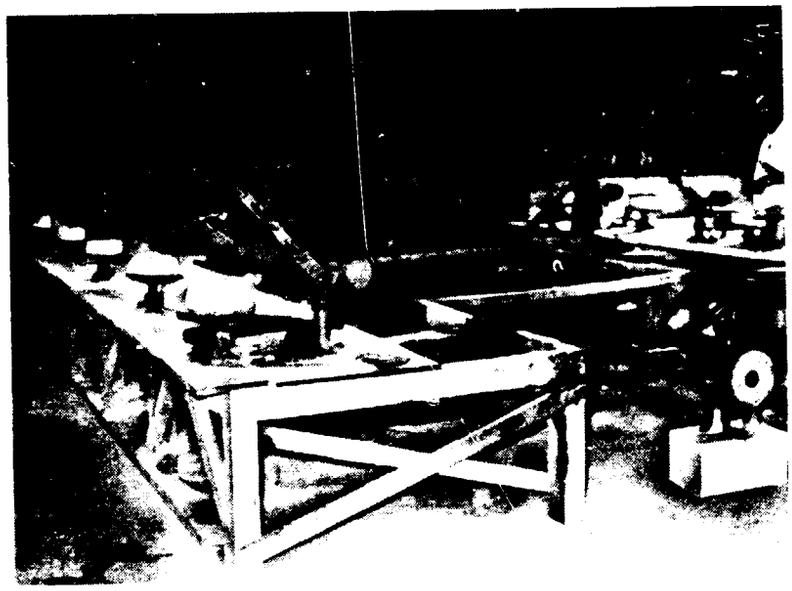
ILLUSTRATIONS



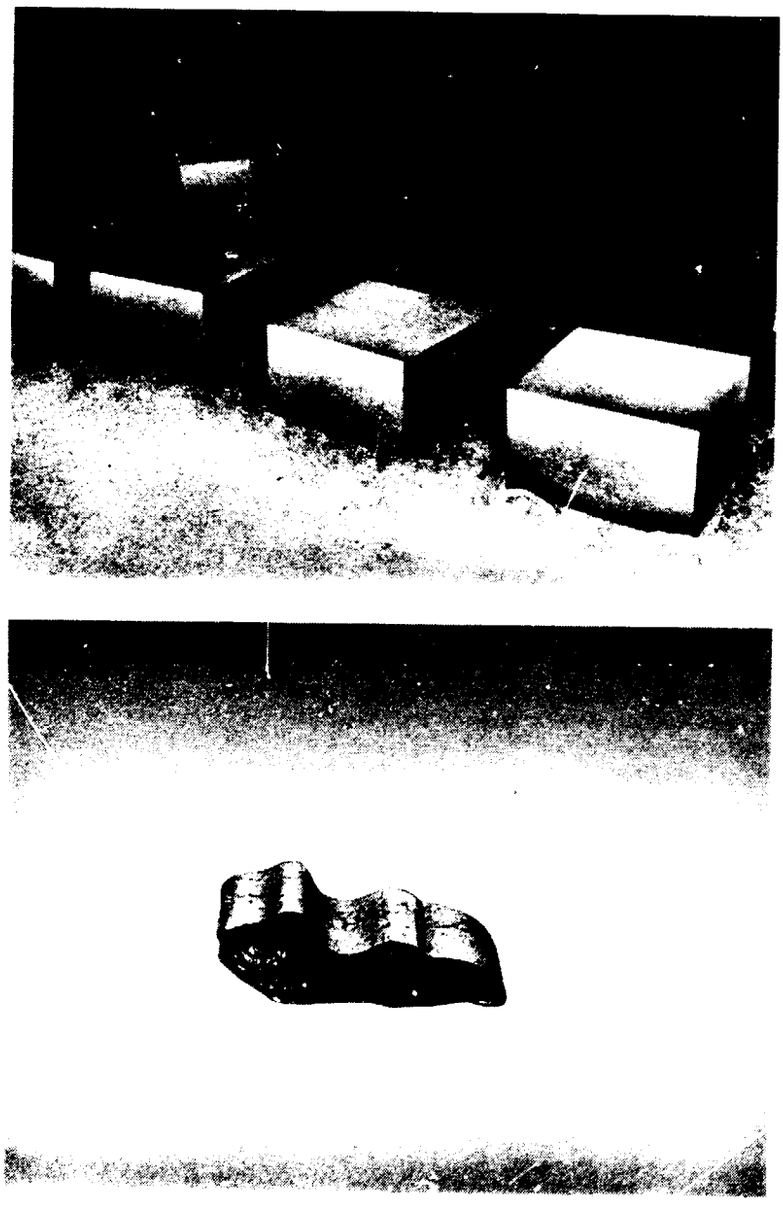


The production in the pilot plant of the institute was going on despite the fact that the gas connection was not complete. Use is made of the electric kiln available the institute for firing the porcelain production of the pilot plant and also some of the cottage industry production. Unfortunately reduction firing necessary for porcelain production is not possible in such an electric kiln.





Master Industries plant in Chittagong. This factory despite nearly complete was forced to be shut down due to the high priced fuel oil and the non availability of natural gas. After the starting of a new pipe line to supply Chittagong with natural gas the adviser visited this factory and suggested the change of the lay out of the factory and the order of new machinery to stream - line the production and avoid the bottle necks. These suggestions are under implementation now waiting for the natural gas to reach Chittagong most probably begining of the next year.



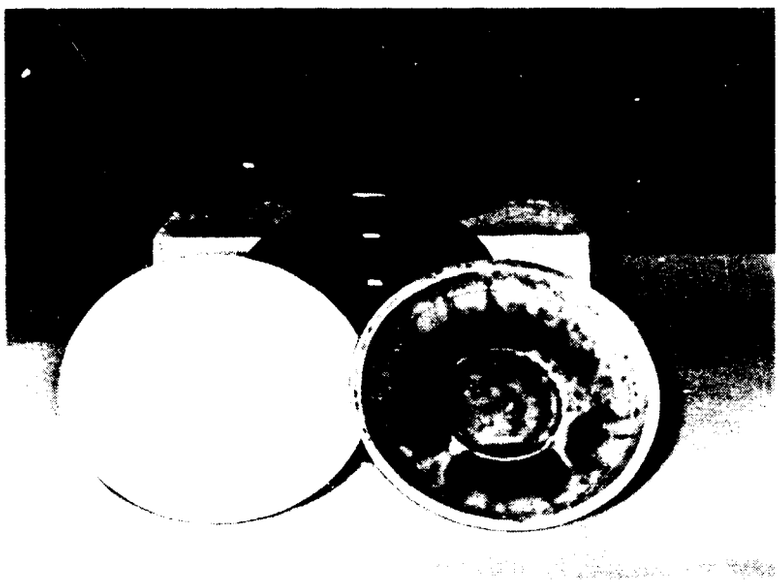
Two of the new products in the refractory production : -

Upper Photo : Refractory blocks 500 x 500 x 300 mm to be used in building ceramic furnaces. This products needs special care in shaping, drying and firing.

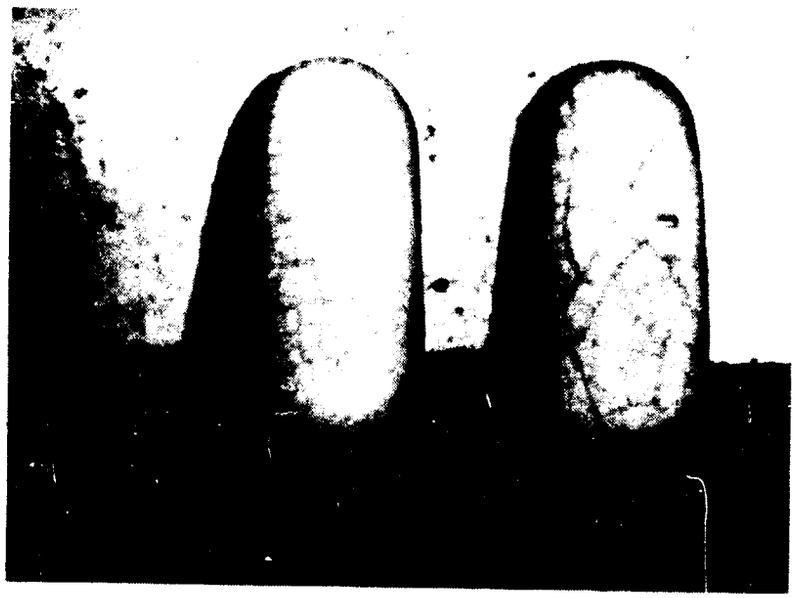
Lower Photo : Cordirite body characterized by very low thermal expansion measured to be 2.55×10^{-6}. This product is needed for refractories under severe thermal fluctuation like heating coils supports shown in the photo.

The frit production applied to an imported clay body and a local clay body. The adviser produced a guide line on the production of fritted glazes. The frit production is not known in Bangladesh and in the time being two factories are studying the start of this production despite the high investment, relatively, needed for this production. BISF is trying now the use of this frit to be blended with local raw materials to produce wall tile glaze instead of importing this glaze.

In cooperation with the glass adviser use is made of an old broken glass pot in the institute to produce small pots for testing the glass and frit composition. These pots have been used successfully for frit and glass tests in the institute.



The main fundamental colours for ceramic industry; black, blue, brown and yellow. The black colour is one of the most difficult colours to reach as it can rarely be true black and most of the times is brownish or bluish black. This black colour composed is a realy black colour. The other three colours are compatible and can be intermixed to develope any combination of colours in between these forming a triaxical system of colours.



The fitness of the glaze to the body is one of the biggest problems facing the cottage industries. They have naturally no means to measure the thermal expansion of the two layers to match them together. However this defect could be utilized as shown in the photo to create an antique effect which is very attractive and can be a way of decoration.

The Bangladesh Insulator and Sanitary Ware Factory has received some assistance after the departure of the Czech team of expert. The problems of glaze crawling and glaze crystalisation have been solved and a new mould for the cisterns has been designed together with some change in the casting system which could solve the problem of 40-50 % cracks.