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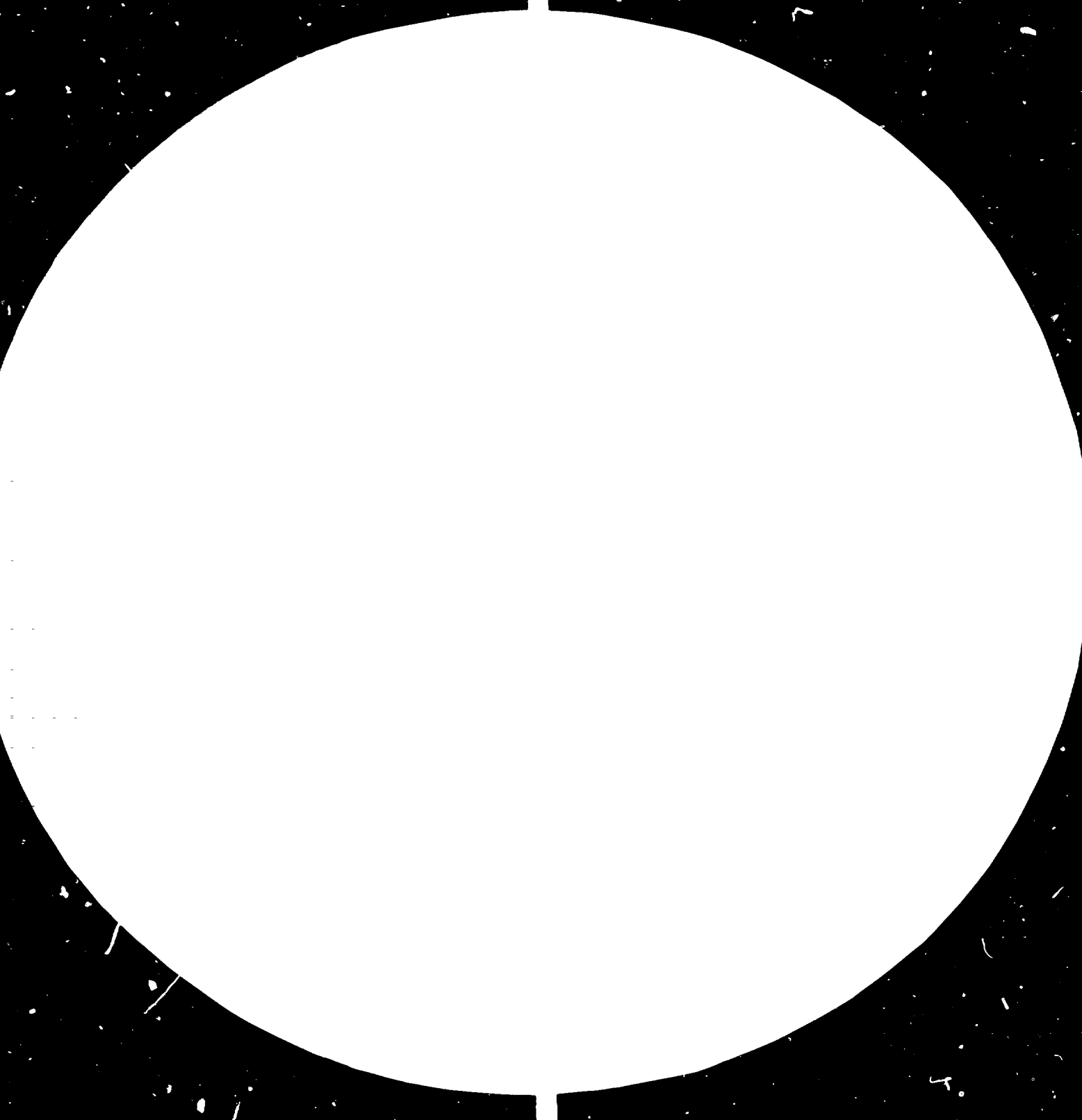
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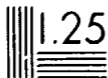
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JOINT IDCAS/UNIDO PROJECT FOR DEVELOPMENT
OF THE PLASTICS PROCESSING INDUSTRIES
IN ARAB COUNTRIES
UC/IDC/79/088

Mission report (

Prepared for the Arab Industrial Development Organization
by the United Nations Industrial Development Organization

Based on the work of H.M. El Sharkawy,
expert in plastics

Explanatory notes

A comma (,) is used to distinguish thousands and millions.

A full stop (.) is used to indicate decimals.

References to "tons" are to metric tons, unless otherwise specified.

The following abbreviations are used in this report:

AIDO	Arab Industrial Development Organization
ABS	Acrylonitrile-butadienestyrene co-polymer
DOP	Diocetyl phthalate
EPS	Expandable polystyrene
GRP	Glass reinforced polyester
HDPE	High density polyethylene
LDPE	Low density polyethylene
PE	Polyethylene
PP	Polypropylene
PS	Polystyrene
PU	Polyurethane
PVC	Polyvinyl chloride
UF	Urea formaldehyde
VCM	Vinyl chloride monomer

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ABSTRACT

The "Joint IDCAS/UNIDO Project for Development of the Plastics Processing Industries in Arab Countries" (UC/IDC/79/088) was approved by UNIDO in May 1980 and the four-month mission covered by this report began in April 1981. It was designed to survey existing plastics processing industries in the Arab countries and the future market for plastic products, and to study the feasibility of setting up new plastics industries for local and export markets.

The countries visited during the mission were Algeria, Bahrain, Iraq, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Sudan, Syrian Arab Republic and Tunisia. Substantial work was done towards the achievement of the aims and objectives of the mission.



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I. FINDINGS AND RECOMMENDATIONS

A. Findings

Plastics processing industries have existed in Arab countries for 20 years. They started by producing simple household articles, and then expanded rapidly to process all types of plastics materials.

There are approximately 1,000 plastics processing factories in the Arab countries.

As the plastics processing industry does not require heavy investments, most factories belong to the private sector, with the exception of a few factories in Algeria, Iraq and the Syrian Arab Republic which are either partly or totally government-owned. Such factories are fairly large and deal with more sophisticated equipment.

Table 1 shows the plastics raw materials processed in the Arab countries in 1980 and the forecasts for 1985.

1. The biggest consumers of plastic raw materials among all Arab countries are Algeria, Iraq and Saudi Arabia. Their consumption is about 40 per cent of the total plastic material processed in Arab countries.
2. The smallest consumers are Bahrain, Qatar and Sudan. Their consumption represents only 3 per cent of total consumption in Arab countries.
3. Polyvinyl chloride (PVC) represents about 40 per cent of total plastic material consumption, most of it being used to produce water pipes for drinking, irrigation and drainage purposes. A small part is used to produce tiles for floor coverings, shoes, artificial leather and garden hoses.
4. Eighty per cent of low density polyethelene (LDPE) is used for making film and producing heavy-duty sacks for fertilizers, shopping bags and polyethelene (PE) pipes.
5. Glass reinforced polyester (GRP) is widely used in Kuwait, Saudi Arabia and the Syrian Arab Republic for the production of water tanks, boats, sewage pipes and lightweight sheds.
6. Soft polyurethane (PU) is widely used in most Arab countries, and most of the factories are working with less than 20 per cent of their design capacity.
7. Polypropylene (PP) is not widely used for household articles, although its lower price enables it to replace high density polyethelene (HDPE).

Table 1. Plastics raw materials processed in Arab countries in 1980 and consumption forecast for 1985
(tons).

Country	Low density polyethelene	High density polyethelene	Polyvinyl chloride	Polypropylene	Polystyrene	Polyurethane	Polyester	Total processed (1980)	Consumption forecast (1985)
Algeria	30 000	17 000	22 000	2 000	5 000	750	1 200	77 950	191 000
Bahrain	1 500	750	550	50	100	100	350	3 400	5 000
Iraq	26 000	15 000	38 000	10 000	8 000	8 000	1 000	106 000	128 000
Jordan	7 000	2 000	8 000	500	500	700	1 300	20 000	40 000
Kuwait	3 000	1 000	2 500	1 000	600	4 500	3 500	17 000	24 400
Morocco	20 000	6 000	13 000	600	1 400	140	500	41 640	46 500
Qatar	800	300	1 200	50	100	100	400	2 950	4 000
Saudi Arabia	19 700	15 000	62 000	2 000	6 500	12 000	12 000	129 200	190 000
Sudan	4 000	4 000	7 000	700	300	75	150	16 225	20 000
Syrian Arab Republic	18 000	7 000	19 000	8 000	3 000	2 000	5 000	62 000	95 000
Tunisia	10 000	3 000	7 000	4 000	4 000	2 000	800	30 800	40 000
All other Arab countries	60 000	28 950	119 750	10 100	20 500	18 735	23 800	281 835	320 000
Total	200 000	100 000	300 000	39 000	50 000	50 000	50 000	789 000	1 103 900

B. Recommendations

1. Establishment of plastics processing complexes in Arab countries. Plastics processing complexes may be established in some Arab countries lacking in hard currency with the assistance of oil-producing Arab countries. This was discussed with the Director of the Tunisian-Kuwaiti Bank in Tunis, which is searching for projects in which to invest its money. The Islamic Bank could also share in such projects. Feasibility studies are required. The complexes could be established in Morocco, Sudan and Tunisia. The articles recommended to be produced in such complexes are PVC pipes and fittings for irrigation and drainage, woven PP bags, shopping bags, melamine tableware and sanitary equipment. Part of the product will be consumed in the local market and the rest will be for export to other countries.

2. Research and development centres. There should be close co-operation between plastics centres and industry. To initiate co-operation it is necessary to provide such centres with plastics processing machines for testing and for training people working in the plastics industry, given the lack of technicians observed in most Arab countries.

3. Establishment of a plastics development centre in Iraq. Although Iraq is building up its infrastructure very rapidly, both the partly and the totally government-owned plastics processing complexes have no plastics technology centre. Establishing a plastics technology centre to serve the industry in Iraq is greatly needed. This possibility was discussed with the general director of mixed government and private sector organizations, and it was found that such a centre is essential, and that the assistance of UNIDO would be needed for its establishment.

4. Establishment of standard specifications for plastic articles. Most of the plastic articles in Arab countries are produced without any specific standards. The establishment of such standards for industrial and technical products is therefore recommended. Research and development centres can play an important role in establishing standard specifications for Arab countries with the assistance of UNIDO.

5. New fields of application recommended for the plastics processing industry.

Plastics in Agriculture. As the population of most Arab countries increases, some of them have recently started to apply plastics on a very small scale in agriculture. A serious effort should be made to promote this new technology. UNIDO could participate in such an effort through the provision of experts to assist in training and for solving problems which might arise.

There should be close co-operation between those responsible for agriculture and industry.

The seminar on the application of plastics in agriculture should be organized by UNIDO and the Arab countries.

Plastics in building and construction. In view of the diminishing world resources of wood, which is imported by all Arab countries, wood products and building materials could be replaced by plastics in the following form:

Window and door frames

PVC pipes for water, sewage systems and electrical conduits

Lightweight concrete consisting of a mixture of expandable plastic material, sand and lime

Expandable polystyrene (PS) sheets and rigid PU for ceiling insulation and for panels and partitions.

Plastics in furniture. Soft PU is widely used in Arab countries to produce mattresses, but rigid PU, structure foams, and polyesters are rarely used in furniture. Such plastic materials can replace wood.

6. Consultative group meeting. A consultative group meeting of representatives from Arab countries, the Arab Industrial Development Organization (AIDO), the Islamic Bank and other Arab banks should be held to discuss recommendations and further action which might be taken in collaboration with UNIDO experts.

7. Regional plastics technology centre. The establishment of a regional plastics technology centre to cover all the requirements of Arab countries with regard to plastics development, application and testing is greatly needed. A suitable location for such a centre would be Casa Blanca, Morocco. The Moroccan Institute for Packaging was established with UNIDO assistance in 1979. It needs only a number of pilot plastics processing machines to be made suitable for the centre, which will help to promote new applications of plastics in such fields as agriculture and construction.

8. Petrochemical training centres in oil-producing countries. It was found that there is no need to establish petrochemical training centres in Arab oil-producing countries, because they have their own centres which operate mainly as joint ventures with the participation of foreign partners.

II. PLASTICS PROCESSING INDUSTRIES IN ARAB COUNTRIES

A. Jordan

Information was obtained from the following sources: the Ministry of Industry, the Royal Scientific Society, the Industrial Development Bank, the National Institute for Planning and factory visits.

Jordan is a country with 2.5 million inhabitants. Beginning more than 20 years ago, the plastics processing industry in Jordan produced simple moulded household articles on a small scale and then expanded gradually until it reached about 54 factories in 1977.

Status of the plastics industry in Jordan

Jordan currently has approximately 75 plastics processing factories engaged in all types of plastics processing activities. All the factories belong to the private sector. Data on the available machinery are given below.

<u>Types of machines used</u>	<u>Number of machines</u>
Extrusion	80
Injection moulding	60
Blow moulding	30
PU foaming	12
PVC compounding	6
Thermoforming	8
Pressing	10

Extrusion machines are used mainly to produce PE film for packaging and agriculture, PVC and PE pipes for irrigation, drainage and for housing, PVC profiles for window and door frames, wire and cable coating.

Injection moulding machines are used to produce household articles, toys, handles for shopping bags, small electrical boxes, buckets and vegetable and bottle crates.

Most of the machines have a shot capacity of less than 500 g. Seven machines have a shot capacity of less than 2,000 g, and three can only produce moulded articles over 2,000 g.

Blow moulding machines are used to produce hollow articles in PE or in PVC.

Most of the machines produce bottles of less than 5 l capacity.

Five machines can produce jerrycans of up to 10 l capacity, two of up to 23 l capacity, one of up to 70 l capacity and one of up to 250 l capacity.

PU foaming machines produce mattresses and shoe soles and heels. Thermoforming machines produce disposable caps for yoghurt and ice cream. Presses for thermosets produce melamine tableware, ashtrays and toilet seats.

Plastics raw materials processed in Jordan

The main plastics raw materials processed are PE, PVC, PS, PP, PU and polyesters. Table 2 shows the plastics raw materials processed in Jordan during the period 1976-1980 and the consumption forecast for 1985.

Table 2. Plastics raw materials processed in Jordan and consumption forecast for 1985 (tons)

Material	1976	1977	1978	1979	1980	Consumption forecast (1985)
PE	3 000	5 000	6 000	8 000	9 000	20 000
PVC	1 500	3 000	4 000	5 500	8 000	14 000
PS	150	200	300	500	500	1 000
PP	100	100	300	500	500	1 000
PU	200	400	600	600	700	1 500
Polyester	200	300	800	900	1 300	2 500
Total	5 150	9 000	12 000	16 000	20 000	40 000

Visits to plastics processing factories in Jordan

Seven factories were visited, all of them belonging to the private sector.

General plastics factory

Main activity: production of PVC pipes and PVC compounding

The factory has three extruders and two PVC compounding units. The PVC pipes produced are used for irrigation, housing, sewage systems and electrical conduits.

Findings

1. The factory was running at 30% of its design capacity.
2. No quality control could be noticed.
3. There was an interruption in the power supply.

Jordan polymers

Main activity: production of homopolymers and copolymers, alkyds and unsaturated polyesters, urea formaldehyde (UF) resins, dioctyl phthalate (DOP) and PVC compounding

The design capacity is given below.

Polyvinyl alcohol: 6,000 t/a

Alkyd resins for paints: 2,500 t/a

DOP: 8,000 t/a

PVC compounding: 10,000 t/a

UF resin: 2,500 t/a

Findings

1. All raw materials used are imported.
2. Industrial safety measures are needed.
3. Sixty per cent of the products are exported.
4. There is a fairly satisfactory quality control system.

Future plans for extension call for a doubling of the production capacity of the DOP unit and the alkyd resin unit.

Jordanian melamine company

Main activity: production of melamine tablewares and ashtrays

The factory has three presses, each with a capacity of 350 t/a, and four presses, each with a capacity of 200 t/a.

Findings

1. There is a shortage of technicians.
2. The power supply was interrupted.
3. All moulds are imported.
4. There is no workshop for mould repairs.
5. Fifty per cent of the design capacity is lost.
6. Motion and time studies are not applied in the production process.

Nackle and Salem for Plastics

Main activity: production of LDPE shopping bags

The factory has one extruder with a capacity of 1,000 t/a, one printing machine and one bag-making machine.

Findings

1. Although the factory was running 24 hours a day its production is one third of the design capacity.
2. Handles for the shopping bags are imported.
3. Factory upkeep is not perfect.

Mehmari Enterprise

Main activity: production of rigid PVC profiles for window and door frames. The factory has two twin-screw extruders with a design capacity of 5,800 t/a

Findings

1. There is a shortage of technicians.
2. Only twenty per cent of the design capacity of the machines is used.
3. The factory is facing problems in marketing its product.
4. Production is carried out according to German standards.

Technical Plastics Company

Main activity: production of PVC pipes for drainage and trickle irrigation

The factory has four extruders to produce plain and corrugated PVC pipes. The design capacity of the machines is 2,500 t/a, but the actual capacity is only 1,000 t/a.

Findings

1. A part of the production is exported.
2. There is a shortage of raw material.

National Plastics Factory

Main activity: injection moulding, extrusion blow moulding, thermoforming, offset printing and silk screen printing on PE containers

The factory has 11 injection moulding machines and eight extrusion blow moulding machines to produce hollow articles of from 250 cc up to 250 l; a thermoforming machine to produce disposable cups with a capacity of 50 million pieces per year; an offset printing machine and a silk screen printing machine.

Findings

1. Ninety per cent of the production is exported.
2. Most of the qualified technicians are foreigners.
3. The factory has its own power supply.
4. There is a fairly satisfactory testing laboratory.

B. Syrian Arab Republic

Information was obtained from the following sources: the Ministry of Industry, the Industrial Testing Research and Development Centre and factory visits.

The Syrian Arab Republic is a country with 8.5 million inhabitants. The plastics processing industry started growing in 1970. All basic plastics raw materials in addition to machines, equipment and moulds are imported.

The Syrian Arab Republic currently has about 150 plastics processing factories. Most of them belong to the private sector, and 10 are government-owned. They are mostly located in Damascus and Aleppo, and a few are in Latakia. Data on the types and number of machines used are given below.

<u>Types of machine</u>	<u>Number</u>
Extruders	90
Injection moulding	160
Blow moulding	25
FU foaming	12
Thermoforming	9
Presses for thermosets	26
Polyester machines	4
Raffia machines	2
PVC compounding	8

Extruders are mainly used to produce films for packaging or agriculture, pipes for housing, irrigation and drainage, and cable and wire coating.

Injection moulding machines are used to produce household articles such as basins, trays, buckets and crates, and industrial articles such as PVC fittings and toilet seats.

Extrusion blow moulding machines are used to produce hollow articles such as jerry cans and bottles for vegetable oil and mineral water.

FU foaming machines are used to produce both soft and semi-rigid articles. Seven of them are located in Damascus and five in Aleppo.

Five of the PVC compounding machines belong to the private sector and three to the public sector.

Thermoforming machines and vacuum forming machines produce yoghurt and ice cream cups and the inner lining of refrigerators. Six machines are located in Damascus and three in Aleppo.

Presses for thermosets are used to produce melamine tableware and electrical parts from phenolics. Sixteen machines are in Damascus and 10 in Aleppo.

Polyester machines produce boats, corrugated sheets and drainage pipes. All articles are reinforced by glass fibres.

Factories belonging to the public sector
and their activities

1. National Factory for Plastics and Rubber

Unit I: Main production is agricultural film and PVC shoes.

Unit II: It produces calendered PVC foils, foam rubber, shoes and O-rings.

Unit III: It produces PVC shoes and O-rings.

2. National Cables Factory
It produces PVC and rubber-coated cables.
3. National Paint Factory
It produces paints from imported alkyds.
4. National Electronic Factory
It produces television and radio cabinets.
5. Arab Company for Rubber and Plastics
It produces PVC and rubber shoes and hoses.
6. Plastics Products Association Company
It produces household goods, blown film and industrial articles.

Plastics raw materials processed in the Syrian Arab Republic

Table 3 shows the plastics raw materials processed in the Syrian Arab Republic during the period 1976-1980 and the consumption forecast for 1985.

Table 3. Plastics raw materials processed in the Syrian Arab Republic and the consumption forecast for 1985
(tons)

Material	1976	1977	1978	1979	1980	Consumption forecast (1985)
PE	15 000	18 000	20 000	22 000	25 000	40 000
PVC	8 000	10 000	15 000	17 000	19 000	30 000
PS	3 000	5 000	5 000	7 000	8 000	10 000
PP	1 000	1 000	1 500	2 000	3 000	5 000
PU	1 500	2 000	2 000	2 000	3 000	4 000
Polyester	1 500	2 000	3 000	4 000	5 000	6 000
Total	30 000	38 000	46 500	54 000	63 000	95 000

Visits to plastics processing factories in the Syrian Arab Republic

Four factories were visited, two belonging to the public sector and two to the private sector.

National factory for plastics and rubber (Units I, II and III)

Unit I

Main activity: production of PVC shoes and PE film for agriculture

The factory has four machines producing PVC shoes and one big extruder to produce agricultural PE film with a maximum width of 10 m.

The PE extruder was running at 23 per cent of its design capacity, which is 3,000 t/a. Its actual consumption was only 700 t/a.

Unit II

Main activity: production of artificial leather for bag-making and upholstery, foam rubber, O-rings and rubber shoes

The factory has a PVC calendaring unit to produce PVC film laminated on cotton fabrics and presses for rubber O-rings and shoes.

Findings

1. The unit has a very large work-force.
2. There is no quality control system.
3. There is a shortage of technicians.
4. Industrial safety and plant upkeep are insufficient.

Mahjoub Plant

Main activity: production of PVC pipes for drinking and electrical purposes, HDPE pipes for irrigation, PVC window shutters, PVC fittings up to 10 cm in diameter and PP toilet seats

The factory has eight extruders with capacities ranging from 25 kg/h to 125 kg/h and three injection moulding machines.

Findings

1. The factory has a work-force of 75.
2. All moulds are imported.
3. Upkeep is satisfactory.
4. There is a reasonably satisfactory quality control.
5. There are plans to produce window and door frames in future.
6. Most of the products are industrial articles.

Artine Stampolian

Main activity: PVC compounding and production of PVC shoes and PU soles

The factory has a compounding unit that consumes 2,000 tons of PVC/a and four machines for shoe-making.

Findings

1. The compounding unit operates at 50 per cent of its design capacity.
2. There is no quality control system.

C. Tunisia

Information was obtained from the following sources: the Director of INS, the Director of the Plastics Industry, the General Director of CNEI, the Director of Industrial Co-operation and an official of the Tunisian-Kuwaiti Development Bank.

Tunisia is a country with 6.25 million inhabitants. The plastics processing industry started in 1960 with three factories producing simple household articles. In 1968 the plastics industry began to expand rapidly, and by 1980 about 120 factories had been established. All plastics factories belong to the private sector and a certain co-operation between those factories and the Government could be observed. A new trend towards specialization in factory activities has emerged.

About 20 factories are employing more than 100 workers, most of them for 24 hours a day. Nearly all machines are imported from western European countries, mainly France, Germany, Federal Republic of, Italy and the United Kingdom of Great Britain and Northern Ireland. The work-force is entirely Tunisian.

Status of the plastics industry in Tunisia

All plastics raw materials processed in Tunisia are imported, mainly from western European countries, the leading suppliers being France and Italy. Data on the types and number of machines used are given below.

<u>Types of machine</u>	<u>Number</u>
Extrusion	80
Injection moulding	100
Blow moulding	20
PU foaming	4
PVC compounding	2
Thermoforming	6
Pressing	12
Polyester machines	4

Plastics raw materials processed in Tunisia

The present processing capacity of all plastics factories in Tunisia is approximately 40,000 t/a. The actual consumption of plastics raw materials in 1980 was 75 per cent of the installed capacity. Table 4 shows the plastics raw materials processed in Tunisia during the period 1978-1980 and the consumption forecast for 1985.

Table 4. Plastics raw materials processed in Tunisia and consumption forecast for 1985
(tons)

Material	1978	1979	1980	Consumption forecast (1985)
PE	14 000	12 000	13 000	20 000
PVC	9 000	6 500	7 000	8 500
PS	3 000	3 700	4 000	4 000
PP	2 500	3 800	4 000	4 000
PJ	2 500	1 800	2 000	2 000
Polyester	1 000	700	800	1 500
Total	32 000	28 500	30 800	40 000

About 80 per cent of PE consumed is low density polyethylene for packaging. Table 5 shows the plastics raw materials consumption by product in Tunisia during the period 1978-1980 and the consumption forecast for 1985.

Table 5. Plastics raw materials consumption by product in Tunisia
(tons)

Product	1978	1979	1980	Consumption forecast (1985)
Household articles	3 000	2 770	3 000	4 200
Cosmetics	500	380	350	650
School and office articles	5 000	4 070	4 420	5 650
Toys	500	370	400	600
Furniture	3 000	2 400	2 800	3 000
Electrical parts	4 000	3 200	3 500	5 000
Housing and sanitary equipment	4 000	3 500	3 800	5 000
Car industry	-	-	-	100
Boats	300	200	300	450
Chemical industry	400	370	400	500
Agriculture	700	650	1 000	1 600
Packaging	1 000	9 000	9 700	12 400
Others	600	1 590	1 130	850
Total	32 000	28 500	30 800	40 000

Visits to plastic processing factories in Tunisia

Two factories were visited.

Coplacelle

Main activity: injection moulding for household articles, production of HDPE and LDPE film and blow moulding for hollow articles

The factory has 12 injection moulding machines with clamping forces ranging from 100 t to 1,000 t, 12 extruders for making film and two blow moulding machines.

Findings

1. The factory operates 24 hours a day and all machines are imported from Europe. The work-force consists of 120 Tunisians.
2. The factory is well kept and organized.
3. The machines have a processing capacity of 2,500 t and their actual consumption is 2,000 t.
4. There are plans to install an extruder to produce PE pipes with a diameter of up to 150 mm for irrigation purposes.
5. All moulds are imported from Spain and the United Kingdom.

Cotoplast

Main activity: production of foil and sheet making for disposable cups.

The factory has four up-to-date extruders.

Findings

1. The factory operates 24 hours a day, the machines are well kept and the production is fairly good.
2. All the workers and technicians are Tunisians.
3. The factory nearly covers all the requirements of factories in Tunisia producing disposable cups.

D. Algeria

Information was obtained from the following sources: the National Bureau of Statistics, the UNDP publication entitled "Plasticulture", the Deputy Director of the Petrochemical Industries, the Commercial Management Department of Sonitex, the Ministry of Planning, the Vice-president of Sonatrach and factory visits.

The population of Algeria is about 18 million. It is concentrated in the northern provinces where industry is located and the climatic conditions are favourable.

Status of the plastics industry in Algeria

The plastic processing industry in Algeria started on a small scale and has expanded rapidly during the past 15 years. Most of the factories belong to the private sector, with the exception of some plastics processing complexes which are government-owned. All machines, dies, moulds, and raw materials are imported, except for PVC which is produced locally in the petrochemical complex at Skekeda. Most of the plastics processing factories are either in Stef or in Elasmam. All belong to Sonatrach, which is a government organization. They process all types of plastic products, such as PVC profiles, PVC tiles for floor covering, soft PU expandable polystyrene (EPS) for insulation and packaging, and polyester decorative sheets. Two factories for electrical and telephone cables are in Algiers, the capital.

Table 6, based on data obtained from the Ministry of Planning and from industries, shows the plastics raw materials processed in Algeria during the period 1978-1980 and the consumption forecast for 1985.

Table 6. Plastics raw materials processed in Algeria and consumption forecast for 1985
(tonn.)

Material	1977	1978	1979	1980	Consumption forecast (1985)
LDPE	16 000	20 000	25 000	30 000	65 000
HDPE	14 000	16 000	17 000	17 000	37 000
PVC	20 000	18 000	18 000	22 000	69 000
PS	1 500	1 500	4 000	5 000	10 000
PP	250	1 000	1 500	2 000	5 000
PU	250	350	500	750	2 000
Polyester	500	700	1 000	1 200	3 000
Total	52 500	57 550	67 000	77 950	191 000

Status of the petrochemical industry in Algeria

There are two petrochemical complexes in Algeria, one located in Skekeda and the other in Arzew. Table 7 presents data on the complex at Skekeda.

Table 7. Data on the petrochemical complex at Skekeda
(tons)

Product	Design capacity	Actual capacity	Local market consumption	Exported
Ethylene	120 000	100 000	50 000	50 000
LDPE	48 000	-	30 000	-
VCM	40 000	28 000	70% for PVC	-
PVC	35 000	24 500	22 000	2 500

Ethylene production started in 1978 and LDPE production was planned for June 1981. Vinyl chloride monomer (VCM) and PVC production started in 1980. Table 8 presents data on the complex at Arzew.

Table 8. Data on the petrochemical complex at Arzew
(tons)

Product	Design capacity	Actual capacity	Local market consumption	Exported
Methanol	100 000	100 000	15 000	85 000
Synthetic resin	15 000	15 000	15 000	-

Synthetic resin is used to produce phenol, urea and melamine formaldehyde as adhesives. It is partly used for moulding powders.

There is a project to produce HDPE, with a design capacity of 40,000 t/a. The production facilities are expected to become operational in 1985.

Visits to plastics processing factories

Complex transformation matières plastiques

1. Sonatrac T P I G

Main activity: making film to produce shopping bags, injection moulding to produce household articles and bottle crates, blow moulding for hollow articles up to 30 l.

Findings

1. The factory was running with 50 per cent of its design capacity.
2. All moulds are imported.

2. Sonatrac T P II G

Main activity: production of PVC and PE pipes of up to 350 mm, PVC garden hoses and small electrical parts in PVC and PE, PVC compounding and injection moulding for crates and chairs.

Findings

1. The factory was running at 50 per cent of its design capacity.
2. The compounding unit was running at 70 per cent of its capacity.

There are plans for the future production of rigid PVC pipes of up to 750 mm and increases in the capacity of the compounding unit.

E. Morocco

Information was obtained from the following sources: the Chemistry Department, the Département de la promotion, the Chemical Industries Division and the Research Division of ODI, the General Director and Secretary-General of the National Union of Moroccan Plastics Industries, the General Director of IMEC and factory visits.

Morocco has a population of approximately 20 million. Most of the plastics processing factories are in Casablanca and Rabat. All factories belong to the private sector.

Status of the plastics processing industry in Morocco

About 205 factories for plastics processing operate in Morocco, with a work-force of approximately 15,000 persons. Most of the goods produced are household articles, PE shopping bags, rigid and flexible PVC pipes and EPS for packaging and insulating purposes. Industrial articles represent seven per cent of total production.

The biggest injection moulding machine has a shot weight of 5 kg and the biggest blow moulding machine can produce drums of up to 225 l for storing olive oil. The biggest extruder for pipes can produce PVC pipes with a diameter of up to 200 mm. Most of the machines are imported from Europe.

Plastics raw materials processed in Morocco

According to the data obtained, the installed processing capacity of all machines in Morocco is 65,000 t, while the total consumption in 1980 was about 42,000 t.

Table 9 shows the plastics raw materials processed in Morocco during the period 1976-1980 and the forecast consumption for 1985.

Table 9. Plastics raw materials processed in Morocco and the consumption forecast for 1985
(tons)

Material	1976	1977	1978	1979	1980	Consumption forecast (1985)
FE	23 400	28 363	27 215	27 063	26 272	28 000
PVC	12 770	11 488	13 267	13 060	13 000	15 000
PS	1 200	1 505	2 002	1 342	1 400	1 800
PP	1 000	1 203	1 509	400	600	1 000
PU	100	115	120	100	140	200
Polyester	150	200	210	500	500	500
Total	38 620	42 874	44 323	42 465	41 912	46 500

There is a factory at Mohammadia near Casablanca which became operational in 1978, and which produces PVC resin with a design capacity of 25,000 t/a. This factory is supplying Morocco with its PVC requirements, its actual capacity being 13,000 t/a, which represents the total local consumption.

Visits to plastics processing factories in Morocco

Industrie des matières plastiques SAPA

Main activity: production of PVC shoes and soles, shopping bags, heavy-duty sacks, PE pipes, pipes and tubes for trickle irrigation, PVC discs, EPS sheets for insulation and moulded articles, vacuum forming for lamp shades and PVC compounding.

Findings

1. All factories suffer considerably from high customs duties, which may reach 50 per cent on plastics raw materials, causing high production costs and hindering the growth of the plastics processing industry. This can be easily detected from the data on plastics raw materials processed since 1977.
2. The petrochemicals complex at Mohammadia operates at 50 per cent of its nominal capacity, causing high production costs.

Visit to the Moroccan Institute for Packaging

On the basis of discussions with the General Director of the Institute, the following information was obtained:

(a) With regard to plastics in packaging, half of the plastics processing factories were established during the past 15 years. Articles for packaging, such as shopping bags and fish and fruit crates, represent about 45 per cent of the total production. About 60 per cent of the factories employ less than 50 persons, and 80 per cent of the factories are located in Casablanca, which represents the biggest consumer market. The plastics processing machines work with 40 per cent of design capacity, since the local market is comparatively small and custom duties on imported raw materials is high;

(b) The Institute is well equipped with all the machines required for testing the different types of packaging material;

(c) Ten engineers and six technicians work in the different laboratories of the Institute;

(d) Publications and magazines are issued periodically.

Projects under study for the future development
of the plastics industry in Morocco

PVC floor covering

Project objectives: manufacture of floor covering tiles

Production capacity: 500,000 m²/a

Raw material: 2,500 t of PVC produced locally

Projected employment: 70 persons

Low-density polyethylene

Project objectives: manufacture of LDPE

Production capacity: 60,000 t/a

Raw material: imported ethylene

Projected employment: 250 persons

Ball-point pens

Project objectives: manufacture of ball-point pens

Production capacity: 7,500,000 units per year

Raw material: PS and rubber

Projected employment: 20 persons

Alkyd paint

Project objectives: manufacture of long and medium resins for paints

Production capacity: 5,000 t of diluted resins

Projected employment: 30 persons

Plastic dishware

Project objectives: manufacture of high-quality dishware

Production capacity: 500-1,000 t/a of melamine formaldehyde

Projected employment: 40 persons

Plastic toys

Project objectives: manufacture of plastic toys

Production capacity: 300 t/a

Raw material: PVC

Projected employment: 40 persons

Plastic transformation

Project objectives: manufacture of plastic bags

Production capacity: 300 t/a

Projected employment: 20 persons

Polyurethane foam

Project objectives: manufacture of polyurethane foam

Production capacity: 1,000 t

Projected employment: 50 persons

F. Sudan

Information was obtained from the following sources: the Ministry of Industry, the Ministry of Commerce, the Industrial Research and Consulting Institute and factory visits.

Sudan has about 25 million inhabitants and its plastics processing factories are mainly in Khartoum and Omdurman.

Status of the plastics industry in Sudan

The main plastics processing machines used are listed below.

- 23 extruders for pipe-making and garden hoses
- 34 extruders for making film
- 39 injection moulding machines for PVC shoes
- 30 injection moulding machines for household articles
- 25 blow moulding machines for hollow articles
- 4 twin screw extruders for rigid PVC pipes

Most of the machines work only one shift because of the lack of raw materials, and about 50 per cent of the existing machinery is idle due to the interrupted power supply. Customs duties on imported plastics raw materials, which may reach 60 per cent, are comparatively high. All moulds are imported and production of industrial articles is rare.

Plastics raw materials consumption in 1980

LDPE: 4,000 t (2,200 for packaging, 600 for pipes, 400 for injection moulding, 800 for hollow articles)
 HDPE: 4,000 t (2,000 for crates, 2,000 for household articles)
 PVC: 7,000 t (2,000 for footwear, 2,000 for bottles, 2,000 for hoses, 600 for pipes, 400 for leather)
 PP: 700 t for woven bags
 PS: 300 t for disposable cups and household articles
 PU: 75 t for mattresses
 Total: 16,075 t

Visits to plastics processing factories

Most of the plastics factories visited use old machinery producing primitive household articles, flexible hoses, LDPE pipes and disposable cups. All the factories suffer from a lack of raw materials and technicians and interrupted power supplies.

G. Kuwait

Information was obtained from the following sources: the Ministry of Commerce and Industry, a UNIDO consultant for the chemical and petrochemical industries and factory visits.

Kuwait has 1.25 million inhabitants, 50 per cent of them foreigners from other Arab countries and Asia. Hundreds of plastic finished articles are imported. Hong Kong and Japan being two of the main suppliers.

Status of the plastics processing industry in Kuwait

There are 20 plastics processing factories in Kuwait, all of them belonging to the private sector. Data on the factories are presented in tables 10 and 11.

Table 10. Plastics processing factories in Kuwait and type of production

Number of factories	Type of production	Material	Consumption in 1980 (tons)
3	PU foam for mattresses	PU	5 400
1	Shoe-making	PVC	250
1	PVC rigid pipes and garden hoses	PVC	2 200
1	PVC tiles	PVC	250
3	Disposable cups	PS	450
7	Boats, tanks, ice boxes, pipes	Polyester	3 300
1	PP woven bags and PE bags	PP	1 750
3	Household articles, bottles, shopping bags	PE and PVC	3 200
20			17 000

Table 11. Plastics raw materials processed in Kuwait
(tons)

Material	1976	1977	1978	1979	1980	Consumption forecast (1985)
PE	1 700	2 800	2 250	3 000	4 000	6 000
PVC	1 000	1 650	1 300	1 750	2 500	3 500
PP	450	650	500	700	1 000	2 000
PS	250	450	350	420	600	900
PU	2 000	3 800	3 000	4 000	5 400	6 000
Polyester	1 600	2 150	1 600	2 130	3 500	6 000
Total	7 000	11 500	9 000	12 000	17 000	24 400

Projects currently under study are listed below:

<u>Number of projects</u>	<u>Production objectives</u>
3	Shopping bags
3	Household articles
2	PP cords
2	PVC garden hoses
Total 10	

Data on the petrochemical industry in Kuwait is given below:

<u>Material</u>	<u>Production capacity (1,000 tons)</u>
Ethylene	350
Benzol	184
Ortho-xylene	60
Para-xylene	86
Ethylene glycol	135
Styrene	320
LDPE	130
Melamine	15

H. Bahrain

Bahrain has about 350,000 inhabitants and seven plastics processing factories, two of which are closed because of technical problems. Three factories produce glass-reinforced polyester articles such as boats, tanks and sanitary equipment, three produce film for shopping bags, and one, the largest, produces PVC pipes of up to 225 mm in diameter and consumes about 2,000 tons of PVC.

The following data were obtained through direct contacts with factory owners.

Raw materials processed in Bahrain in 1980

LDPE:	1,500 t for making film for shopping and rubbish bags
HDPE:	750 t for crates and jerrycans
PVC:	550 t for water pipes and electrical conduits
PP:	50 t for mats
PS:	100 t for disposable cups
Polyester:	350 t for tanks, boats and sanitary equipment
Total	<u>3 300 t</u>

Projects currently under study are listed below:

<u>Number of factories</u>	<u>Product</u>
2	Bags
1	PU mattresses
1	Acrylic sheets
1	Polyester tanks
1	Electrical appliances

I. Qatar

Qatar has 250,000 inhabitants, of which 8 per cent are foreigners from other Arab countries and Asia. Qatar has a big petrochemical complex constructed by the French company Chémie de France.

Information was obtained from the following sources: a consultant of the petrochemical industries in GOIC, the head of the Industrial Technology and Development Centre (ITDC), an ITDC consultant of petrochemical industries and an ITDC engineer.

Status of the plastics processing industry in Qatar

There are five factories for plastic processing: one factory for PVC pipes, with a capacity of 1,200 t/a; one factory for EPS sheets for insulation, with a capacity of 200 t/a; two factories for shopping bags, with a capacity of 800 t/a; and one factory for disposable cups, with a capacity of 200 t/a.

Raw materials processed in Qatar in 1980

LDPE:	800 t
PVC:	1,200 t
EPS:	200 t
PS:	<u>200 t</u>
Total	2,400 t

Visit to the petrochemical complex at Umm Said (QAPCO)

The petrochemical complex at Umm Said is a joint-venture project between Qatar and Chémie de France. It is designed to utilize one of the important natural resources of Qatar. Its annual production is 140,000 t of ethylene, but the actual capacity is 280,000 t/a.

The LDPE plant, with a capacity of 140,000 t/a in one line, is only the second plant in the world having such a unit capacity. The LDPE is sold through a marketing contract with Chémie de France. About 60 per cent of the production will be loaded in containers and the rest on pallets.

The number of employees is about 600, most of them Arabs, Asians and French. About 10 per cent are Qatarians.

A new project for QAPCO is a plant for HDPE with an annual capacity of 70,000 t, which is planned to go on stream by the end of 1983.

J. Saudi Arabia

Information was obtained from the following sources: the Ministry of Industry, a Saudi Arabian consulting house, the Saudi Arabian Basic Industries Corporation (SABIC) and factory visits.

The plastics processing industries in Saudi Arabia started 20 years ago to produce simple moulded articles and PE film for packaging, and then expanded until it reached about 40 factories in 1977.

Status of the plastics processing industry in Saudi Arabia

The number of plastics processing factories in Saudi Arabia at present is about 75. They are privately-owned and carry out almost all plastics processing operations. Most are located in Riyadh, Jeddah and Dammam and are engaged in the following activities.

Building, construction and agriculture

PVC pipes for drinking water, sewage and electrical conduits
PVC profiles for window and door frames
PVC fittings, tiles and floor covering
EPS and PU sheets for heat insulation
Sanitary equipment such as toilet seats and artificial marble
Electrical parts

Packaging

Shopping bags made from HDPE and LDPE
Woven bags and heavy-duty sacs for fertilizer
Medical packaging

Bottle and fruit crates
Ice cream and yoghurt cups
Jerrycans and PVC bottles for vegetable oil
GRP tanks for water and chemicals
Rubbish pots

Industrial production

Soft PU for mattresses and furniture
Artificial leather
Tables, chairs and sheets made from polyester
PP cords and tapes for packaging
PP battery cases for lead acid batteries
Spare parts for textile machines
Electrical cables

Production of household articles

Houseware made from thermoplastic materials
Houseware made from melamine formaldehyde moulding powder
Toys, mats and PVC shoes

The number of plastics processing machines is approximately 400, of which 150 are for making film, 134 for injection moulding, 45 for blow moulding, 16 for vacuum forming, 10 for block moulding, 20 for shoe-making and 25 for thermosetting material.

Plastics raw materials processed in Saudi Arabia

Table 12 shows the amount of plastics raw materials processed in Saudi Arabia in 1980 and the consumption forecast for 1985.

Table 12. Plastics raw materials processed in Saudi Arabia
(tons)

Material	1980	Consumption forecast (1985)
LDPE	19 700	25 000
HDPE	15 000	20 000
PVC	26 000	95 000
PS	6 500	8 000
PP	2 000	4 000
PU	12 000	20 000
Polyesters	12 000	18 000
Total	129 200	190 000

Visits to plastics processing factories in Saudi Arabia

Saudi Arabian Plastics Products Company (SAPPCO)

Main activity: PVC pipes for water, irrigation and electrical conduits, PVC fittings and EPS in the form of blocks, sheets and moulded articles

The main factory is located in the industrial zone of Riyadh and has 22 extruders and all the ancillary equipment needed.

Findings

1. The factory is well organized.
2. PVC consumption is about 50,000 t/a.
3. EPS consumption is 4,500 t/a.
4. Ninety-five per cent of the technicians are foreigners, mainly from Arab countries.
5. There is a project to produce rigid PU for insulation, with a design capacity of 9.2 million m²/a.

El-Shark for Plastics and Paper

Main activity: PE film for shopping bags and packaging, PE film for heavy-duty sacks and for agriculture, household articles, bottle and fruit crates and rubbish bags

Findings

1. Most of the technicians and workers are foreigners.
2. LDPE consumption is about 3,500 t/a.
3. HDPE consumption is about 2,100 t/a.
4. All machinery is imported from western European countries.
5. The making of film is expected to expand.

Petrochemical industries in Saudi Arabia

The current petrochemical projects in Saudi Arabia, which is considered the biggest Arab country in the production of polymers, are listed below:

Saudi Methanol Company

Location: Jubail

Feedstock: methane

Production: 600,000 t/a of chemical grade methanol

Production time: 1983

National Methanol Company

Location: Jubail

Feedstock: methane

Production: 650,000 t/a of chemical grade methanol

Production time: 1985

Saudi Yanbu Petrochemical Company

Location: Yanbu

Feedstock: ethane

Production: 200,000 t/a of LDPE and 90,000 t/a of HDPE
450,000 t/a of ethylene and 220,000 t/a of ethylene glycol

Production time: 1985

Al Jubail Petrochemical Company

Location: Jubail

Feedstock: ethylene

Production: 260,000 t/a of LDPE

Production time: 1985

Saudi Petrochemical Company

Location: Jubail

Feedstock: ethane

Production: 656,000 t/a of ethylene, 295,000 t/a of styrene, 281,000 t/a of crude
industrial ethanol, 454 t/a of ethylene dichloride

Production time: 1985

Arabian Petrochemical Company

Location: Jubail

Feedstock: ethane

Production: 500,000 t/a of ethylene, 180,000 t/a of LDPE and HDPE

Production time: 1985

Eastern Petrochemical Company

Location: Jubail

Feedstock: ethylene

Production: 130,000 t/a of linear LDPE, 300,000 t/a of ethylene glycol

Production time: 1985

K. Iraq

Information was obtained from the following sources: the Ministry of Industry, documents from the AIDO library, a plastics expert of AIDO and the Director General of the General Directorate for Mixed Sector Enterprises.

Iraq has 16 million inhabitants. Its plastics processing industry, which started twenty years ago, has expanded rapidly during the past ten years. In 1980 the number of plastics factories was about 400, most of them belonging to the private sector, with the exception of a few which are either government-owned or in the mixed sector. All plastics raw materials are processed in Iraq, especially those used to produce engineering or technical articles. Imports of plastics raw materials are organized by the Government and there is co-ordination between the Ministry of Industry and the private sector.

Status of the plastics processing industry in Iraq

The factories are distributed throughout the country, although most are located in Baghdad. The biggest plastics processing factory, which can be regarded as a plastics transformation complex, is located in Baghdad and belongs to the mixed sector.

The plastics processing industry in Iraq is engaged in the following activities:

- (a) Building and construction of such products as PVC and PE pipes for housing and agriculture, PVC tiles, EPS for insulation, sanitary equipment and electrical parts;
- (b) Industrial production of such items as electrical cables, spare parts for machines, artificial leather and PP battery cases;
- (c) Production of packaging, including shopping bags, PP woven bags, heavy-duty sacks for fertilizer, disposable cups, and bottle and fruit crates;
- (d) Manufacture of houseware such as buckets, trays, plates, toys, mats and PVC shoes.

Plastics raw materials processed in Iraq

The main plastics raw materials processed in Iraq are PE, PVC, PS, PP, PU and Polyester. Data on the plastics raw materials processed in Iraq in 1980 and the consumption forecast for 1985 are presented in table 13.

Table 13. Plastics raw materials processed in Iraq
(tons)

Material	1980	Consumption forecast (1985)
PE	41 000	50 000
PVC	38 000	45 000
PS	8 000	10 000
PP	10 000	12 000
PU	8 000	9 000
Polyester	1 000	2 000
Total	106 000	128 000

About 65 per cent of PE consumption consists of LDPE, and the rest is HDPE.

The government and mixed sectors consume about 60 per cent of the plastics raw materials processed in Iraq, and the rest goes to the private sector.

Visit to the National Company for Chemical and Plastic Industries

This company with a work-force of approximately 1,000, is the biggest factory in Iraq in terms of raw materials consumption and the number of workers. It belongs to the mixed sector and is engaged in nearly all plastics processing activities, including the following:

- (a) Injection moulding to produce radio and television cabinets and all big technical articles in acrylonitrile-butadienestyrene copolymer. The clamping force of machines installed ranges from 40 t to 800 t;
- (b) The use of PU machines to produce mattresses. Its capacity of 8,000 t/a exceeds the requirements of the country;
- (c) The operation of a PVC compounding factory with a consumption of 6,000 t/a and a design capacity of 8,000 t/a;
- (d) The use of presses for thermosets with a consumption of 250 t/a of melamine and phenol formaldehyde moulding powder;
- (e) Sheets and foil extrusion to produce disposable cups and sheets of refrigerator inner liner from high impact polystyrene;
- (f) The use of extruders to produce PE film for bags and for agriculture. The current capacity of 7,000 t/a will be increased to 10,000 t/a;
- (g) The use of extruders for PVC pipes of 50 mm to 100 mm in diameter. The annual consumption is 600 t/a.

Findings

1. The factory operates 24 hours a day.
2. There is a shortage of technicians and workers.
3. All moulds are imported.
4. All machines are up-to-date and imported mainly from western European countries.

New projects under study are listed below:

<u>Project</u>	<u>Raw materials consumption</u> <u>(tons per annum)</u>
Bottles for mineral water	PVC (1,500)
Tiles for floor covering	PVC (1,500)
PVC fittings	PVC (2,500)
PVC electrical conduits	PVC (1,600)
New compounding unit	PVC (15,000)
Increasing the capacity of agricultural film	PE (3,000)

A petrochemical complex located in Basra has a nominal capacity of 60,000 t/a of LDPE and 30,000 t/a of HDPE. There is a plan to establish a factory to produce PVC, with a design capacity of 60,000 t/a.

Annex

PETROCHEMICAL PROJECTS IN ARAB COUNTRIES

Petrochemical projects operating or planned in Arab countries
(production in 1,000 t/a)

	Ethylene	Propylene	Butadiene	Benzol	LDPE	HDPE	PP	PVC	Melamine	Methanol
Algeria	120	-	-	95	48	40	-	35	-	100
Bahrain	-	-	-	-	-	-	-	-	-	330
Iraq	135	-	-	-	60	30	-	60	-	-
Kuwait	350	-	-	184	130	-	-	-	15	86
Libyan Arab Jamahiriya	330	165	45	-	100	50	50	60	-	-
Qatar	280	-	-	-	140	70	-	-	-	-
Saudi Arabia	2 056	-	-	-	778	276	-	150	-	1 300
United Arab Emirates	450	-	-	-	-	-	-	-	-	-
Total	3 721	165	45	379	1 256	426	50	305	15	2 390

