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19861

FATTY ACIDS PRODUCTION

Consultant: Graham RUIE
Building off Herco Vigie 1987/1991/1992

CONTENT

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INTRODUCTION

Fats and oils are considered one of the three major classes of basic food substances and a source of energy. For purposes others than human nutrition, fatty acids play an important role.

Fatty acids are carboxylic acids derived from or contained in an animal or vegetable fat or oil. All fatty acids are composed of a chain of alkyl groups containing from 4 to 22 carbon atoms (usually evennumbered) and characterized by a terminal carboxyl group $-COOH$.

Fatty acids may be saturated or unsaturated (olefinic), and either solid, semisolid or liquid. They are classed among the lipids, together with soap and waxes.

The most common saturated fatty acids in edible fats and oils are palmitic (16c.), stearic (18c.) and lauric(12c.). The most common unsaturated acids are oleic, linoleic and linolenic. The unsaturation accounts for the broad chemical utility of these substances, especially of drying oils.

Fatty acids are produced industrially from tallow, palm oil, palm stearin, palm kernel oil and coconut oil. The current and future supply situation of these raw materials and market economics favour palm stearin and palm kernel oil as major raw materials for fatty acids.

Referring to processes, the Malaysian oleochemical industry has adopted high-temperature and high-pressure "splitting" of triglycerides. Enzymic hydrolysis at low temperature has the advantage of energy conservation compared to the high-temperature and pressure-splitting process.

Fatty acids in turn may be fractionated into saturated/unsaturated acids and to specific chain lengths by winterization, panning and pressing, fractional distillation, solvent crystallization and hydrophilization methods.

Malaysia produces approx. 65% of the world's palm oil. Palm oil products are refined, bleached and deodorized oil for edible or industrial use and the acid oil or fatty acid distillate for industrial uses.

Oleochemical markets are extremely diverse but usually involve surface modification. Fatty acid disposition and real consumer personal income correlate closely. Growth of consumer income in the 1990s will be the most important factor in determining growth of fatty chemicals.

Fatty chemicals compete with petroleum-derived products; and therefore, price relation-ship of natural fats versus petroleum will affect market share.

1.- RETROSPECTIVE INFORMATION SEARCH : 1980-1992

ABSTRACTS :

- 1.- 110. 191101f Application of microorganisms to organic synthesis. Asano, Yasuhisa (Sagami Chuo Kagaku Kenkyusho, Japan). *Petrotech (Tokyo)* 1989, 12(1), 42-8 (Japan). A review with 40 refs. on microbial fermt. for prodn. of fatty acids, D-amino acids, and fatty acid amides.

2.- 839529 PROJECT COSTS FOR THE MANUFACTURE OF STEARIC ACID AND OLEIC ACID FROM CASTOR OIL. Processes have been developed on a pilot-plant scale (13 kg/batch) for the manufacture of castor stearin and castor olein by simultaneous hydrogenation and dehydration of castor oil in a single step using indigenous catalysts. High-pressure splitting (12 kg/batch) of castor stearin and castor olein and straight distillation (14 kg/batch) of crude fatty acids gave stearic acid of 91-92 percent purity and oleic acid of 75-77 percent purity respectively. Yields based on castor oil were 77 percent distilled stearic acid and 76 percent distilled oleic acid. Preliminary project cost estimates have been made. (Author abstract). 8 Refs.

Lakshminarayana, G. (CSIR, Hyderabad, India); Paley, M.M.; Rao, H. Shripathi; Venkateshram, B.; Chandrasekharan, K.; Rao, K.V.S.A. *Res Ind* v 33 n 1 Mar 1988 p 12-15.

3.- 852839 Biotechnological processes for production of poly-unsaturated fatty acids. Fungal mycelia were found to be new and rich sources of C_{22} -polyunsaturated fatty acids through our screening for wide variety of microorganisms. A soil isolate, *Mortierella alpina* 15-4 produced 4.3 g/L (474 mg/g dry mycelia) of arachidonic on cultivation in a medium containing glucose. The value accounted for more than 65% of the total fatty acids in the extracted lipids from the mycelia. The mycelial dihomogamma-linolenic acid content of the same fungus was found to increase (107 mg/g dry mycelia), with an accompanying marked decrease in its arachidonic acid content on cultivation with sesame oil. This phenomenon was found to be due to a specific repression of the conversion of dihomogamma-linolenic acid to arachidonic acid. (Edited author abstract) 26 Refs.

Yanada, H. (Kyoto Univ, Kyoto, Jpn); Shimizu, S.; Shimizu, Y.; Kawashima, H.; Akimoto, K. *J Dispersion Sci Technol* v 10 n 4-5 Aug-Oct 1989 Proceedings of the 1988 Nara Workshop on Functional Fats and Lipids. Nara, Jpn, Oct 4-6 1988. p 561-579.

4.- 109: 151893p Process for the continuous fractionation of a mixture of fatty acids. Trailter, Helmut; Wille, Hans Juergen (Societe des Produits Nestle S. A.) Eur. Pat. Appl. EP 271,747 (Cl. C11C1/00), 22 Jun 1988, CH Appl. 86/5,027, 17 Dec 1986; 10 pp. In order to enrich the content of biol. active polyunsatd. fatty acids from a fat material of either vegetable or animal origin, an inclusion complex of the fatty acids with a complexing agent is formed in soln., the soln. is cooled, the insol. inclusion complex is sepd. out as a solid, and the enriched fatty acid fraction is recovered in the liq. phase. The insol. inclusion complex is formed by cooling the reaction mixt. over 1-5 serially arranged grater-plate heat exchangers. Black currant oil was sapond., the fatty acids mixed with EtOH and di-Na EDTA, the mixt. heated to 60° for 30 min, cooled, acidified, and the insol. inclusion complex removed, producing an enriched fraction which contained 65% γ -linolenic acid, vs. 17.4% for unenriched black currant oil.

British Library Lending Division,
Boston Spa, Wetherby, West Yorkshire,
United Kingdom, LS23 7BQ.

5. - 108:7829) Industrial uses [of palm oil]. De Vries, R. J. (Acidchem (Malaysia). Penang, Malay.). *Crit. Rep. Appl. Chem.* 1987, 15(Palm Oil), 92-7 (Eng). A review with no refs. on the industrial uses of palm oil, including fatty acid prodn., soap making, tin plating, cosmetic and pharmaceutical applications, palm Me esters, and textile lubricants.

6. - 043309 BIOSYNTHESIS OF FATTY ACIDS AND LIPIDS. The major lipid types, including the various fatty acids, of bacteria, yeasts and fungi are enumerated together with brief indications of the metabolic relevance of the various materials. The patterns of lipid accumulation are described for eukaryotic microorganisms growing in batch- and continuous culture. Information is provided concerning how the amount of lipid and its composition in an organism varies with its environment and growth conditions. The biosyntheses of fatty acids, saturated, unsaturated, branched chain and hydroxylated, are described and include mention of how oleaginous microorganisms are able to accumulate high amounts of lipid. There is brief coverage of the synthesis of triacylglycerols, phospholipids and waxes. The final section covers the utilization of alkanes and deals primarily with the mechanisms of oxidation and the ensuing pathways of metabolism. The various products which can arise from alkanes are enumerated. (Author abstract) 76 refs.

Boulton, C.A. (Univ of Hull, Engl); Rattledge, C. *Compr. Biochem. The Princ. Appl and Regul of Biotechnol in Ind, Agric and Med. v 1. Princ of Biotechnol: Sci Fundam* Publ by Pergamon Press, Oxford, Engl and New York, NY, USA, 1981, p 459-482.

7. - 041708 PROCESSING FOR INDUSTRIAL FATTY ACIDS - II. Fatty acids are produced industrially from tallow, palm oil, palm stearin, palm kernel oil and coconut oil. The current and future supply situations of these raw materials and market economics favor palm stearin and palm kernel oil as major raw materials for fatty acids. The Malaysian oleochemical industry has adopted high-temperature and high-pressure "splitting" of triglycerides. Enzymic hydrolysis at low temperature has the advantage of energy conservation compared to the high-temperature and pressure-splitting process. (Edited author abstract) 4 refs.

Ooi, Sean Lin (Acidchem (M) Sdn Bhd, Butterworth, Malaysia); Poo, Ho Kee. *JAOCS J Am Oil Chem Soc* v 62 n 2 Feb 1985, 1984 World Conf on Process of Palm, Palm Kernel and Coconut Oils, Malays, Nov 12 1984 p 348-351

8. - 041707 PROCESSING FOR INDUSTRIAL FATTY ACIDS - I. Palm kernel and coconut oils are particularly important to the fatty acid industry because they are the major sources of lauric acid. This paper describes the processes used to convert these oils to their fatty acids. These in turn may be fractionated into saturated/unsaturated acids, and to specific chain lengths by winterization, punning and pressing, fractional distillation, solvent crystallization and hydrophilization methods. (Edited author abstract) 16 refs.

Combs, Duane E. (Emery Industries). *JAOCS J Am Oil Chem Soc* v 62 n 2 Feb 1985, 1984 World Conf on Process of Palm, Palm Kernel and Coconut Oils, Malays, Nov 12 1984 p 327-330

067838 CHALLENGES TO A MATURE INDUSTRY: MARKETING AND ECONOMICS OF OLEOCHEMICALS IN THE UNITED STATES. Oleochemical markets are extremely diverse but usually involve surface modification. Fatty acid disposition and real consumer personal income correlate closely. Growth of consumer income in the 1980s will be the most important factor in determining growth of fatty chemicals. Fatty chemicals compete with petroleum-derived products; and therefore, price relationship of natural fats versus petroleum will affect market share. In this paper, the terms fatty chemicals and oleochemicals will be used interchangeably. 2 refs.

Leonard, E. Charles (Witco Chemical Corp. Memphis, Tenn. USA); Kopold, S.L. Jr. *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem. Montreux, Switz. Sep 18-23 1983 p 176-179.

064874 PRODUCTION OF FATTY ALCOHOLS FROM FATTY ACIDS. Detergent-range alcohols from natural feedstocks can be produced by high pressure hydrogenation of either methyl esters or fatty acids. The increasing quantities of fats and oils on the world market secure a reliable and economically priced material. Although fatty acid is an abundant worldwide commodity, most alcohol producers hydrogenate methyl esters, because direct hydrogenation of fatty acids is difficult as the catalyst is sensitive to acid attack. The process described here makes it possible to hydrogenate fatty acids directly to alcohols of high quality without prior esterification. 8 refs.

Voecke, Theodor (Lurgi Kohle und Mineraloeltechnik GmbH, Forschungslaboratorium, Frankfurt am Main, West Ger); Buchold, Henning. *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem. Montreux, Switz. Sep 18-23 1983 p 350-352.

067837 CHALLENGES TO A MATURE INDUSTRY: MARKETING AND ECONOMICS OF OLEOCHEMICALS IN WESTERN EUROPE. Availability and price development of oils and fats are discussed with particular reference to European conditions. The importance and development of the oleochemical raw material fatty acids, fatty acid methyl esters, glycerine, fatty alcohols and amines are considered on the basis of historical data. In considering future developments of oleochemicals, the capacity, demand and the possible influence of petrochemistry or crude oil is discussed. 1 ref.

Richter, H.J. (Henkel KGaA, Oleochemicals Div., Duesseldorf, West Ger); Knaur, J. *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem. Montreux, Switz. Sep 18-23 1983 p 160-175.

046064 FATTY ACID FRACTIONATION BY COLUMN DISTILLATION: PURITY, ENERGY CONSUMPTION AND OPERATING CONDITIONS. This paper discusses the optimal process conditions for production of individual fatty acids of any desired purity up to higher than 99%. The design of columns for efficiency and low pressure drop is influenced by the thermal properties of crude acids and the quality demands on distillate fractions. Environmental requirements can be met by working without open steam. Bottom temperatures should not exceed 250 C, to prevent thermal degradation of fatty acids as well as corrosion of stainless steel. 10 refs.

Stage, Hermann (ATT-Verfahrenstechnik GmbH, Muenster, West Ger). *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem. Montreux, Switz. Sep 18-23 1983 p 204-214.

13. -
046068 UTILIZATION OF MALAYSIAN PALM OIL AND PALM KERNEL OIL FOR FATTY ACIDS AND DERIVATIVES. Malaysia produces ca. 65% of the world's palm oil, or (in 1982) ca. 3,500,000 metric tons. By 1985, this will increase to 80% of world production, or ca. 4,800,000 metric tons. Palm oil products are refined, bleached and deodorized oil for edible purposes, palm olein for edible use, palm stearin for edible or industrial use, and the acid oil or fatty acid distillate for industrial uses.

de Vries, Roy J. (Acidchem (Malaysia), Butterworth, West Malays). *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem, Montreux, Switz, Sep 18-23 1983 p 404-407.

14. -
046052 CHEMISTRY OF DIBASIC AND POLYBASIC FATTY ACIDS. Current processes for production of dibasic and polybasic fatty acids including azelaic, sebacic, dodecanedioic, fatty dimer and trimer acids, are discussed. A number of alternative routes to produce azelaic, sebacic and fatty dimers are also discussed, including the preparation of azelaic and sebacic acids from butadiene and sebacic acid from adipic acid. Physical properties of the various dibasic acids are compared. Preparation of important derivatives and their applications are discussed. 51 refs.

Johnson, R W (Union Camp Corp, Chemical Products Div, Savannah, Ga, USA). *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem, Montreux, Switz, Sep 18-23 1983 p 241-246.

15. -
046036 NEW DEVELOPMENTS IN THE FATTY ACID INDUSTRY IN AMERICA. Among the new developments are the continuing development of new vegetable oil raw materials like 90% erucic acid rapeseed oil and 80% oleic acid sunflower; the intense process development under way in some areas for the minimization of thermal energy requirements of certain reactions like polymerization (dimer acids), glycerolysis (mono- and diglycerides) and fat splitting; the ever-increasing substitution of methyl esters for fatty acids in the production of a whole series of oleochemicals; development of new esterification catalysts; lipase catalysis of interesterification; development of new corrosion-resistant materials of construction; the use of irradiation sulfotylation as a preferred production route to randomly sulfonated methyl esters; and superemulsification as an aid to hydrophobic/hydrophilic liquid chemical reactions. 25 refs.

Sonntag, Norman O V. *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem, Montreux, Switz, Sep 18-23 1983 p 229-232.

16. -
004075 MARKETING AND ECONOMICS OF FATTY ALCOHOLS. Alcohols represent 35% of the world's major surfactant intermediates, with natural alcohols accounting for one-third of that percentage. Present trends suggest that alcohols will become increasingly important in the detergent industry during the next 10 years. Factors contributing to the growth of alcohols as surfactant intermediates include better derivative biodegradability, better solubility, better hard-water tolerance, and a reputation for better detergency on synthetic fabrics.

Houston, Colin A (Colin A Houston & Associates Inc, Mamaroneck, NY, USA). *JAACS / Am Oil Chem Soc* v 61 n 2 Feb 1984, Proc - World Conf on Oleochem, Montreux, Switz, Sep 18-23 1983 p 179-184.

2. UNIDO REPORTS ON FATTY ACIDS PRODUCTION

DATA BASE : Industrial Development Abstracts (IDA)

RECORD NUMBER: 015147
DOCUMENT DATE: 1986
CALL NUMBER:
CORP. AUTHOR: UNIDO
TITLE: THE VEGETABLE OILS AND FATS INDUSTRY. THE SECTOR IN FIGURES, 1985. SECTORAL STUDIES SERIES NO. 22.
SOURCE: Vienna, 1986. vi, 61 p. tables.
DOC. NUMBER: UNIDO-UNIDO/IS.604
ABSTRACT: <UNIDO pub> giving <statistics> on the <vegetable oils> and fats industry - covers (1) <definition> of the sector and the structure of <world production> and <trade> (2) production and trade by type of crop and region for 1976, 1980 and 1984 (3) major producing and trading countries, by crop and processing stage (4) <oilseeds> processing and <production capacity>s for selected countries (5) world <export> and <import> <prices> and quantity indices for vegetable <oils and fats>.

LANGUAGES: ENGL
CLASSIFICATION: 31.70

RECORD NUMBER: 013968
DOCUMENT DATE: 1984
CALL NUMBER:
CORP. AUTHOR: UNIDO
TITLE: THE VEGETABLE OILS AND FATS INDUSTRY IN DEVELOPING COUNTRIES. OUTLOOK AND PERSPECTIVES. SECTORAL STUDIES SERIES NO. 13, VOLUME I AND II.
- L'INDUSTRIE DES HUILES ET GRAISSES VEGETALES DANS LES PAYS EN DEVELOPPEMENT. SITUATION ET PERSPECTIVES. SERIE DES ETUDES SECTORIELLES NO. 13, VOLUME I ET II.
SOURCE: Vienna, 1984. 2 vol. 219 p. tables, graphs, diagram.
DOC. NUMBER: UNIDO-UNIDO/IS.477
UNIDO-UNIDO/IS.477/Add.1
ABSTRACT: <UNIDO pub> on outlook and <development potential> of <vegetable oils> production in <developing countries> - covers (1) the role of such industries within the <food industry> and the <manufacturing> sector (2) <world production> of vegetable <oils and fats> and the position of DCs (3) <trade> in <oilseeds>, oils and meals; <product mix>; <trade barriers>; <world consumption> (4) the processing of oilseeds; <choice of technology> in DCs (5) factors affecting <production capacity>; technical and <economic aspects>; <small scale industry>; <transnational corporations>; <advanced technology>; <innovations> (6) opportunities for an integrated <development policy> and <agro-industry>. <Statistics>.

LANGUAGES: ENGL FREN
CLASSIFICATION: 31.70

RECORD NUMBER: 012896
DOCUMENT DATE: 1983
CALL NUMBER:
PERSONAL AUTHOR: Patterson, H.B.W.
CORP. AUTHOR: UNIDO
CONFERENCE: EXPERT GROUP MEETING ON MEASURES AND FORMS IN PROMOTING
INTEGRATED DEVELOPMENT OF THE VEGETABLE OILS AND FATS
INDUSTRY WITHIN THE FOOD-PROCESSING INDUSTRY, ALEXANDRIA,
EGYPT, 1983
TITLE: MEASURES AND FORMS TO PROMOTE INTEGRATED DEVELOPMENT OF THE
VEGETABLE OILS AND FATS INDUSTRY WITHIN THE FOOD-PROCESSING
INDUSTRY. DISCUSSION PAPER.
SOURCE: Vienna, 1983. 36 p. tables.
DOC. NUMBER: UNIDO-ID/WG.404/4
ABSTRACT: <UNIDO pub> on integration of the <vegetable oils> industry
within <agro-industry> - covers (1) meaning of integration;
past experience; guides to the future (2) <vertical
integration> (3) horizontal integration and methods to
promote it (4) possible forms of integrated development (5)
international <cooperation> and integration in the vegetable
<oils and fats> industry (6) indicated action on the various
levels. Additional references: <role of UNIDO>, <regional
cooperation>, <planning>, <investment>, <training>, <trade>.
LANGUAGES: ENGL
CLASSIFICATION: 31.70

RECORD NUMBER: 010416
DOCUMENT DATE: 1981
CALL NUMBER:
CORP. AUTHOR: UNIDO
CONFERENCE: REGIONAL CONSULTATIVE FORUM ON THE VEGETABLE OILS AND FATS
INDUSTRY FOR ASIA AND THE PACIFIC, 1ST, DJAKARTA, 1981
TITLE: REPORT. (CONSULTATIVE FORUM ON THE VEGETABLE OILS AND FATS
INDUSTRY FOR ASIA AND THE PACIFIC).
SOURCE: VIENNA, 1981. 15 P.
DOC. NUMBER: UNIDO-UNIDO/PC.4
ABSTRACT: <UNIDO pub>. <Report> of a <meeting> on <vegetable oils> and
fats industry for <Asia> and the Pacific (reference:
<ESCAP>) - covers (1) organization of the session (2)
<regional> harmonization of <development plan>s and
programmes for the vegetable <oils and fats> industry (3)
manufacture of <spare parts> and <components> of <machinery>
in the <developing countries> (4) issues to be considered at
consultation to be held in 1982. <Recommendations>, <list of
participants>, <list of documents>. Additional references:
<regional cooperation>, <role of UNIDO>.
LANGUAGES: ENGL
CLASSIFICATION: 31.70

3. AVAILABLE BOOKS AND JOURNALS FOR FATTY ACIDS AND RELATED SUBJECTS

Johnson & Fritz (1988). Fatty Acids
Dekker, ISBN 0-8247-7672-0

Johnston & Johnston (1989). Flaxseed's Omega-3 Oils.
Keats, ISBN 0-87983-505-2

Lands, W.E. ed. (1987). Polyunsaturated Fatty Acids &
Eicosanoids
Am Oil Chemists, ISBN 0-935315-15-2, 3; 593p.

Markley, K. S. (1983). Fatty Acids : Their Chemistry,
Properties, production & uses
2nd., Kieger, ISBN 0-89874-576-4

Pattison, E.S. Fatty Acids & and their industrial
applications
Bks Demand UMI, ISBN 0-317-07984-0

4. WORLDWIDE FATTY ACIDS PRODUCERS

4.1 EUROPEAN PRODUCERS

BELGIUM

Mosselman S.A.-N.V.

Rene, Boulevard
Industriel 80, B-1070,
Bruxelles,
ph.: 02-5243947

Oleofina S.A.-N.V.

Rue de la Science 37,
B-1040 Bruxelles,
ph.: 02-2339111

Vandemoortele S.A.-N.V.

Prins Albertlaan 12,
B-8700 Izegem.
ph.: 051-332211

Pattyn, Florent C.

Kortrijkstraat 5, B-
8201 Sint-Michiels,
ph.: 050-383905

Westbrook Lanolin Co.
S.A.

Rue Beribou 4-6,
B-4800 Verviers,
ph.: 087-336121

CYPRUS

United Cyprus Oil
Industries LTD.

P.O.Box 1139,
CY-Nicosia,
ph.: 02-444277

DENMARK

Aarhus Oliefabrik A/S,

P.O.Box 50, DK-8100
Aarhus-C,
ph.: 86-126000

C.E. Basts Eftf. A/S

Ingerslevsgade 44,
DK-1705 Copenhagen-V.,
ph.: 45-1313355Dansk Sojakagefabrik
ApS.Islands Brygge 24,
DK-2300 Copenhagen-S,
ph.: 31-546600

Superfos A/S

P.O.Box 39, DK-2950,
Copenhagen-Vedbaek,
ph.: 42-893111**FINLAND**

Enso-Gutzeit Oy

SF-55100 Imatra-10,
ph.: 954-2911

Veitsiluoto Oy

P.L.196, SF-90101
Oulu-10,
ph.: 981-221411

Raisio Tehtaat

SF-21200 Raisio,
ph.: 921-780311**FRANCE**Derives Resiniques et
TerpeniquesB.P.206, F-40104
Dax-Cedex,
ph.: 33-58749122

Vanlaer S.A.R.L,

B.P.1, F-59320,
Haubourdin,
ph.: 33-20076061

Unichema France S.A.

148, bd. Haussmann,
F-75008, Paris,
ph.: 1/45630863

Stella S.A.

41 ter, av. de la
Marne, F-59200
Tourcoing,
ph.: 33-20265764**GERMANY**

Chemie-Export-Import,

Storkower Str.133,
Berlin,
ph.: 02-43220

Henkel KGaA

Postfach 1100, D-4000
Dusseldorf-13,
Holthausen,
ph.: 0211-7970

Unichema International
Unichema Chemie GmbH

Steintor 9, Postfach
1280, D-4240,
Emmerich,
ph.: 02822-721

Berg & Schmidt
(GmbH & Co.)

An der Alster 81,
D-2000 Hamburg 1,
ph.: 040-24830-02

Fedderson & Co.
(GmbH & Co.) K.D.

Postfach 111753,
D-2000 Hamburg-11,
ph.: 040-3618-01

Hamburger Fettchemie
Brinckman & Mergell
GmbH

Seehafenstr.2, D-2100
Hamburg, ph.: 040-
771244

Jahres Fabrikker A/S

Postboks 2051 N-3201,
Sandefjord/Noewegen,
D-2000 Hamburg,
ph.: 004734-74700

Mohrmann & Co.
(GmbH & Co.)

Wendenstr.29, D-2000
Hamburg-1,
ph.: 040-233177

Oelmuhle Hamburg AG

Postfach 930320,
D-2102 Hamburg-93,
ph.: 040-75194-0

Brokelmann + Co. Olmuhle
und Raffinerie KG

Postfach 1291, D-4700,
Hamm-1,
ph.: 02381-4260

Siegert & Cie.GmbH

Postfach 2065, D-5450
Neuwied,
ph.: 02631-22060

Ullmann GmbH, Carl

Postfach 1427, D-2057
Reinbeck,
ph.: 040-7222095

Heess GmbH + Co.

Postfach 54, D-7000
Stuttgart-1,
ph.: 0711-651026

Schmidt & Hagen GmbH
& Co. KG.

Deichstr. 25a, D-2082
Uetersen,
ph.: 04122-7109-0

Chemische Fabrik
Fridingen, G. Rubelmann
GmbH & Co.

Postfach 1240, D-6806
Viernheim,
ph.: 06204-70090

Brandes GmbH, Carl E.

Werner-von-Siemens-
Str. 12, D-3015,
Wennigsen,
ph.: 05103-8802

GREAT BRITAIN AND N.I.
Unichema Chemicals Ltd.

GB-Bebington, Wirral,
Merseyside-L62 4UF,
ph.: 051-6452020

Ellis & Everard
(Chemicals) Ltd.

Candlehouse La., GB-
Coupar Angus,
Blairgowrie,
Perthshire-PH3 9DD,
ph.: 082-82684

Procter & Gamble Ltd.

P.O.Box 9, GB-Hayes,
Middx.-UB4 OJD,
ph.: 01-8489671

Croda Premier Oils Ltd.

Ann Watson St.,
Stoneferry, GB-Hull-
HU8 OEJ,
ph.: 0482-41311

Foster & Co. (Stearines)
Ltd.

H., Aire Place Mills,
Kirkstall Rd.,
GB-Leeds-LS3 IJL,
ph.: 0532--439016

Albright & Wilson Ltd.

1 Knightsbridge Green,
GB-London -SW1 7QD,
ph.: 01-5896393

Alembic Products Ltd.

Oaklands Ho., Oaklands
Drive, Sale, GB-
Manchester -M33 1NS,
ph.: 061-9624423

Gerard Bros.

Kersal Vale, GB-
Manchester -M& OGL,
ph.: 061-7926111

Croda Chemicals
International Ltd.

Cowick Hall, GB-
Snaith, Goole, North
Humberside -DN14 9AA,
ph.: 0405-860551

GREECE

Triantaphyllou S.A.

Thomas, 405,
Tatoiustr., GR-136 71
Acharnai,
ph.: 01-2462411

Papoutsanis S.A.

P.D., GR-145 00
Kifissia,
ph.: 01-8010961

EVGLO S.A.

5, Piraeus str., GR-
186 46 Moschaton,
ph.: 01-4812145

Eleorgia Voriou
Hellados S.A.

13, Frangon str., GR-
546 26 Thessaloniki,
ph.: 031-536466

HUNGARY
AGRIMPEX

Postfach 278, H-1392
Budapest,
ph.: 01-113800

ITALY
S.I.M.E.L. SpA.

Via Bergamo, 66,
I-26100 Cremona,
ph.: 0372-35995

Mira Lanza SpA.

Via Rivarolo, 14,
I-16121 Genova-
Rivarolo,
ph.: 010-41001

NETHERLANDS
Chempri B.V.

Postbus 153, NL-4940
AD Raamsdonksveer,
ph.: 01621-15550

Rhenus B.V.

P.O.Box 5, NL-3910 AA
Rhenen,
ph.: 08376-19115

Duphar B.V.

Postbus 900, NL-1381
CP Weesp,
ph.: 02940-77711

Croklaan B.V.

Postbus 4, NL-1520 AA
Wormerveer,
ph.: 075-292911

NORWAY
Kielland A/S M.H.

P.O.Box 441, N-5001
Bergen, ph.: 05-255917

Martens & Co. A/S.
Johan C.

P.O.Box 571-572,
N-5001 Bergen,
ph.: 05-256000

Denofa og Lilleborg
Fabriker A/S.

P.O.Box 4236 Torshov,
N-0401 Oslo -4,
ph.: 02-220050

Jahres Fabrikker A/S.

P.O.Box 235, N-3201
Sandefjord,
ph.: 034-74700

POLAND

ROLIMPEX Export-Import

Chalubinskiego 8,
PL-00-613, Warszawa,
ph.: 022-301000

ROMANIA

Dañubiana

Postfach 1-74,
R-70033, Bukarest,
ph.: 90-156051

PRODEXPORT

Piata Valter,
Maracineanu 1-3,
R-79526, Bukarest,
ph.: 90-161660

SPAIN

Union Derivan S.A.

Av. Meridiana 133,
E-08026, Barcelona,
ph.: 93-2322113

Abello S.A.

J. Camarillo 8,
E-28037 Madrid,
ph.: 91-7541600

Astolfi S.A.

A.Maura 2, E-41013,
Sevilla,
ph.: 954-616448

SWEDEN

Auson HB

Barlastgatan 2, S-414
63, Goteborg,
ph.: 031-124490

Karlshamns
Oljefabriker AB

S-374 82 Karlshamn,
ph.: 0454-82000

Bergvik Kemi AB

P.O.Box 500, S-826 01
Soderhamn,
ph.: 0270-70030

SWITZERLAND

Sabo

Postfach 983, CH-6901
Lugano (TI),
ph.: 091-234461

TURKEY

Alendar Kimya
Endustrisi A.S.

Turistik Camlica
Cad.19, Buyukcamlica,
TR- Istanbul,
ph.: 1-3357000

EXIM, Hayrettin Tok.

Bagdat Ca i.185/301,
Feneryolu, TR-81030
Istanbul,
ph.: 1-3376683

Komili Pazarlama ve
Dis Ticaret A.S.

Setustu Ha-Han 45/1,
Kabatas, TR- Istanbul,
ph.: 1-1492141

USRR

Sojuschimiexport V/O
Sennaja

Smolenskaja-
32/34, Su-121200
Moskau,
ph.: 0095-2442284

YUGOSLAVIA

HEMPRO

Terazije 8, YU-11000,
Beograd,
ph.: 011-324751

Prerambeni Kombinat
Brckoro Bimal,

Mustafa Golubica 9,
YU-76000 Brcko,
ph.: 076-21011

Helios

P.O.Box 23, YU-61230,
Domzale,
ph.: 061-721711

Riviera

Industrijska zona, YU-
85330 Kotor,
ph.: 082-16311

Nevena

P.O.Box 70, Yu-16001
Leskovac,
ph.: 016-51010

4.2 IMPORTANT U.S.A. PRODUCERS

Akzo Chemie America
Armak Chemicals

Chicago, IL

Alfa Products
Morton Thiokol, Inc.

Danvers, MA

Arizona Chemical Co.

Panama City, FL

Ashland Chemical Co.

Columbus, OH

Celanese Chemical Co.
Inc., Subs. of Hoechst
Celanese Corp.

Dallas, TX

Dial Corp. The
Chemical Specialities
Div.

2000 Aucutt Rd.,
Montgomery, IL 60538

Emery Chemicals	P.O.Box 11501, Cincinnati, OH 45249
Georgia-Pacific Corp.	Atlanta, GA
Henkel Corp. Functional Prod. Div.	LaGrange, IL
Hercules Incorp.	Wilmington, DE
Hunko Chemical Div. Witco Corp.	Memphis, TN
Lonza Inc.	Fair Lawn, NJ
Pfau's Sons Co., Inc., Geo.	833 Wall St., P.O.Box 7, Jeffersonville, IN 47131
Procter & Gamble Distributing Co.	Cincinnati, OH
Reichhold Chemicals, Inc.	White Plains, NY
Sherex Chemical Co., Inc.	Dublin, OH
Sylvachem Corp.	Jacksonville, FL
Thompson-Hayward Chemical Co.	Kansas City, KS 66106 ph.: 913-321-3131
Unichema Chemicals, Inc.	Chicago, IL
Union Camp	Wayne, NJ
Welch Holme & Clark Co., Inc.	7 Avenue L. Newark, NJ 07105
Westvaco Corp. Chemical Div.	P.O.Box 70848, Charleston Heights, SC 29415

5. SOME EQUIPMENT SUPPLIERS AND CONSULTANCY SERVICES

GERMANY

Lurgi Group

Gervinusstr. 17-19,
P.O.Box 11 12 31,
D-600, Frankfurt am
Main 11, ph.: 157-1

INDIA

SBP Consultants &
Engineers PVT Ltd.

SBP building, 4/45
Roop Nagar, Delhi
110007, ph.: 223701

ITALY

Tecnimont Spa.

Viale Monte Grappa 3,
1-20124 Milan,
ph.: 02-63331

JAPAN

Sumitomo Chemical
Engineering Co. Ltd.

13-5, Kudan Kita 1-
chome, Chiyoda-Ku,
Tokyo 102,
ph.: 03-2308441

UNITED KINGDOM

Croda Universal Ltd.

Cowick Hall,
Snaith.Goole N.
Humberside DN 14 9AA,
ph.:0405-860551

Langley-Smith & CO.
Ltd.

8-10 Paul St., London,
EC2A 4JH,
ph.:01-247-7473

Mowlem Engineering

Port Causeway,
Blomborough, Wirral
L62 4TP

Top Cast Engineering

56 Maybury Rd.,
Woking,
Surrey GU21 5AJ

Unichema Chemicals Ltd.

Bebington, Wirral,
Merseyside L62 AUF,
ph.: 051-645-2020

U.S.A.

Foster Wheeler U.S.A.
Corp., Process Plants,
Fired Heater Div.

Livingston, NJ

Glitsch, Inc. Glitsch
Package Plants Div.

Parsippany, NJ 07054-
0918,
ph.: 201-299-9350

Luwa Corp.

Charlotte, NC

6. R & D INSTITUTES

Country	Institute	Address
FRANCE	Institut Des Corps Gras	10A rue de la Paix, 75002, Paris, ph.: 01-2965029
NETHERLANDS	Unilever Research Vlaardingen Lab.	Postbus 114, Vlaardingen
POLAND	Household Chemistry	
U.S.A.	Glycerine and Oleo- chemicals Assocn.	475 Park Ave. New York, NY 10016, ph.:212-725-1262
	Emery Industries Research Library	4900 Este Ave. Cincinnati, OH 45232

7. BIBLIOGRAPHY

7.1 Books, reports and journal articles :

- Industrial Organic Chemicals in Perspective : Part I ;
Raw Materials and Manufacture,
Wittcoff, H.A., Reuben, B.G., 1980
- Chemical and Process Technology Encyclopedia
Considine, D.M. (ed.), 1974
- Ullmann's Encyclopedia of Industrial Chemistry, 1987
- Unit Processes in Organic synthesis
Groggins, P.H., 5th. ed., 1958
- Chemical Process Industries
Shreve, R.N., 4th. ed., 1977

7.2 On line searches : 1980-1992

- Data Base CA search (Chemical Abstracts)
- Data Base IDA (Industrial Development Abstracts)

7.3 Directories

- Seisst Industrial Catalog 88
- Chemical Engineering Catalog (CEC 88)
- US Industrial Export Directory 1991
- ABC Europe Production 1988
- European Research Centers 1982