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INDUSTRY PROFILE #8

FISH OIL AND  
FISH MEAL

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Fish Oil and Fish Meal  
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## INDUSTRY PROFILES

### Introduction

This Industry Profile is one of a series briefly describing small or medium-sized industries. The Profiles provide basic information for starting manufacturing plants in developing nations. Specifically, they provide general plant descriptions, financial, and technical factors for their operation, and sources of information and expertise. The series is intended to be useful in determining whether the industries described warrant further inquiry either to rule out or to decide upon investment. The underlying assumption of these Profiles is that the individual making use of them already has some knowledge and experience in industrial development.

Dollar values are listed only for machinery and equipment costs, and are primarily based on equipment in the United States. The price does not include shipping costs or import-export taxes, which must be considered and will vary greatly from country to country. No other investment costs are included (such as land value, building rental, labor, etc.) as those prices also vary. These items are mentioned to provide the investor with a general checklist of

considerations for  
setting up a business.

### IMPORTANT

These profiles should not be substituted for feasibility studies. Before an investment is made in a plant, a feasibility study should be conducted. This may require skilled economic and engineering expertise. The following illustrates the range of questions to which answers must be obtained:

- \* What is the extent of the present demand for the product, and how is it now being satisfied?
- \* Will the estimated price and quality of the product make it competitive?
- \* What is the marketing and distribution plan and to whom will the product be sold?
- \* How will the plant be financed?
- \* Has a realistic time schedule for construction, equipment, delivery, obtaining materials and supplies, training of personnel, and the start-up time for the plant been developed?
- \* How are needed materials and supplies to be procured and machinery and equipment to be maintained and repaired?

\* Are trained personnel available?

\* Do adequate transportation, storage, power, communication, fuel, water, and other facilities exist?

\* What management controls for design, production, quality control, and other factors have been included?

\* Will the industry complement or interfere with development plans for the area?

\* What social, cultural, environmental, and technological considerations must be addressed regarding manufacture and use of this product?

Fully documented information responding to these and many other questions should be determined before proceeding with implementation of an industrial project.

#### Equipment Suppliers, Engineering Companies

The services of professional engineers are desirable in the design of industrial plants even though the proposed plant may be small. A correct design is one that provides the greatest economy in the investment of funds and establishes the basis of operation that will be most profitable in the beginning and will also be capable of expansion without expensive alteration.

Professional engineers who specialize in industrial design can be found by referring to the published cards in various engineering magazines. They may also be reached through their

national organizations.

Manufacturers of industrial equipment employ engineers familiar with the design and installation of their specialized products. These manufacturers are usually willing to give prospective customers the benefit of technical advice by those engineers in determining the suitability of their equipment in any proposed project.

## VITA

Volunteers in Technical Assistance (VITA) is a private, non-profit, volunteer organization engaged in international development. Through its varied activities and services, VITA fosters self-sufficiency by promoting increased economic productivity. Supported by a volunteer roster of over 5,000 experts in a wide variety of fields, VITA is able to provide high quality technical information to requesters. This information is increasingly conveyed through low-cost advanced communication technologies, including terrestrial packet radio and low-earth-orbiting satellite. VITA also implements both long- and short-term projects to promote enterprise development and transfer technology.

## FISH OIL AND FISH MEAL

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## PRODUCT DESCRIPTION

### 1. The Product

Fish oil is the oil from rendering whole fish or from fish cannery waste.

Fish meal is the clean, dried, ground tissue of undercooked whole fish or fish cuttings.

### 2. The Facility

This profile describes two plants. The first is a 20-ton per day plant operating with an eight-hour shift and producing 8,000 tons of fish meal and 4,000 tons of fish oil a year. The second is a 40-ton plant operating with an eight-hour shift and producing 8,000 tons of fish oil and 16,000 tons of meal per year.

## GENERAL EVALUATION

Fishery by-products have a big future in both developed and developing countries because of their multiple uses. For example, stickwater, the liquid residue after the fish is rendered, can be

used by some feed manufactueres, especially those who produce pelleted and extruded feed, as water, protein, and binder components. However, they must compete with oils, animal feeds, and fertilizers from a variety of sources. For example, the glut in palm oil production and its worldwide supply as well as the use of soy protein as a cheaper source of protein for animal feed have affected demand for fish oil and meal. This should be considered before locating a plant.

Prospects for these products depend upon sufficient market outlets. Since they are jointly produced, it should be ascertained that there is a sufficient market for both of them before venturing into the production. The possibility of selling concentrated fish solubles should also be considered, as this would reduce drying costs and some equipment expenses.

## 1. Outlook

### A. Economic

Fishery products in general have a rising market in the future because of their nutritional superiority and greater availability than land-based animal products. However, the operation requires a moderately large capital investment.

### B. Technical

Competition from microbial processing methods can be expected (biotechnology). Fish silage production is already receiving attention.

## 2. Manufacturing Equipment Flexibility

With some addition and modifications, the machinery can easily handle poultry meat processing wastes and slaughterhouse by-products.

## 3. Knowledge Base

Before implementation of such a plant, it is very important to conduct a detailed biological study of species abundance. Also, a record-keeping system needs to be set up to evaluate the effect of the activity on basic fish supply. Records should include production/unit of effort, size and weight of fish, and length of the season. Knowledge of marine life is also important to eliminate unwanted species such as copepods and mollusks. Other considerations include:

- Knowledge of high oil and low oil fish to predict meat to oil ratio.
- Knowledge good cleaning and manufacturing practices for putrescible products.
- Knowledge of sewage treatment, chemical oxygen demand (COD), and biological oxygen demand (BOD) regulations.
- Knowledge of odor control and stack emissions, if plant is located near population centers.

## 4. Quality Control

Raw materials need to be checked for foreign objects such as metal, grit, and sand. In the laboratory, fish meal should be



tested for crude protein and fat, and fish oil should be tested for free fatty acids and unpleasant smells. Standard methods of analysis such as the Association of Official Analytical Chemists or country standards should be followed.

## 5. Constraints and Limitations

The plant should be designed to handle one-third its capacity for lean supply periods. Restrictions on discharge of high BOD effluent should be checked. Sewage treatment could be expensive, especially for a 20-ton plant. Fish meal plants emit a strong odor and should be situated leeward of dwellings. Water treatment can be expensive if soft water is unavailable for boiler.

## MARKET ASPECTS

### 1. Users

Mostly domestic consumers and manufacturers of margarine, animal feeds, aquatic feeds (e.g., catfish feed), fungicide sprays, soap, fertilizer, paints, lubricating oil, fat liquor for leather industry, oil tanning, manufacturers of fatty acids, and crude glycerol for explosives.

### 2. Suppliers

Fish must be available locally. Access to fish processing plants is available.

### 3. Sales Channels and Methods

Sales are generally made to large dealers of fish meal and fish oil with representatives in many countries. Local sales are usually made directly to local industries and wholesalers of animal feeds. Fish oil and fish meal are easily transported.

#### 4. Geographic Extent of Market

Domestic - While the product is fairly easy to transport, freight cost may be an important factor in limiting the market area.

Export - Market can be international, but quality specifications may restrict export.

#### 5. Competition

Quality control can provide an edge over competition.

Domestic - There is usually competition from similar products derived from other sources. Delivery price is the determining factor.

Export - Competition from other oils and protein sources may affect demand. As in the domestic market, delivery price is also the decisive factor.

#### 6. Market Capacity

It is not feasible to estimate the size of the market needed in terms of population or other quantitative measure. The essential

requirement is accessibility to areas where user industries are located.

## PRODUCTION AND PLANT REQUIREMENTS

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Requirements Annual Output:

Meal/Oil Meal/Oil

8,000/4,000T 16,000/8,000T

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1. Infrastructure, Utilities Small Plant Medium Plant

Land 5 acres 7 acres

Building 100'x200' 150'x200'

Power Requirement 30 hp 70 hp

(\* Power Requirement, Boiler 700 hp 1,050 hp

Fuel Bunker C oil 560 Tons 1,120 Tons

Water production, sanitation, fire

Other \_\_\_\_\_

(\* Power requirement means that the factory is hooked up to a power source capable of handling the HP mentioned.

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2. Major Equipment & Machinery Small Plant Medium Plant

Units Units

Tools & Machinery

fish receiving and storage system

(bins, dumper, tipper, etc.) 1 2

screw conveyor 1 2  
cooker 1 2  
presser 1 2  
decanter centrifuge 1 2  
multiple effect evaporator 1 1  
drier (tubular, direct or  
indirect) 1 1  
grinder (excludes motor cost) 1 1  
boiler (steam or thermic fluid; water treatment costs should  
be considered if steam boiler is used.)

(\*\*) TOTAL ESTIMATED COST  
of equipment & machinery only \$1,116,000 \$2,100,000

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### 3. Materials & Supplies Small Plant Medium Plant

#### Raw Materials

raw fish 40,000 tons 80,000 tons

#### Supplies

lubricants & hand tools 2,000 3,000

gas, oil & maintenance of  
truck 15,000 30,000

office supplies 2,000 3,000

#### Packaging

bagging & weighing equipment 15,000 30,000

bags

oil drums & filling equipment

(Packing and oil drum costs arise for retail outlets. Wholesale outlets need containers and oil trucks).

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#### 4. Labor Small Plant Medium Plant

Skilled 2 5

Semiskilled 2 4

Unskilled 4 8

Indirect

Manager 1 1

Supervisor 1 1

Quality Control Assistant 1 2

Office 2 3

Maintenance 1 1

Truck driver 1 1

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#### 5. Distribution/Supply flow Small Plant Medium Plant

Amount in/out per day fish meal 25-27 tons 50-55 tons

Amount in/out per day fish oil 8-13 tons 16-26 tons

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#### 6. Market Requirements Small Plant Medium Plant

(To be assessed by the manufacturer)

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## 7. Other Requirements Small Plant Medium Plant

Sewage treatment and red tape management  
Export quarantine health certificates

(\*\*) Based on \$US 1987 prices. The costs provided are estimates and are given only to provide a general idea for machinery costs. They are not intended to be used as absolute prices. Costs should be determined on a case by case basis. Installation costs are not included, and they are usually 10 percent of total equipment cost. Other costs such as licensing fees, additional pollution and odor control fees, quality control costs, transport, auditing, and legal fees must be considered. Buying used machinery may possibly reduce costs.

### PROCESS DESCRIPTION

#### 1. Diagram

Figure II Composition of fish material during the process.

Material Water % Solids % Fat %

raw fish 70 18 12

press cake 53 44 3

press liquor 78 6 16

dilute stickwater 95 5 <1

concentrated stickwater 65 33 2

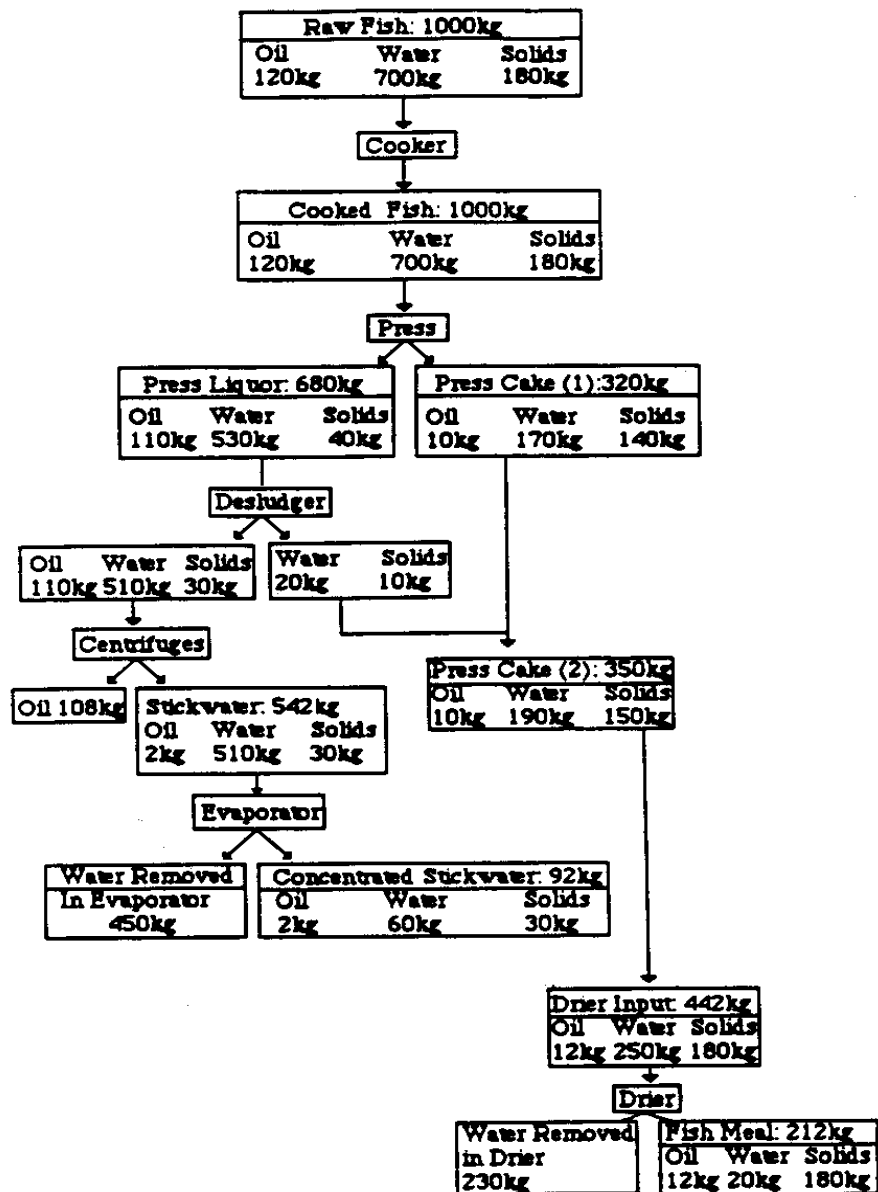
fish meal 9 85 6

## 2. Remarks

There are many methods for processing fish meal. The method used to produce most of the world supplies is described below. The process is shown by the diagram in Figure 1. The composition of

08p06y.gif (600x600)

Figure 1



materials at each stage is shown in Figure 2. The diagrams and description are extracted from "Introduction to Fishery By-Products," by M. Windsor & S. Barlow, Fishing News Books Ltd., Farnham, Surrey, England, 1981.



**COOKING:** This ruptures the cells and releases the oil. Cooking time should be for 20 minutes at 95-100 degrees Centigrade.

**COOKER:** This is a long steam-jacketed cylinder through which fish are moved by a screw conveyor that can itself be heated. Direct injection of steam is not beneficial.

**PRESSING:** A single or double screw press is used. The press cake has 55 percent moisture and 3-4 percent oil. Note that very fresh fish cause problems in pressing due to high content of slime.

**TREATMENT OF PRESS LIQUOR:** Press liquor contains:

Water 78%

Solids 6%

Oil 16%

**Stage 1. Decanter:** desludge to remove fine suspended solids. A decanter centrifuge separates oil from water fraction.

**Stage 2. Evaporation of stick water:** Multiple effect evaporator using either double, triple or quadruple effect using 0.6, 0.4, and 0.3 kg steam per kg of water evaporated respectively. Stick water evaporation is complex and expert guidance is required.

**DRYING:** Cake with 50 percent moisture is dried to 10 percent moisture. Drying is done in direct dryers where heat is supplied by heated air or steam, usually at 170 [degrees]C.

**GRINDING:** The dried material should be ground and sieved to a

uniform mesh size.

**SACKING:** Sacking in bags when planning retail outlets in small plant. The product may be shipped to user in containers and no sacking may be needed.

**ENERGY CONSUMPTION:** 60-70 kg fuel per ton of raw fish.

Percent distribution of energy per process: cooking - 21%

pressing - 8%

Stick water drying to 30% solids 33%. drying - 38%

**TOTAL - 100%**

## REFERENCES

Unless otherwise stated, these addresses are in the United States.

### 1. Technical Manuals & Textbooks

Introduction to Fishery By-Products. by Malcolm Windsor & Stuart Barlow. Fishing News Books Ltd., Farnham, England, 1981. Catalogue available on request.

Fishi Processing in India. By M.N. Moorjani. Indian Council of Agricultural Research, New Delhi, 1984.

### 2. Periodicals

"Feedstuffs". ABC Publishing Co. 13330 Avenue of the Americas.  
New York, New York 10019. A weekly newspaper.

FAO Fisheries Reports, by Food & Agriculture Organization  
Rome, Italy

### 3. Trade Associations

National Renderers Association  
O'Hare Lake Office Plaza. 312/827-8151  
2250 E. Devon Avenue  
Des Plaines, Illinois 60018

The National Fish Meal & Oil Association  
2000 M Street, NW, Suite 580  
Washington, DC 20036

### 4. Equipment Suppliers, Engineering Companies

The Dupps Company, Germantown, Ohio 45327  
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STORD Bartz Americas Inc., 309 Regional Road,  
South Greensboro, North Carolina 27409. (919) 668-7727.

Anderson International Corporation, 6200 Harvard Avenue,  
Cleveland, Ohio 44105. (216) 641-1112.

Westfalia Separators, 4740 OELDE 1 W. Germany  
Phone (02522) 77-1. Telex 89474.

## 5. Directories

Official Methods of Analysis of the Association of Official Analytical Chemistry. Edn. 14, 1984.

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### 'INDUSTRY PROFILE SERIES'

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answers must be obtained before proceeding with implementation of an industrial project.

All profiles are available in English only. They are priced at \$9.95 each. You may take advantage of the introductory offer and order any three Profiles for just \$25.00 or order the entire set of teen profiles for a bargain price of only \$150.00.

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