

# Phospholipids and Sphingolipids of Milk

## Contents

- 1 Objective
- 2 Background
  - ◆ 2.1 Introduction
  - ◆ 2.2 Phospholipids
  - ◆ 2.3 Sphingolipids
- 3 Concept Table
- 4 Relevant Class Code Definitions
  - ◆ 4.1 IPC/ECLA
  - ◆ 4.2 US Class
  - ◆ 4.3 F-Terms
- 5 Search Strategy
  - ◆ 5.1 Search Strategy Using English Keywords
  - ◆ 5.2 Search Strategy Using French Keywords
  - ◆ 5.3 Search Strategy Using German Keywords
  - ◆ 5.4 Search Strategy Using F-Terms
  - ◆ 5.5 Final Query
- 6 Taxonomy
- 7 Relevant Patents (Sample Set)
- 8 Sample Analysis
- 9 Assignee Analysis and IP Activity
  - ◆ 9.1 Top Assignees
  - ◆ 9.2 Assignee Categorization
  - ◆ 9.3 Geographical Distribution
  - ◆ 9.4 IP Activity
- 10 Patent-Product Mapping
- 11 Scientific Articles
  - ◆ 11.1 Relevant Scientific Articles
- 12 Dolcera Dashboard
- 13 **Purchase Information**

## Objective

To create a technology landscape report on **Phospholipids and Sphingolipids of Milk**<

- ◇ Identify market players with prolific IP activity in the technology area
- ◇ Segment the players by the industry they belong to

**Note:** This report is just a template and gives an indication of what the paid report contains.  
[Click here](#) for information to purchase the report

## Background

### Introduction

Error creating thumbnail: /var/www/htdocs/dolcera.com/wiki/includes/limit.sh: line 101: 13410 Aborted /usr/bin/timeout \$MW\_WALL\_CLOCK\_LIMIT /bin/bash -c "\$1" 3>&-

Error code: 134

#### MFGM Str

**MFGM:** Milk fat globule membrane (MFGM) is a protein-lipid biopolymer that originates from the apical surface of mammary epithelial cells and surrounds fat globules in milk. While MFGM is in all dairy products containing milk fat, it is especially enriched in churn **buttermilk**, a co-product of butter production. The phospholipids and membrane glycoproteins found in MFGM likely interact extensively with the gut epithelia during digestion, both physically and biochemically. Moreover, MFGM has a relatively high concentration of sphingolipids, which in purified form have been demonstrated to be protective against colon cancer. [Hintze et al](#)

Phospholipids and sphingolipids fall under the category of **polar lipids**. The polar lipid content of raw milk is reported to range between **9.4 and 35.5 mg per 100 g** of milk [Rombaut and Dewettinck](#). The major phospholipid fractions are phosphatidylethanolamine(**PE**) and phosphatidylcholine(**PC**) followed by smaller amounts of Phosphatidylserine(**PS**) and phosphatidylinositol(**PI**). The major sphingolipid fraction is **sphingomyelin** with smaller portions of **ceramides** and **gangliosides**. These polar lipids are mainly (~60%) located in the milk fat globule membrane (**MFGM**), rest are located in skim milk phase. [Lars Wiking](#)

The phospholipids and sphingolipids in milk are gaining interest due to their nutritional and technological qualities. Sphingolipids and their derivatives are highly bioactive compounds with anti-cancer, bacteriostatic and cholesterol-lowering properties. [Rombaut and Dewettinck](#)

| Nutritional Aspects/ Biological Effects of Some Polar Lipids of MFGM |  |   |   |   |
|--|--|---|---|---|
| MFGM Component   | Sphingolipids and Metabolites  | Phosphatidylserine (PS)                         | Phosphatidylcholine (PC)                  | Lyso-Phosphatidylcholine (lyso PC)          |
| Nutritional  | 1) Reduction in the number of aberrant crypt foci (clusters of abnormal tube-like glands in the lining of the colon and rectum) and adenocarcinomas (Epithelium Cancer). | 1) Restore normal memory on a variety of tasks. | 1) Reduction of necrotising enterocolitis | 1) Bacteriostatic and bactericidal capacity |
|  |  |   |   |   |

|  |   |   |  |
|--|---|---|--|
|  | 2) Shift in tumor type (malignant ? benign)   | 2) Positive effects on alzheimer patients.        | 2) Support liver recovery from toxic chemical attack or viral damage |
|  | 3) Anti-cholesterolemic.  | 3) Improve exercise capacity of exercising humans | 3) Protects the human GI mucosa against toxic attack                 |
|  | 4) Protection of the liver from fat- and cholesterol-induced steatosis(abnormal retention of lipids within a cell). |   |  |
|  | 5) Suppression of gastrointestinal pathogens.   |   |  |
|  | 6) Neonatal gut maturation.   |   |  |
|  | 7) Myelination of the developing central nervous system.  |   |  |
|  | 8) Associated with age-related diseases and the development of Alzheimer.   |   |  |

Mohamed Mansour El-Loly

## Phospholipids

Phospholipids are fat derivatives in which one fatty acid has been replaced by a **phosphate group** ( $PO_4^-$ ) and one of several nitrogen-containing molecules. These play a major role in milk due to their **amphiphilic** properties, i.e. they contain both hydrophobic tail(hydrocarbon chain) and hydrophilic head regions. Phospholipids represent a major portion of total lipids of buttermilk and skim milk, reflecting presence of proportionately larger amounts of membrane materials in these products [Fox and McSweeney\(Pg 71\)](#). **MFGM** phospholipids contain high levels of **palmitic** and **oleic** acid, while the short and medium-chain fatty acids are present in very low levels. [Lars Wiking](#)

**Dairy phospholipids** are important structurally, because they are able to:

- stabilize emulsions and foams,
- form micelles and membranes.

Phospholipids also have the potential to be **pro-oxidants**, because they contain **mono-unsaturated** and **poly-unsaturated** fatty acids and have the ability to attract metal ions. **Phosphatidyl ethanolamine** binds copper strongly and is believed to be important in **copper induced oxidation** in milk [Fox and McSweeney\(Pg 580\)](#). The polyunsaturated fatty acids and metal ions accelerate lipid oxidation, especially when heat is applied; hence, phospholipids can be degraded during the processing of milk. [Fox and McSweeney\(Pg 20\)](#)

## Sphingolipids

Sphingolipids are composed of a **ceramide core**, which in turn, is composed of a **sphingosine**(12-22 C-atoms) backbone with a fatty acid covalently bonded via an **amide linkage**. Several different head groups may be covalently attached to the ceramide, each resulting in a different class of sphingolipid. **Examples** include **sphingomyelin**, with a phosphocholine headgroup, **glycosphingolipids** with one or more monosaccharides in the headgroup and **gangliosides**, which have at least three sugars in head group including at least one sialic acid. Like phospholipids, sphingolipids are also amphiphilic in nature. [Hintze et al](#)

Sphingolipids and their derivatives are **highly bioactive** compounds with **anti-cancer**, **bacteriostatic** and **cholesterol-lowering** properties. [Rombaut and Dewettinck](#) One significant source of dietary sphingolipids is the milk fat globule membrane (**MFGM**) [Hintze et al](#). Milk contains (per L) 39?119 mg of sphingomyelin, 6?11 mg of glucosylceramide, 6.5?15 mg of lactosylceramide and ~11 mg of gangliosides. [Rombaut and Dewettinck](#)

## Concept Table

### ENGLISH KEYWORDS

| Concept 1    | Concept 2    | Concept 3                 | Concept 4 |
|--------------|--------------|---------------------------|-----------|
| Polar Lipid  |              | Milk Fat *****            | Dairy     |
| Phospholipid | Sphingolipid | Milk Fat Globule Membrane | Milk      |
| Phospha***** | *****        | *****                     | ****      |
| *****        | *****        | *****                     | ***       |

◇ An indicative list of terms to show how a concept table is generated. View paid report for complete list.

◇ Concept Table was enriched by searches related to phospholipids and sphingolipid of milk from relevant patents, scientific articles and various thesauri

## Relevant Class Code Definitions

## IPC/ECLA

### Milk Classes (IPC/ECLA)

| IPC/ ECLA | DEFINITION   |
|-----------|--|
| A23C      | DAIRY PRODUCTS, e.g. MILK, BUTTER, CHEESE; MILK OR CHEESE SUBSTITUTES; MAKING THEREOF. |
| A23C9/00  | Milk preparations; Milk powder or milk powder preparations                             |
| ****      | ****   |

## US Class

### Milk Classes (US)

| US Class Code | DEFINITION  |
|---------------|---|
| 426           | FOOD OR EDIBLE MATERIAL: PROCESSES, COMPOSITIONS, AND PRODUCTS.   |
| 426/34        | Of milk or milk product: Processes wherein the substrate fermented is milk or a lacteal derived source. |
| *****         | *****   |

### Phospholipids and Sphingolipids Classes (US)

| US Class Code | DEFINITION  |
|---------------|---|
| 514           | DRUG, BIO-AFFECTING AND BODY TREATING COMPOSITIONS. |
| 514*****      | *****   |

## F-Terms

### Milk F-Terms

| F-Theme | Definition                                       | View Point | Definition                               | F-Term | Definition    |
|---------|--|------------|--|--------|---------------|
| 4B018   | COLORING FOODS AND IMPROVING NUTRITIVE QUALITIES | LB         | APPLICABLE FOOD                          | LB07   | Dairy Product |
|         |  | MD         | NUTRITION MODIFYING SUBSTANCES AND FUNGI | MD71   | Milk          |
| ****    | *****  | ****       | ****                                     | *****  | *****         |

### Phospholipids and Sphingolipids F-Terms

| F-Theme | Definition | View Point | Definition                                      | F-Term | Definition                            |
|---------|------------|------------|---|--------|---------------------------------------|
| 4C083   | COSMETICS  | AD         | ORGANIC INGREDIENTS CHARACTERIZED BY STRUCTURES | AD57   | Phospholipids (Lecithins or the like) |
| ****    | *****      | ****       | ****  | *****  | *****                                 |

◇ An indicative list of various class codes used for the IP search. View paid report for complete list.

## Search Strategy

**Search Engine:** Thomson Innovation

**Timeline:** 01/01/1991 - 08/26/2011 (mm/dd/yyyy)

### Search Strategy Using English Keywords

**Database Covered:** US Grant, GB App, US App, FR App, WO App, DE Util, EP Grant, DE Grant, EP App, DE App, JP Util, JP Grant, JP App, CN Util, CN App, KR Util, KR Grant, KR App, Other, DWPI

| English Keywords |                                 |  |                                   |         |                          |
|------------------|---------------------------------|--|-----------------------------------|---------|--------------------------|
| S.NO             | Scope                           | Concept  | Strategy                          | INPADOC | Total Hits               |
| 1                | Title, Abstract Claims          | Phospholipid <b>OR</b> Sphingolipid Keywords         | (Polar ADJ1 Lipid*1) OR *****     | ###     | #####                    |
| 2                | Full Text                       | Milk Keywords  | Milk OR Dairy OR *****            | ###     | #####                    |
| 3                | Title, Abstract Claims          | Phospholipid Keywords                                | (Polar ADJ1 Lipid*1) OR *****     | ###     | #####                    |
| 4                | Title, Abstract Claims          | Sphingolipid Keywords                                | (Polar ADJ1 Lipid*1) OR *****     | ###     | #####                    |
| 5                | IPC <b>OR</b> ECLA <b>OR</b> US | Milk Classes   | A23C000900 OR A23C0001** OR ***** | ###     | #####                    |
| 6                | IPC <b>OR</b> ECLA <b>OR</b> US | Phospho and Sphingolipid classes                     | A23J000700 OR A61*****            | ###     | #####                    |
| 7                | Combination Queries             | All Keywords   | 1 AND **                          | ###     | #####                    |
| 8                | Combination Queries             | Phospholipid Kws <b>AND</b> Milk Classes             | 3 AND **                          | ###     | #####                    |
| 9                | Combination Queries             | Sphingolipid Kws <b>AND</b> Milk Classes             | ** AND 5                          | ###     | ####                     |
| 10               | Combination Queries             | Milk KWs <b>AND</b> Phospho and Sphingolipid Classes | 2 AND **                          | ###     | #####                    |
| 11               | Combination Queries             | Final Query  | 7 OR ** OR **                     | ###     | ##### (No Relevant Hits) |

### Search Strategy Using French Keywords

Database Covered: FR App, WO App, EP Grant, EP App, DWPI

| French Keywords |                        |  |                           |         |                         |
|-----------------|------------------------|--|---------------------------|---------|-------------------------|
| S.NO            | Scope                  | Concept  | Strategy                  | INPADOC | Total Hits              |
| 1               | Title, Abstract Claims | Phospholipid Keywords                                  | Phospholipid*1 OR *****   | ###     | #####                   |
| 2               | Title, Abstract Claims | Sphingolipid Keywords                                  | Sphingolipides*1 OR ***** | ###     | #####                   |
| 3               | Full Text              | Milk Keywords  | (Membrane*1 *****)        | ###     | #####                   |
| 4               | IPC <b>OR</b> ECLA     | Milk Classes   | A23C000900 OR A23C00***** | ###     | #####                   |
| 5               | IPC <b>OR</b> ECLA     | Phospho and Sphingolipid classes                       | A23J00700 OR A6*****      | ###     | #####                   |
| 6               | Combination Queries    | Phospholipid Kws <b>AND</b> Milk IPC/ ECLA             | 1 AND **                  | ##      | ####                    |
| 7               | Combination Queries    | Sphingolipid Kws <b>AND</b> Milk IPC/ ECLA             | ** AND 4                  | ##      | ###                     |
| 8               | Combination Queries    | Milk KWs <b>AND</b> Phospho and Sphingolipid IPC/ ECLA | ** AND 5                  | ##      | ###                     |
| 9               | Combination Queries    | Final Query  | ** OR 7 OR 8**            | ##      | #### (No Relevant Hits) |

### Search Strategy Using German Keywords

Database Covered: WO App, DE Util, EP Grant, DE Grant, EP App, DE App, DWPI

| German Keywords |       |                       |          |         |            |
|-----------------|-------|-----------------------|----------|---------|------------|
| S.NO            | Scope | Concept               | Strategy | INPADOC | Total Hits |
| 1               |       | Phospholipid Keywords |          | ###     | #####      |

|   |                        |   |                         |     |                         |
|---|------------------------|---|-------------------------|-----|-------------------------|
|   | Title, Abstract Claims |   | Phospholipid*1 OR ***** |     |                         |
| 2 | Title, Abstract Claims | Sphingolipid Keywords                           | Sphingolipid*1 OR ***** | ##  | ###                     |
| 3 | Full Text              | Milk Keywords                                   | ((Milch ADJ2 *****))    | ### | #####                   |
| 4 | IPC OR ECLA            | Milk Classes                                    | A23C000900 OR A23*****  | ### | #####                   |
| 5 | IPC OR ECLA            | Phospho and Sphingolipid classes                | A23J00700 OR *****      | ### | #####                   |
| 6 | Combination Queries    | Phospholipid Kws AND Milk IPC/ ECLA             | ** AND 4                | ##  | ####                    |
| 7 | Combination Queries    | Sphingolipid Kws AND Milk IPC/ ECLA             | 2 AND **                | ##  | ##                      |
| 8 | Combination Queries    | Milk KWs AND Phospho and Sphingolipid IPC/ ECLA | 3 AND **                | ##  | ##                      |
| 9 | Combination Queries    | Final Query                                     | ** or ** or 8           | ### | #### (No Relevant Hits) |

## Search Strategy Using F-Terms

Database Covered: JP Util, JP Grant, JP App, DWPI

| F-Term Search |                        |   |                                   |         |                         |
|---------------|------------------------|---|-----------------------------------|---------|-------------------------|
| S.NO          | Scope                  | Concept                                       | Strategy                          | INPADOC | Total Hits              |
| 1             | Title, Abstract Claims | Phospholipid Keywords                         | ((Polar ADJ1 Lipid*1) OR *****)   | ###     | #####                   |
| 2             | Title, Abstract Claims | Sphingolipid Keywords                         | ((Polar ADJ1 Lipid*1) OR *****)   | ###     | ###                     |
| 3             | Full Text              | Milk Keywords                                 | (Milk ADJ1 Fat ADJ Globule *****) | ###     | #####                   |
| 4             | F-terms                | Milk F-Terms                                  | 4B001AC06 OR 4B0*****             | ###     | ####                    |
| 5             | F-terms                | Phospho and Sphingolipid F-Terms              | 4C086DA41 OR 4C*****              | ##      | ###                     |
| 6             | Combination Queries    | Phospholipid Kws AND Milk F-terms             | 1 AND **                          | ##      | ###                     |
| 7             | Combination Queries    | Sphingolipid Kws AND Milk F-terms             | 2 AND **                          | #       | ##                      |
| 8             | Combination Queries    | Milk KWs AND Phospho and Sphingolipid F-terms | 3 AND **                          | ###     | ####                    |
| 9             | Combination Queries    | Final Query                                   | 6 or ** or **                     | ###     | #### (No Relevant Hits) |

## Final Query

| S.NO | Scope       | Strategy  | INPADOC | Total Hits                               |
|------|-------------|---|---------|--|
| 1    | Final Query | English OR French OR German OR F-Term(Japanese) | ###     | #### (No Relevant Hits) (#.#% Relevancy) |

## Taxonomy

phospholipids and sphingolipids of milk.mm

Flash plugin or Javascript are turned off. Activate both and reload to view the mindmap

## Relevant Patents (Sample Set)

### Control Patents

| S.No. | Patent No.     | Publication date | Assignee/ Applicant | Title  | Dolcera Summary  |
|-------|----------------|------------------|---------------------|--|--|
| 1     | WO2011069987A1 | 6/16/2011        | NESTEC S.A.         | Infant Formula With Probiotics And Milk Fat Globule Membrane Components            | Formulation of infant feed (or nutritional product for patients in need) including probiotics and MFGM components along with other nutrient ingredients for improving immune system and gut comfort. The MFGM components are recovered by ultrafiltration or microfiltration recovered buttermilk, or from whey protein concentrate, sweet whey, acid whey, whey cream, etc.         |
| 2     | EP2308324A1    | 4/13/2011        | Arla Foods amba     | Phosphatidylserine Enriched Milk Fractions For The Formulation Of Functional Foods | Extraction of Phosphatidylserine from natural source i.e. bovine buttermilk, butter oil serum, etc., following steps of centrifugation of cream, homogenizing to break resulting emulsion, collection of serum phase, and separation of fat by ultrafiltration including diafiltration and finally spray drying. This composition can be used as nutraceutical composition in foods. |

## Sample Analysis

[Click here for Sample\\_\\_Patent\\_Analysis\\_Sheet](#)

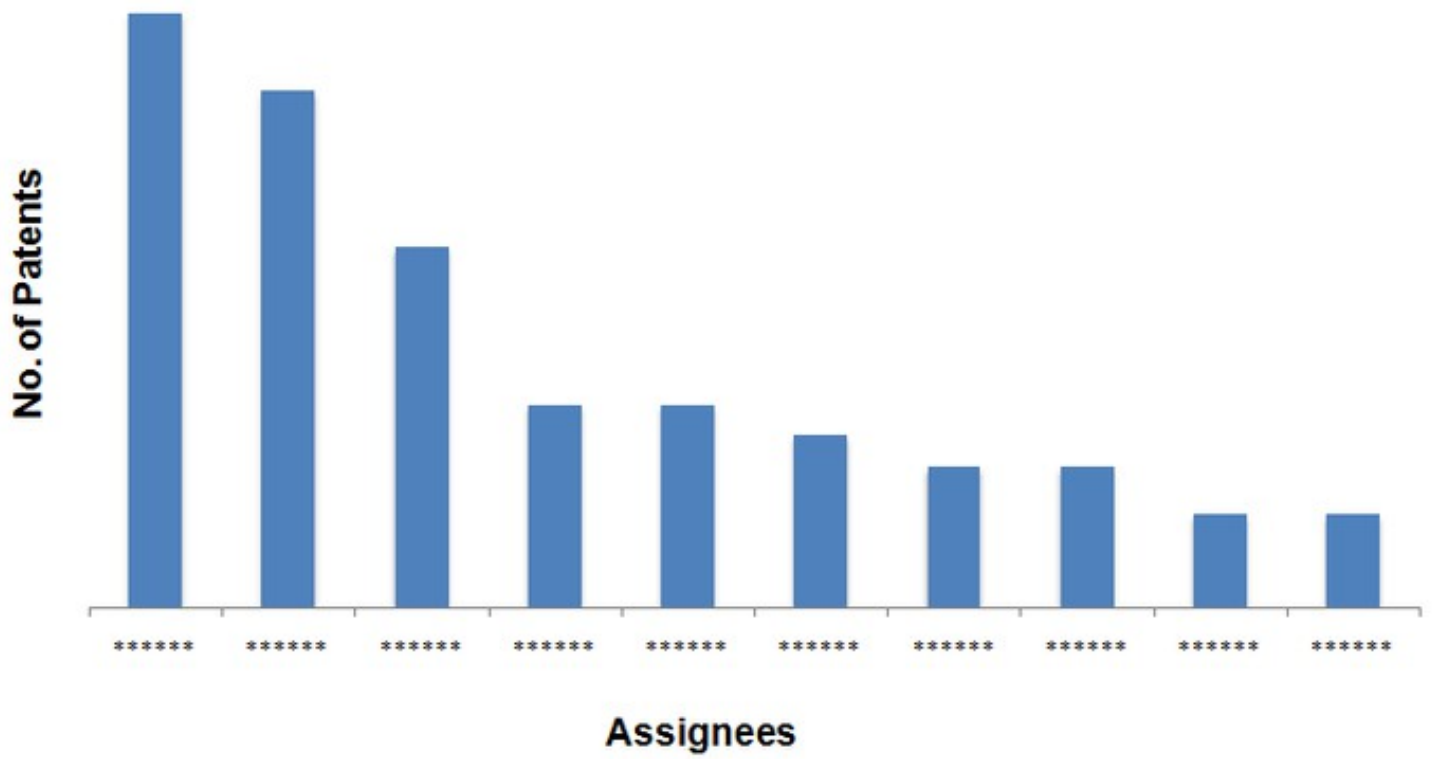
## Assignee Analysis and IP Activity

◇ Labels for all the charts below are available in the paid report.

### Top Assignees

◇ The following graphs explain the placement of the different assignees in this technology area.

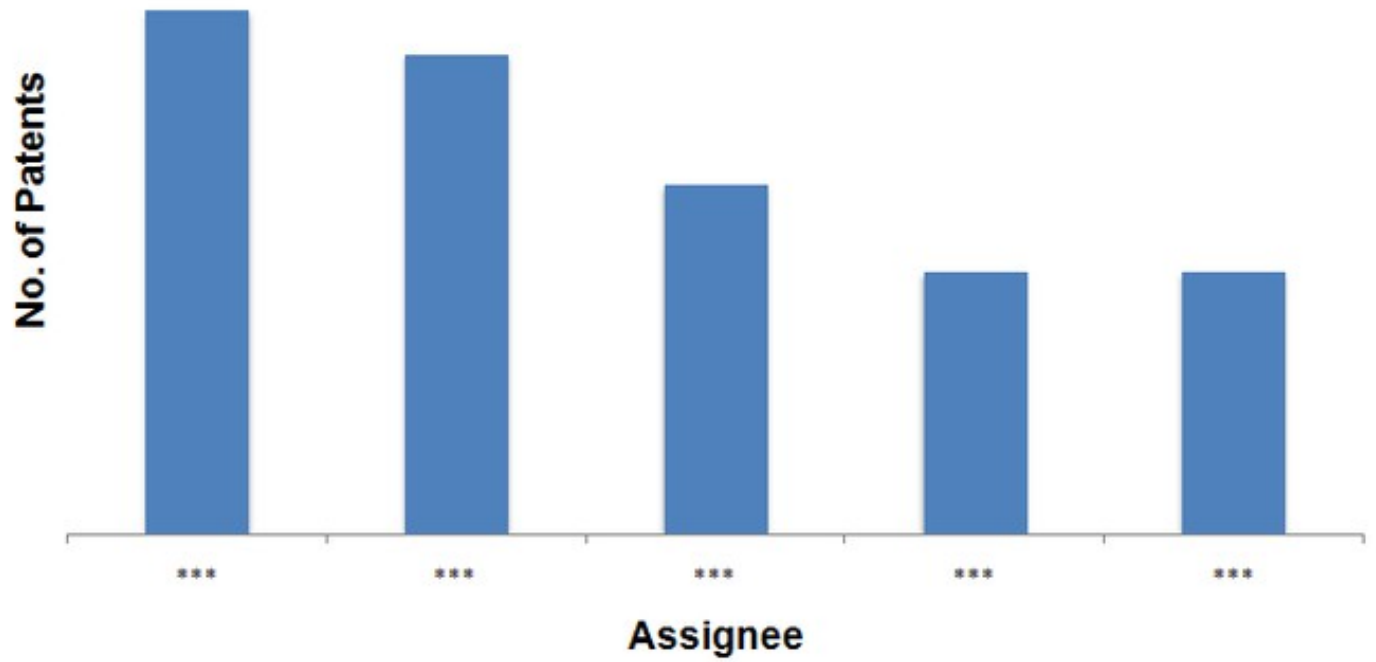
## Top 10 Assignees



Top 10 Assignees

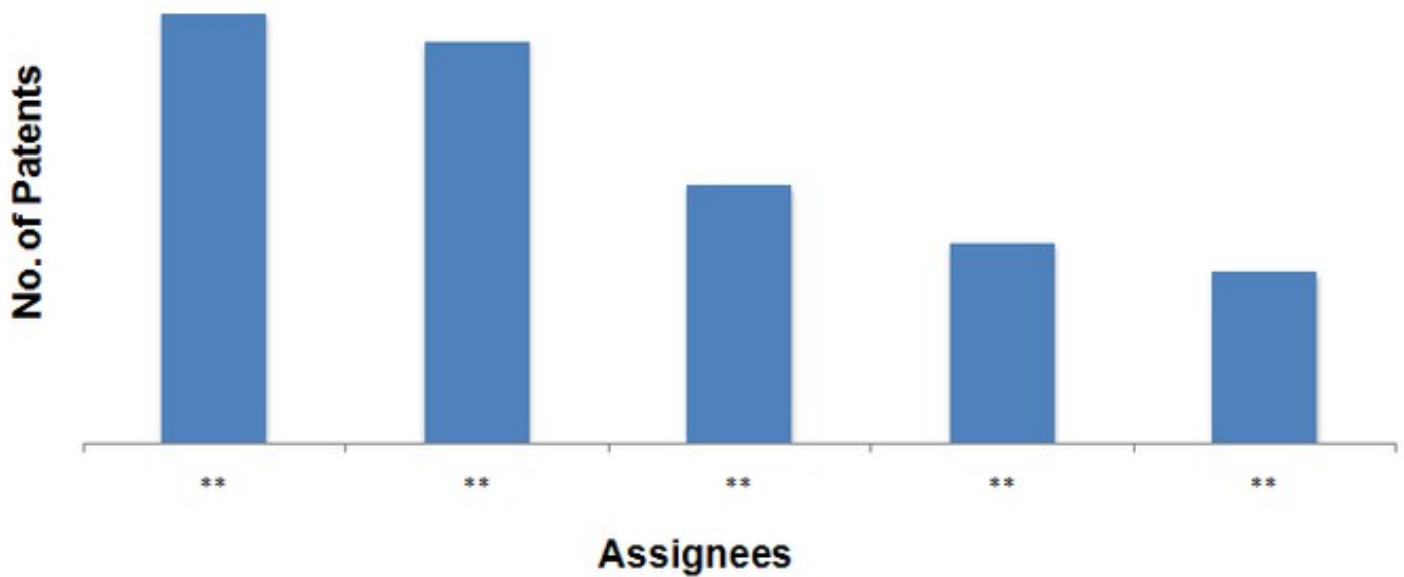
◇ **Top players in field Infant Feed Formulations, Products(other then Infant Formulations) Formulations and Extraction.**

## Top Assignees in Field of Infant Feed Formulations



Assignees in Filed of Infant Feed Formulation

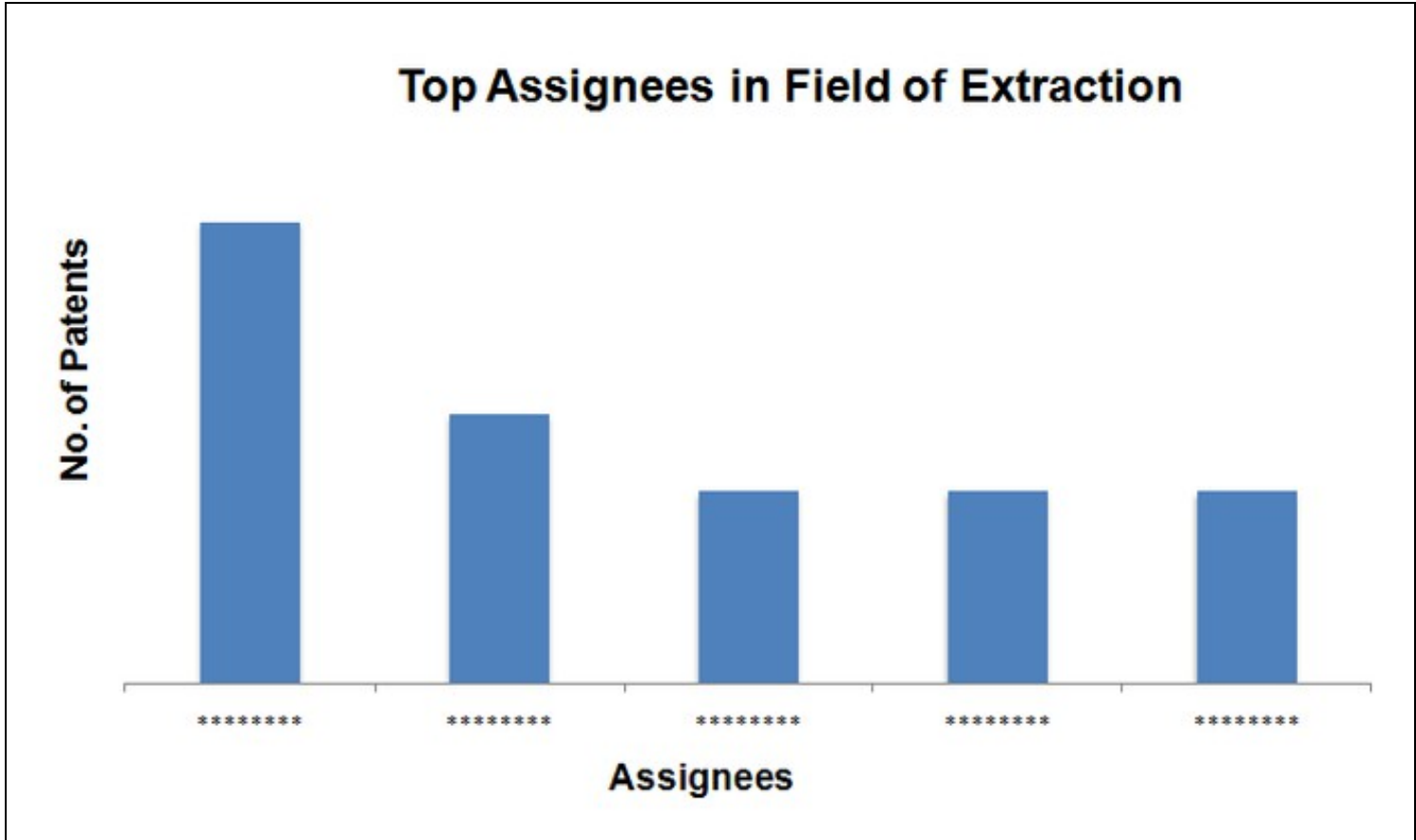
## Top Assignees in Field of Product Formulations







Assignees in Filed of Product Formulation



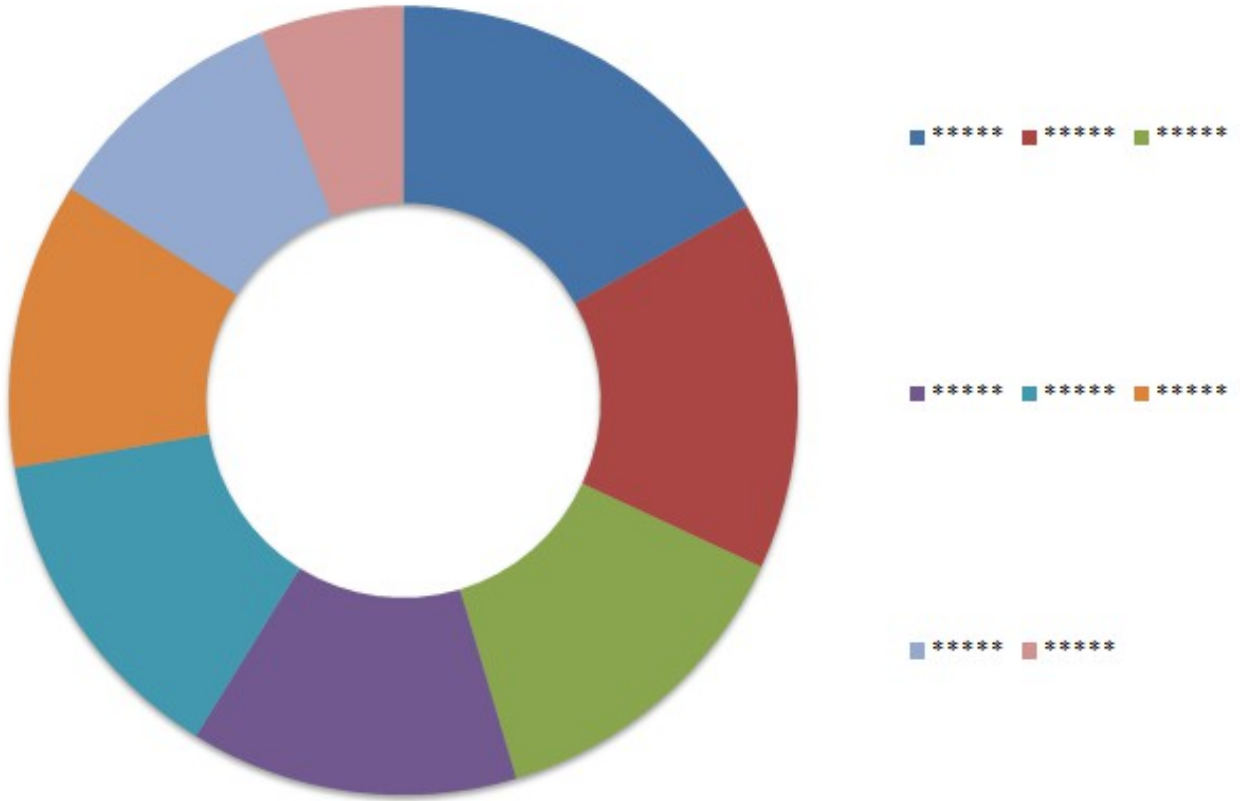
Assignees in Filed of Extraction

### Assignee Categorization

• The assignees have been categorized into following areas:

- ◇ Pharmaceutical Companies
- ◇ Food Processing Companies
- ◇ Dairy Industries
- ◇ Cosmetic Companies
- ◇ Nutraceutical Companies
- ◇ Chemical Suppliers
- ◇ Universities/ Research Institutes
- ◇ Other Technology Partners

## Categorization of Assignees

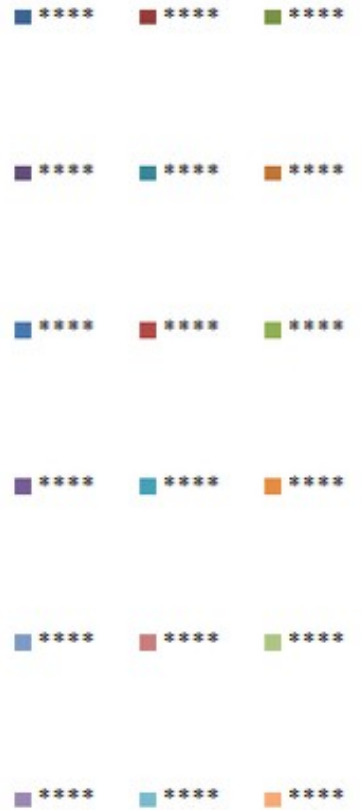
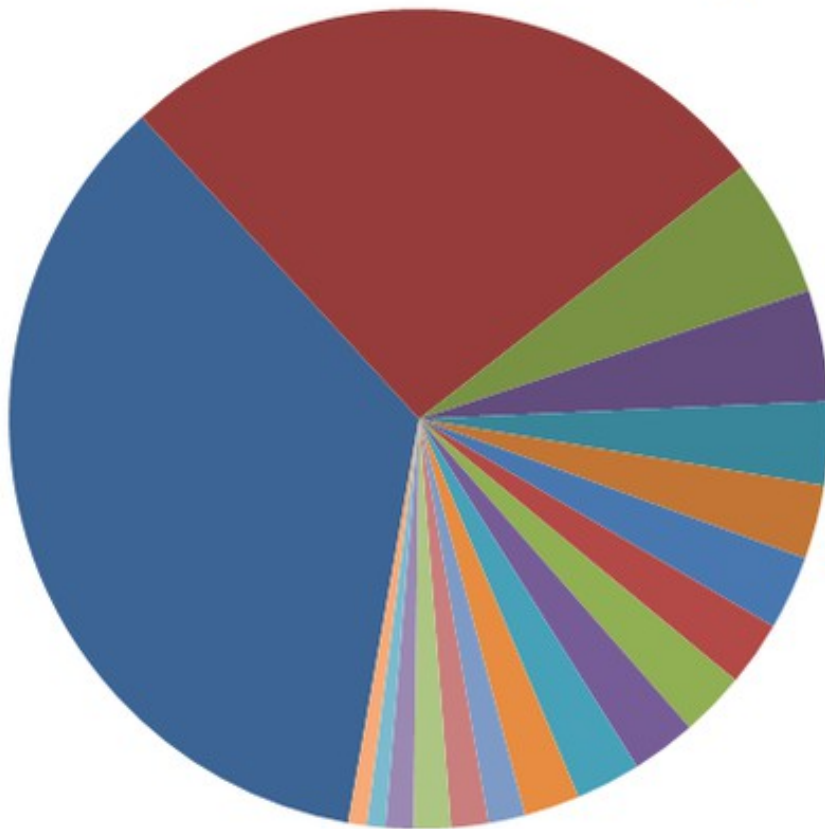


Assignee Categorization

## Geographical Distribution

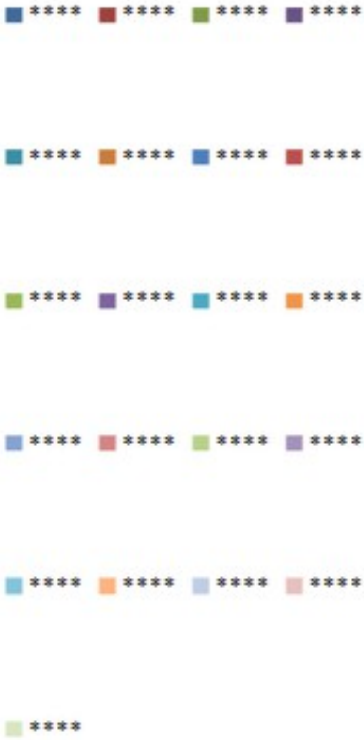
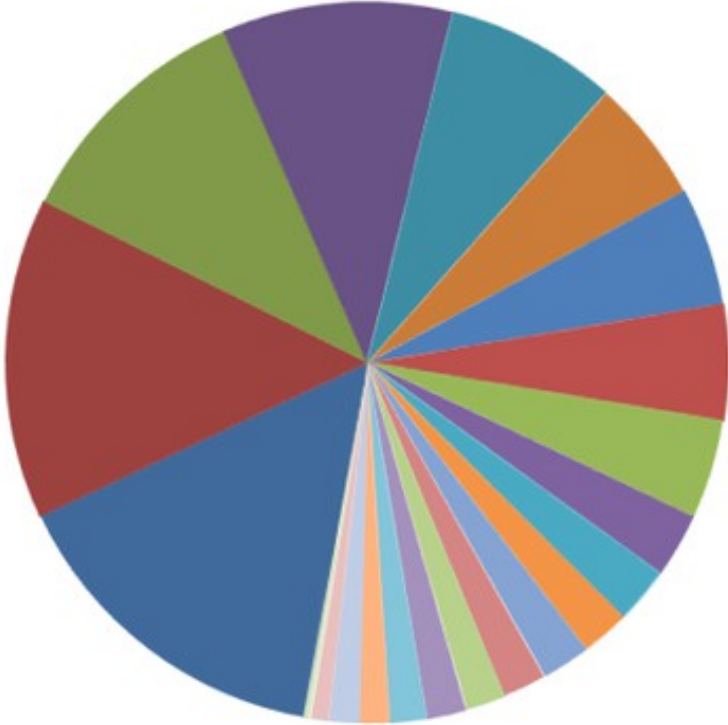
◇ The following graphs explain the geographical distribution of patents.

# Geographical Distribution of Patents (One member per family)



Geographical Distribution of Patents

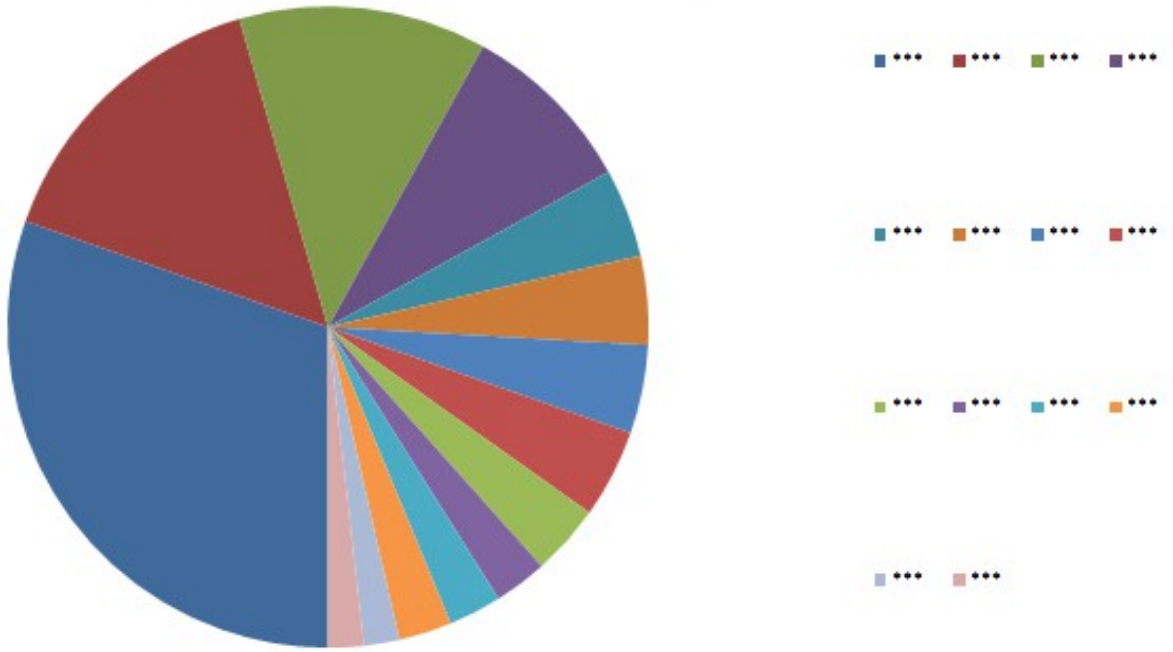
# Geographical Distribution of Patent Family Members



Geographical Distribution of Patents Family Members

◇ The following graph explain the geographical distribution of assignees.

## Geographical Distribution of Assignees



Geographical Distribution of Assignees  
**IP Activity**

◇ The following graphs explain the IP activity based on Priority year and Publication Year

## IP Activity Based on Publication year

No. of Patents

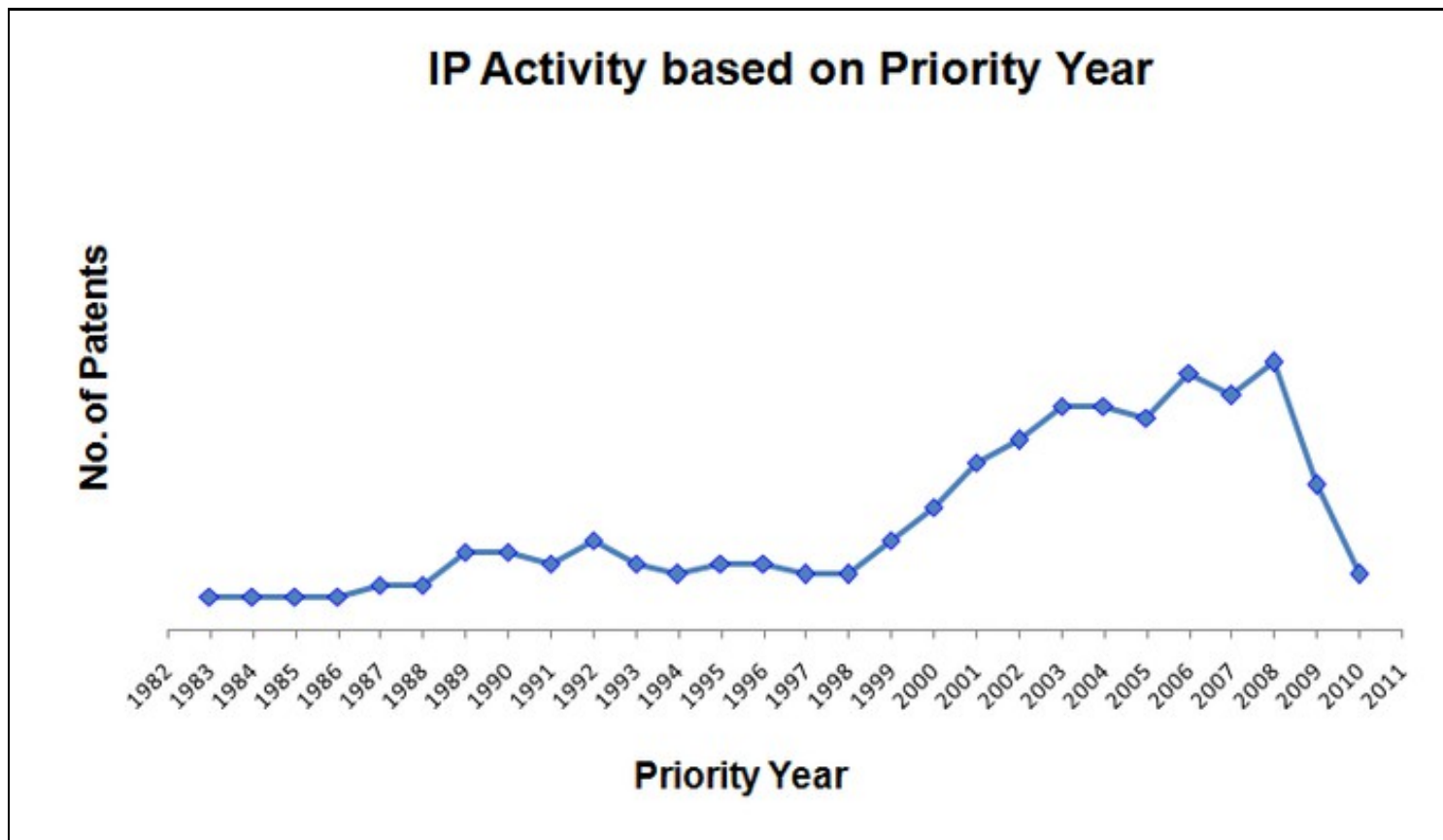
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

Publication Year




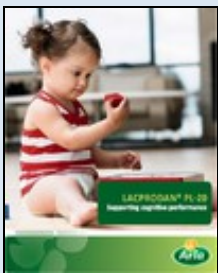


IP Activity Based on Publication Year



IP Activity Based on Priority Year

## Patent-Product Mapping

| S.No | Patent no.      | Title   | Assignee               | Products                            | Product Description   |
|------|-----------------|---|------------------------|-------------------------------------|---|
| 1    | US20110182943A1 | METHODS OF IMMUNE OR HEMATOLOGICAL ENHANCEMENT, INHIBITING TUMOUR FORMATION OR GROWTH, AND TREATING OR PREVENTING CANCER, CANCER SYMPTOMS, OR THE SYMPTOMS OF CANCER TREATMENTS | FONERRA COOP GROUP LTD | <a href="#">Phospholac 600 T.M.</a> |  |
| 2    | US20090123630A1 | PHOSPHATIDYLSERINE ENRICHED MILK FRACTIONS FOR THE FORMULATION OF FUNCTIONAL FOODS  | ARLA FOODS AMBA        | <a href="#">LACPRODAN PL-20</a>     |  |

# Scientific Articles

## Search Strategy

- **Database** : Scirus
- **Timeline** : 1991 - 2011
- **Subject Areas** : Agricultural and Biological Sciences; Chemistry and Chemical Engineering; Engineering, Energy and Technology; Life Sciences; Medicine and Pharmacology.
- **Information Types** : Abstracts, Articles, Articles in Press, Books, Conferences and Reviews.

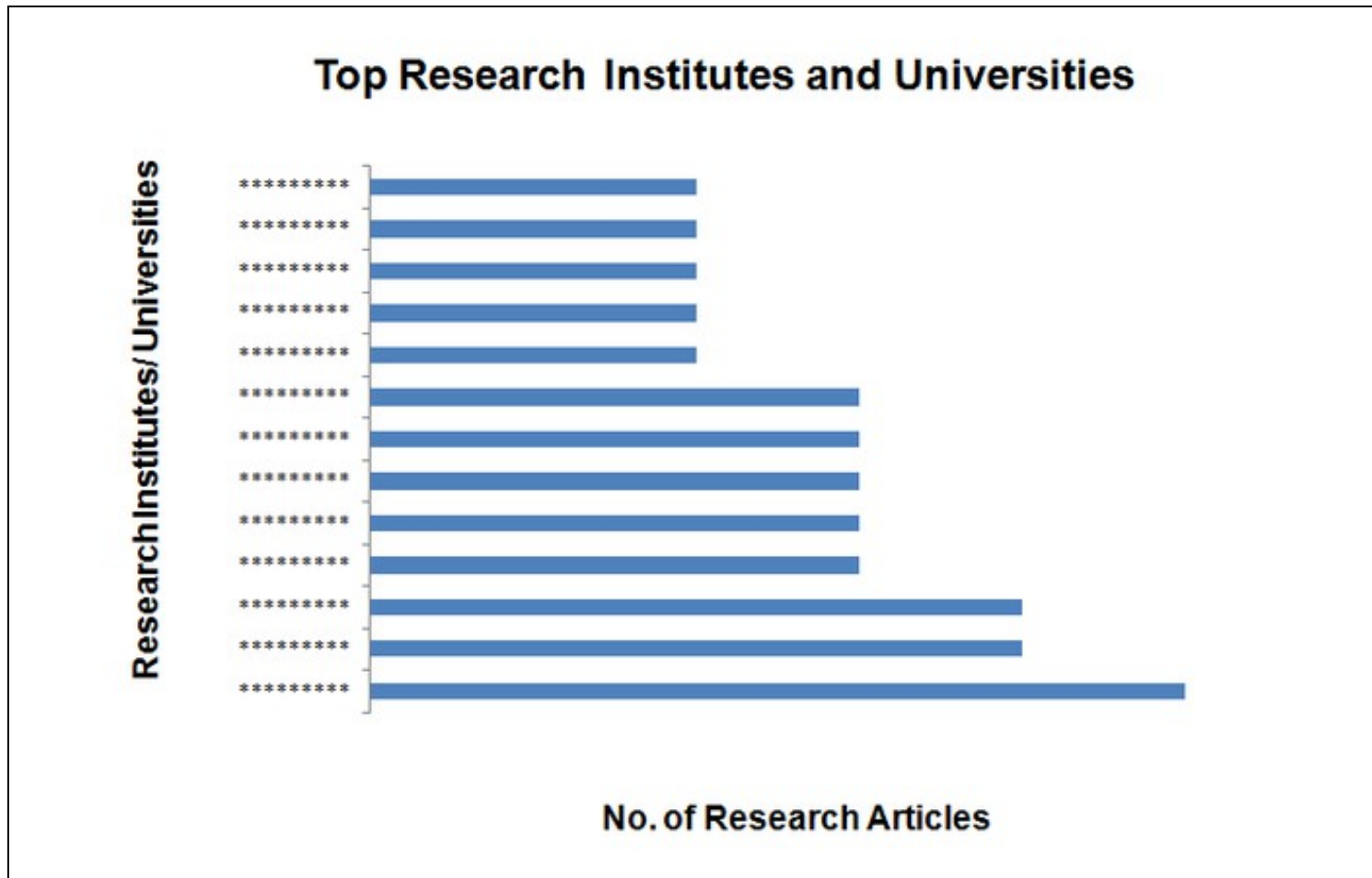
| S.No | Scope             | Concept                                   | Strategy  | Total Hits                  |
|------|-------------------|---|---|-----------------------------|
| 1    | Complete Document | (Phospholipids OR Sphingolipids) Keywords | ("Polar Lipid*" OR Phospholipid* OR ***** Sphingolipid* OR *****) | #### (No Relevant Articles) |
|      |                   |   | AND   |                             |
|      | Keyword(s)        | Milk Keywords                             | ("Milk Fat Globule Membrane*" OR Milk* OR *****)                  |                             |

## Relevant Scientific Articles

◊ [Click here to download relevant Scientific Articles Sheet](#)

• The following graphs explain the placement of different Research Institutes and Universities in this technological area.

◊ Patents with the maximum number of forward citations were determined and the graph shows the top 13 patents with corresponding assignees.



# Dolcera Dashboard

Assignees were categorized based on the type of their Major Business Domians viz. food processing companies, cosmetic companies, pharma companies, nutraceutical companies, chemical suppliers, research and educational institutions, other technological partners, etc. and their patents have been shown in the Dolcera Interactive Dashboard.

◊ A data preview of the dashboard is shown below:

The screenshot displays the Dolcera dashboard interface. On the left, there is a 'Data Filters' sidebar with a search bar and a list of categories including Chemical Suppliers (34), Dairy Industries (122), Food Processing Companies (3), Technology Partners (16), University/ Research Institutes, Cosmetic Companies (29), Pharmaceutical Companies (30), Nutraceutical Companies (3), and Others (11). The main area is titled 'Phospholipids and Sphingolipids of Milk Information' and shows a table of patents. Below the table, detailed information for a selected patent (MX2002005317A) is shown, including its title, priority date, inventor, and abstract.

| Publication     | Title  | Assignee | Pub  | App  | R |
|-----------------|--|----------|------|------|---|
| MX2002005317A   | No title available   | ...      | 2002 | 2002 |   |
| DE1022793A1     | No title available   | ...      | 2004 | 2002 |   |
| US20080145506A1 | Food compositions and products containing balanced ratio of essential fatty acids                                      | ...      | 2008 | 2006 |   |
| US7338678B2     | Composition for treating groundwater contamination   | ...      | 2008 | 2005 |   |
| US20080051369A1 | Skin cosmetic material   | ...      | 2008 | 2007 |   |
| US20080193394A1 | Composition for protection and improvement of skin, or reinforcing skin barrier function comprising phosphatidylserine | ...      | 2008 | 2007 |   |
| US20090131717A1 | Composition for protecting skin  | ...      | 2009 | 2009 |   |
| IN200708979P1   | No title available   | ...      | 2008 | 2007 |   |
| WO2008120214A3  | Compositions containing phosphatidylserine in treating diabetes associated conditions                                  | ...      | 2008 | 2007 |   |
| US20090011075A1 | Polar lipid mixtures, their preparation and uses   | ...      | 2009 | 2008 |   |
| AU2002321300A1  | No title available   | ...      | 2003 | 2002 |   |
| KR2004000413A   | No title available   | ...      | 2004 | 2003 |   |

**MX2002005317A**  
 No title available  
 Priority Date (y-m-d): 2002-05-29  
 First Inventor: Not Available  
 US Class (primary): Not available  
 IPC Class (primary): Not available  
 Abstract: null  
 Dolcera Summary: Not available

◊ A chart preview of the dashboard is shown below:

The screenshot shows the Dolcera dashboard with a bar chart titled 'Phospholipids and Sphingolipids of Milk - ALL COMPANIES'. The chart displays the number of patents for various companies, with the y-axis representing the count and the x-axis listing the company names. The chart is categorized by 'Company Statistics' and includes options for 'Timeline by Pub Year' and 'Timeline by App Year'. The chart shows a high concentration of patents for a few companies, with the number of patents decreasing significantly for the remaining companies.

# Purchase Information

Contact information for purchasing this report:



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