Nanoemulsions in foods

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Objective

To create a technology landscape report on **Nanoemulsions in food**

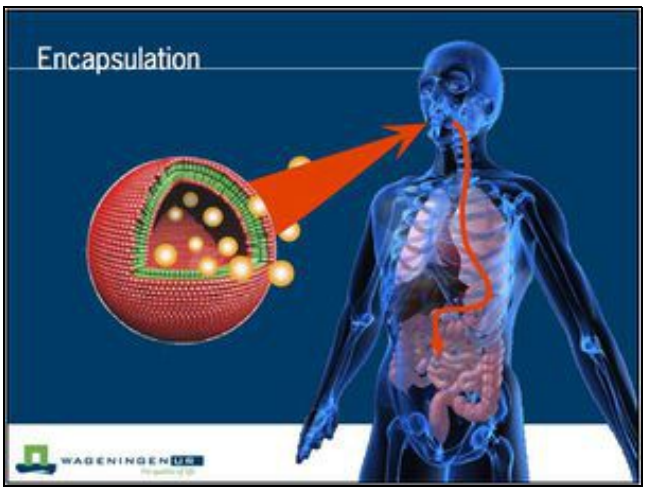
- Identify market players with prolific IP activity in the technology area
- Segment the players by the industry they belong to

Note: *This report is just a template and gives an indication of what the paid report contains.*

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Background

With the rapid technological advances, studies in the field of Food processing and packaging have been extended from micro to nano-sized (10^{-9} m) particles. Food nanotechnology is rapidly emerging with several innovations in food packaging and nutraceuticals. Nano-emulsions are now being increasingly used for encapsulating bio active compounds and act as transport vehicles in probiotic health foods and other functional foods. Furthermore, the so called ?smart foods? containing nanotech sensors in the packages are capable of detecting pathogens, toxins and other chemicals, enabling the consumers to detect food spoilage. Ongoing research areas include ?interactive foods? like beverages which change flavors and colors, foods that can adjust for a person?s nutritional needs Nanovip.



Encapsulation

Emulsion is a system in which one liquid made of a fine particle is dispersed in another liquid, ex- oil dispersed in water (O/W emulsion). The emulsions are highly unstable and encounter problems like flocculation, creaming and coalescence. Though micro-emulsions have found a vast application in food processing, in recent years nano-emulsions are emerging out with better advantages when compared to micro-emulsions, as described below:

- Size of the particle ? 5 to 100 nm
- Thermodynamically stable
- Transparent emulsions- suitable for transparent foodstuffs like beverages
- Continuous self-assembly with hydrophilic and hydrophobic portions to maintain stable emulsion state
- Uncharged particles ? no surface coalescence
- Very small size ? no sedimentation or creaming
- Increased stability- increased bio availability Kim et al.(2010)

In general, Nano-encapsulation involves the incorporation, absorption or dispersion of bioactive compounds in small vesicles with nano (or submicron) diameters. The incorporated bioactive compounds may be protected against degradation, have improved stability and solubility (e.g., solubilizing a hydrophilic compound in hydrophobic matrices and vice versa) and therefore might increase bioavailability and delivery to cells and tissues. Reducing

the size of encapsulates into the nanoscale offers opportunities related to prolonged gastrointestinal retention time caused by bio-adhesive improvements in the mucus covering the intestinal epithelium Bouwmeester et al. (2009)

Depending upon the nature of bioactive compounds, two types of nano-emulsions can be prepared. For water insoluble hydrophobic compounds like certain vitamins, minerals, aroma volatiles, flavor components, antioxidants, carotenoids and lutein, oil-in-water (o/w) emulsion is suitable. For water soluble bioactive compounds like the water soluble vitamins, w/o/w emulsion is used. The compounds are entrapped in the aqueous core of such emulsions. In a w_1 /o/w_2 emulsion system, upon consumption the external w_2 phase will be perceived but the internal w_1 phase will be shielded from the taste receptors during the time scales of eating. This helps to mask bitter fastes and undesirable flavors of the bioactive compounds Lakkis (2007).

Concept Table

S.No	English Keywords			French Keywords			German Keywords		
	Food	Nano	Emulsions	Food	Nano	Emulsions	Food	Nano	Emulsions
1	Food	Nano*	Emulsion, emulsifier, emulsify,emulsification	Alimentaires, aliment, aliments	Nano*	émulsion, émulsions, émulsifiant, émulsifiants, émulsification,	Lebensmittel	Nano*	Emulsion, Emulsionen, Emulgator, Emulgatoren, Emulgieren, Emulgierung
2	Beverage, Drink	Ultrafine	Colloid	Boissons, breuvage, des boissons	ultrafines	Colloïde, colloïdes, colloïdale, colloïdalement	Getränk, Getränke	ultrafeinen	Kolloid, Kolloid-, kolloidale, kolloidal
3	***	***	***	***	***	***	***	***	***
4	****	****	****	****	****	****	****	****	****

- *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 gut biology and probiotics in food from pubmed mesh, relevant patents, scientific articles and various thesauri*

Class Codes and Definition

IPC / ECLA Class codes

CLASS CODES RELATED TO EMULSIONS	
C08J000302	*Making solutions, dispersions, lattices or gels by other methods than by solution, emulsion or suspension polymerization techniques

US Class codes

977702	Nanotechnology - Having biological material component

Relevant F- Terms

1	**4F070**<	**Processes of treating macromolecular substances**	
		AE15	Protective colloids

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

Search Strategy

Search Strategy with English keywords

Database: Thomson Innovation
Timeline: Query: 01/01/2001 - 27/8/2011

Patent Coverage: US, DWPI, FR, WO, EP, JP,CN, KR, DE, GB

S.No	Concept	Scope	Search string	Type of class codes	Class codes	INPADOC hits

1	(Food+Nano) keywords + Class codes of Emulsions	Title, Abstract, Claims	food *** AND Nano***	Any IPC or ECLA	C08J000302 OR ****	##
2				US class	***	
3	**1 OR 2**					#
4	(Food + emulsion) keywords + Class codes of Nano	Title, Abstract, Claims	food *** AND emulsion***	Any IPC or ECLA	****	#
5				US class	977702 ****	###
6	**4 OR 5**					###
7	(Nano keywords) + Class codes of Food emulsions	Title, Abstract, Claims	Nano*	Any IPC or ECLA	*****	###
8				US class	*****	##
9	**7 OR 8**					##
10	Final query	**3 OR 6 OR 9**				##

Search Strategy with French keywords

Database: Thomson Innovation
Timeline: Query: 01/01/2001 - 27/8/2011

Patent Coverage: FR, WO, EP

S.No	Concept	Scope	Search string	IPC or ECLA class codes	INPADOC hits
1	(Food+Nano) keywords + Class codes of Emulsions	Title, Abstract, Claims	alimentaires ****	C08J000302 ***	##
2	(Food + emulsion) keywords + Nano class codes	Title, Abstract, Claims	alimentaires ****	***	##
3	(Nano keywords) + Class codes of Food emulsions	Title, Abstract, Claims	Nano ***	***	##
4	Final query	**1 OR 2 OR 3**			##

Search Strategy with German keywords

Database: Thomson Innovation
Timeline: Query: 01/01/2001 - 27/8/2011

S.No	Concept	Scope	Search string	IPC or ECLA class codes	INPADOC hits
1	(Food+Nano) keywords + Class codes of Emulsions	Title, Abstract, Claims	Lebensmittel ****	C08J000302 ***	##
2	(Food + emulsion) keywords + Nano class codes	Title, Abstract, Claims	Lebensmittel ****	***	##
3	(Nano keywords) + Class codes of Food emulsions	Title, Abstract, Claims	Nano ***	***	##
4	Final query	**1 OR 2 OR 3**			##

Search Strategy with F-terms

Database: Thomson Innovation
Timeline: Query: 01/01/2001 - 27/8/2011

Patent Coverage: JP

S.No	Concept	Scope	Search string	F-Terms	INPADOC hits
1	(Food+Nano) keywords + Emulsion class codes	Title, Abstract, Claims	Food ****	4F070AE15 ***	##
2	(Food + emulsion) keywords + Nano class codes	Title, Abstract, Claims	Food ****	***	##
3	Nano keywords + Food emulsion or encapsulation class codes	Title, Abstract, Claims	Nano ***	***	##
4	**Final query**	**1 OR 2 OR 3**			**##**

Final search Results

Final Query	English OR French OR German OR Japanese	**#### (Relevancy = ##%)**

Relevant Patents(Sample Set)

S.No	Patent/Publication No.	Assignee/ Applicant	Year	Title	Focus	Dolcera summary
1	US 2011/0038942 A1	TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD.	2011	BETA-LACTOGLOBULIN-POLYSACCHARIDE NANOPARTICLES FOR HYDROPHOBIC BIOACTIVE COMPOUNDS	Delivery of hydrophobic nutraceuticals	A colloidally stable nano-dispersion of beta-lactoglobulin in combination with a polysaccharide has been used in foods to deliver hydrophobic bioactive compounds.
2	US 2010/0136207 A1	KOREA FOOD RESEARCH INSTITUTE	2010	NANOEMULSION AND NANOPARTICLE CONTAINING PLANT ESSENTIAL OIL AND METHOD OF PRODUCTION THEREOF	Encapsulation of functional components in food	A nanoemulsion is prepared using a water soluble biopolymer to encapsulate plant essential oils which are used as functional components in foods.
3	US 2010/ 0028444 A1	BASF SE	2010	USE OF WATER-DISPERSIBLE CAROTENOID NANOPARTICLES AS TASTE MODULATORS, TASTE MODULATORS CONTAINING WATER-DISPERSIBLE CAROTENOID NANOPARTICLES, AND, METHOD FOR TASTE MODULATION	Nanoparticles as taste modulators	Water dispersible carotenoid nanoparticles in combination with azo compounds are used to modify the bitter taste and after taste of food compositions.

Analysis sheet

Click here to download the sample patents analysis sheet

Interactive Taxonomy

Taxonomy was populated based on the detailed analysis of patents.

```
        .markmap-node {
            cursor: pointer;
        }

        .markmap-node-circle {
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            stroke-width: 1.5px;
        }

        .markmap-node-text {
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            font: 10px sans-serif;
        }

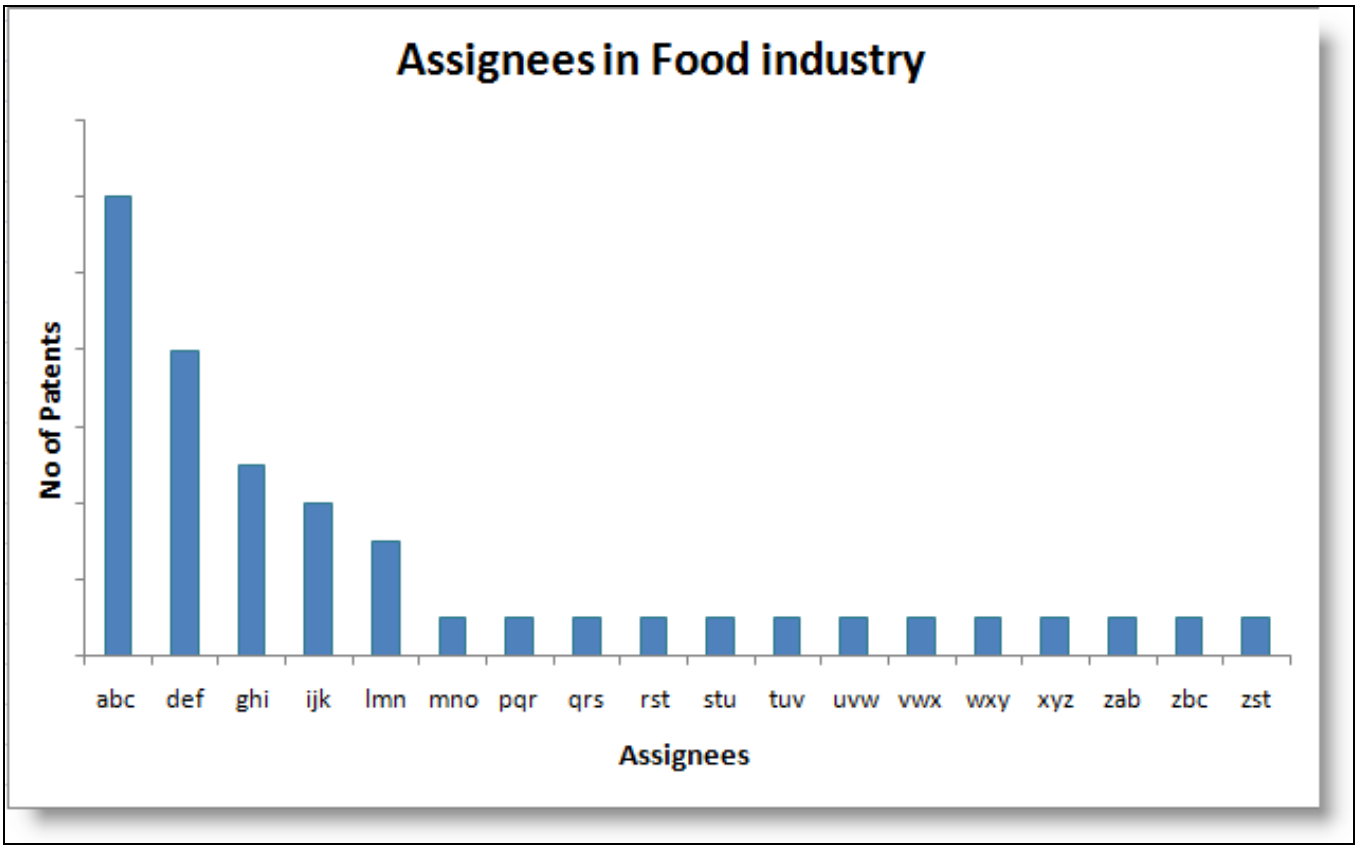
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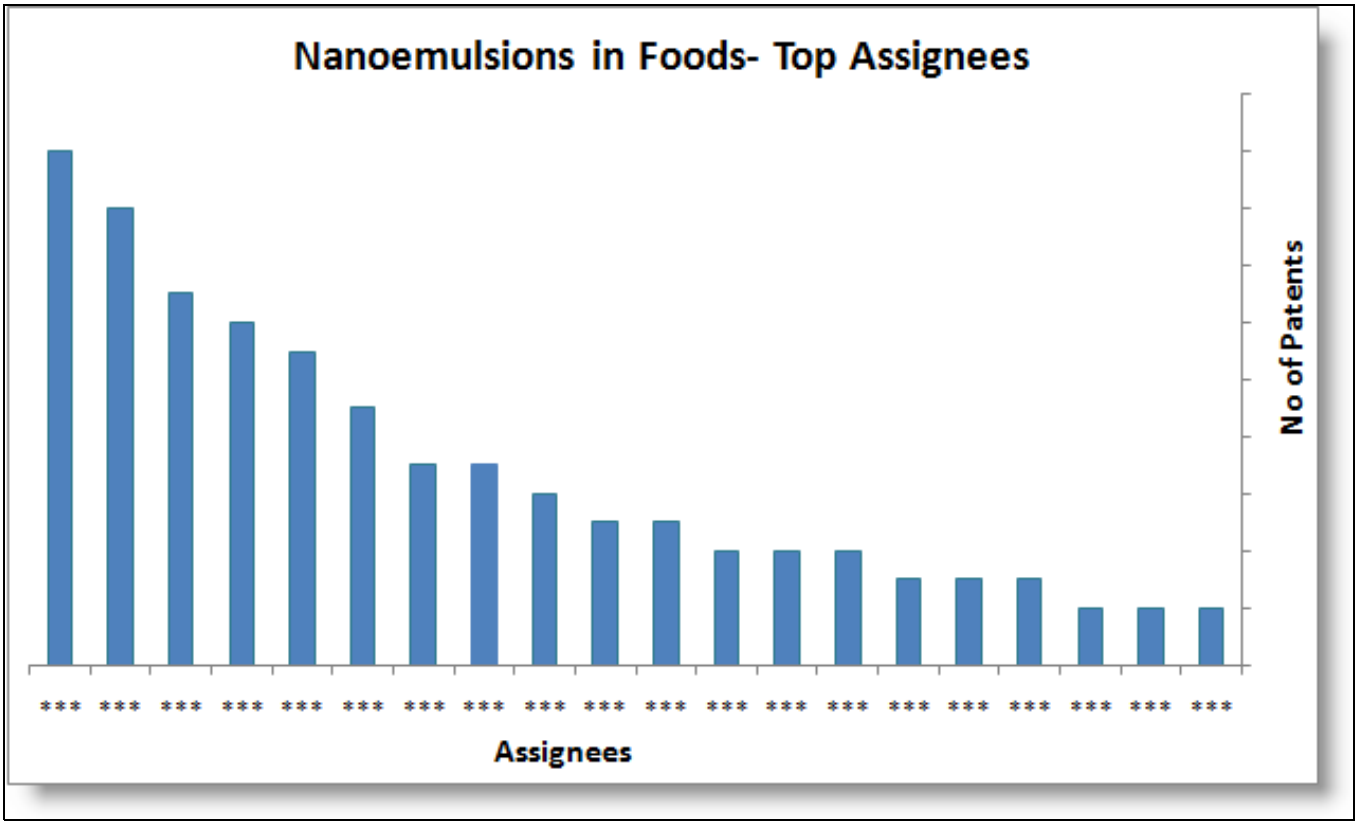
       pre, .mw-code{
         background-color: transparent;
       }
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            if (error) throw error;

            markmap("svg#mindmap_cede5a12841b6c043cfd40409ca778a3", data, {
                preset: "colorful",
                linkShape: "diagonal"
            }, "xml");
          });
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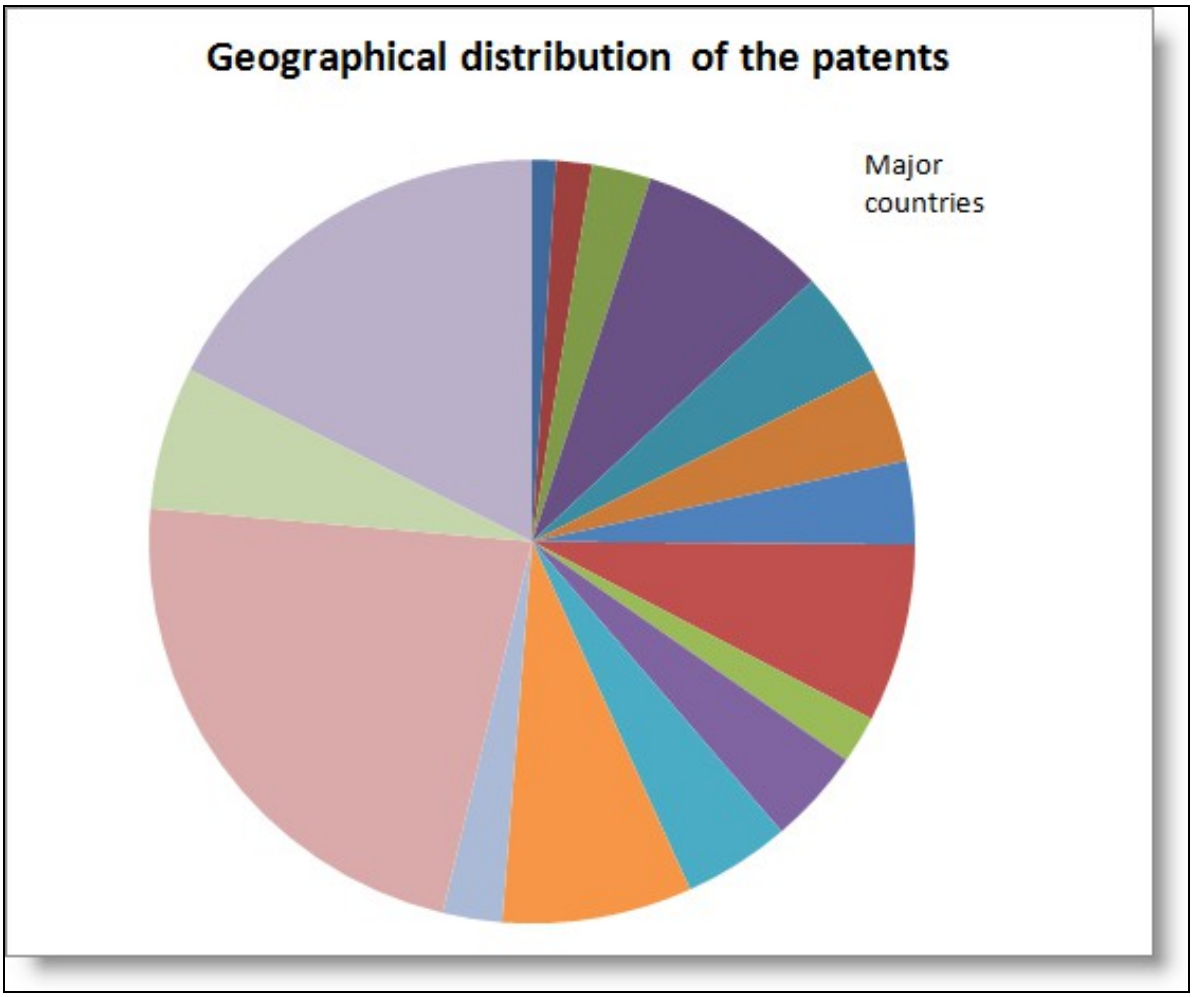
Assignee Analysis and IP Activity

- *Labels for all the charts below are available in the paid report.*
- **The following graphs explain the placement of the different assignees in this technology area.**

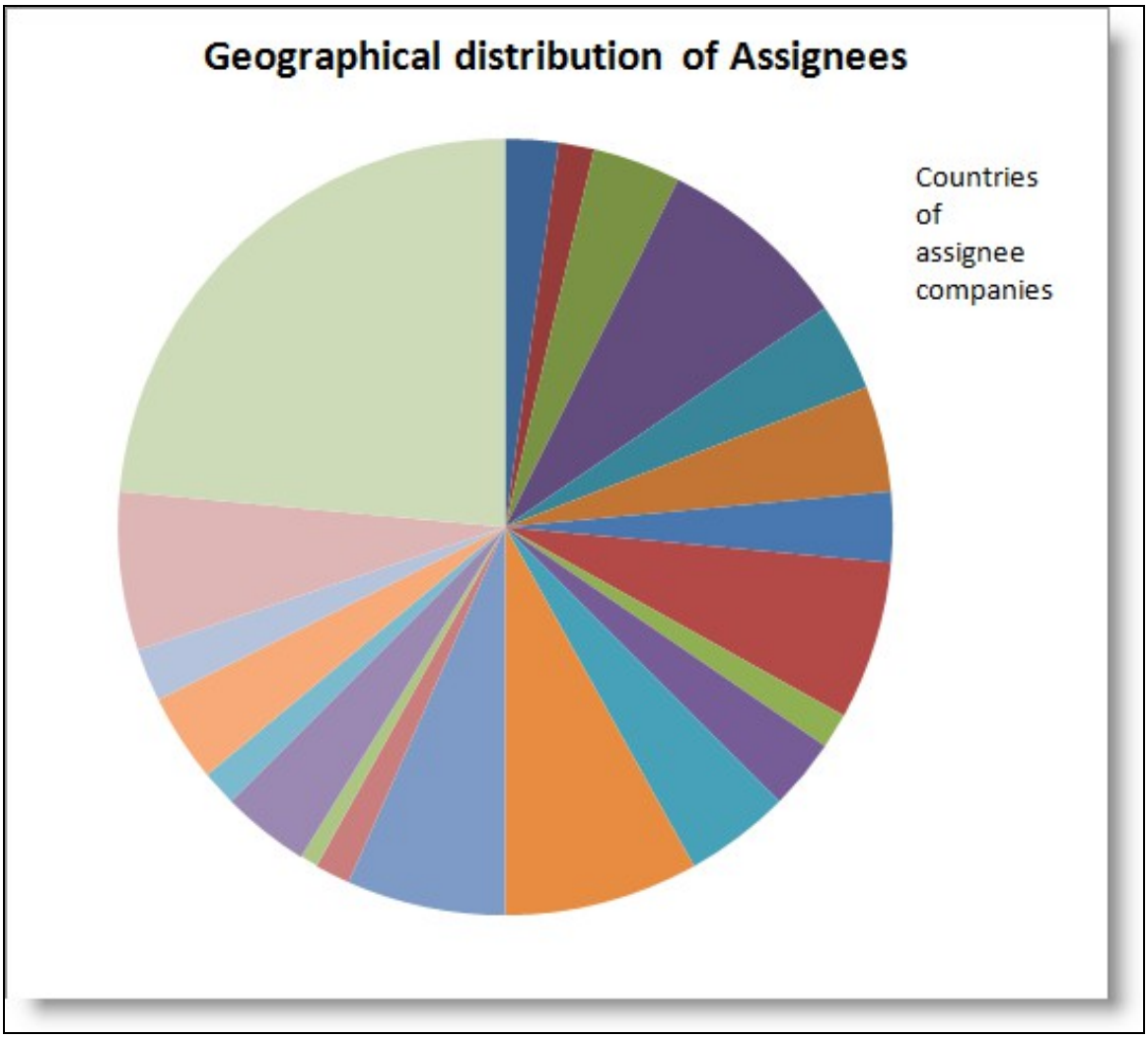




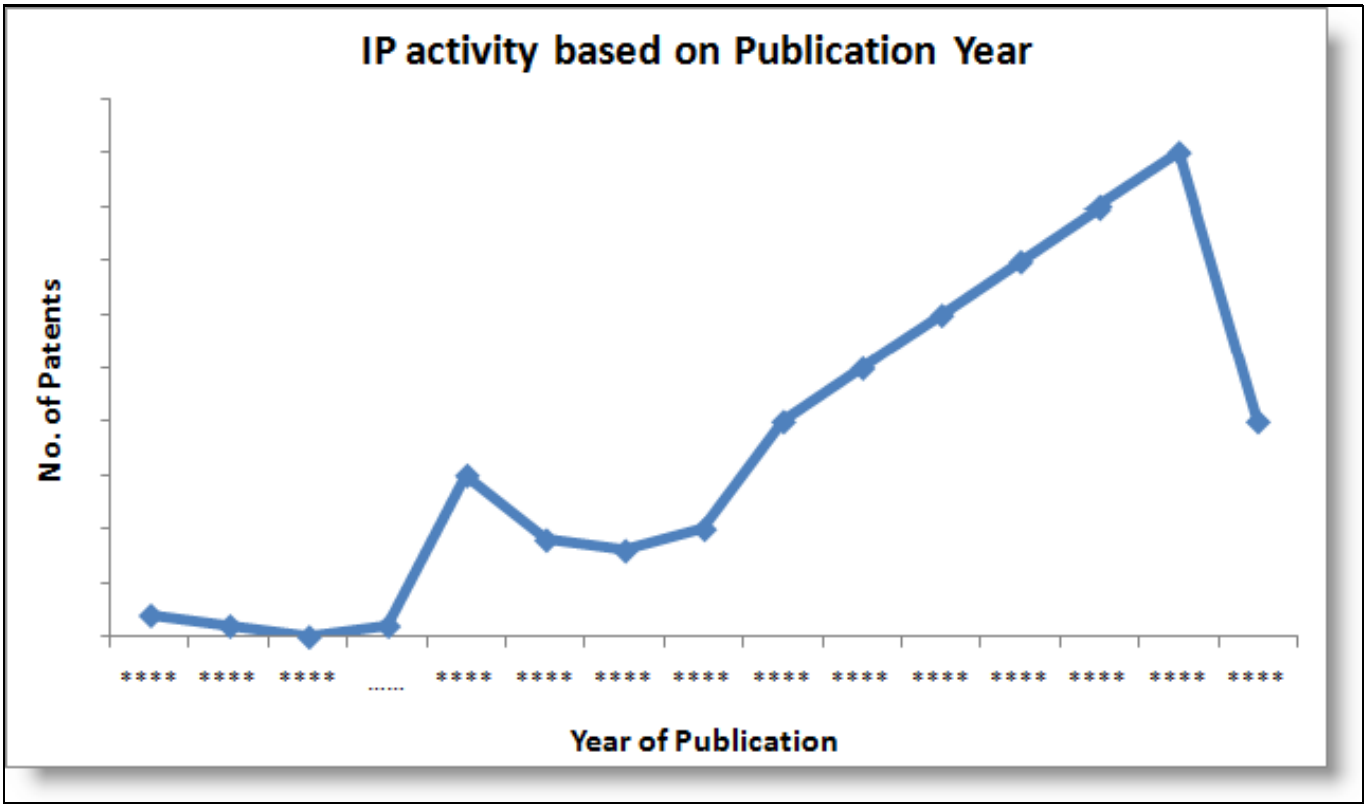
- **Geographical distribution of Patents**

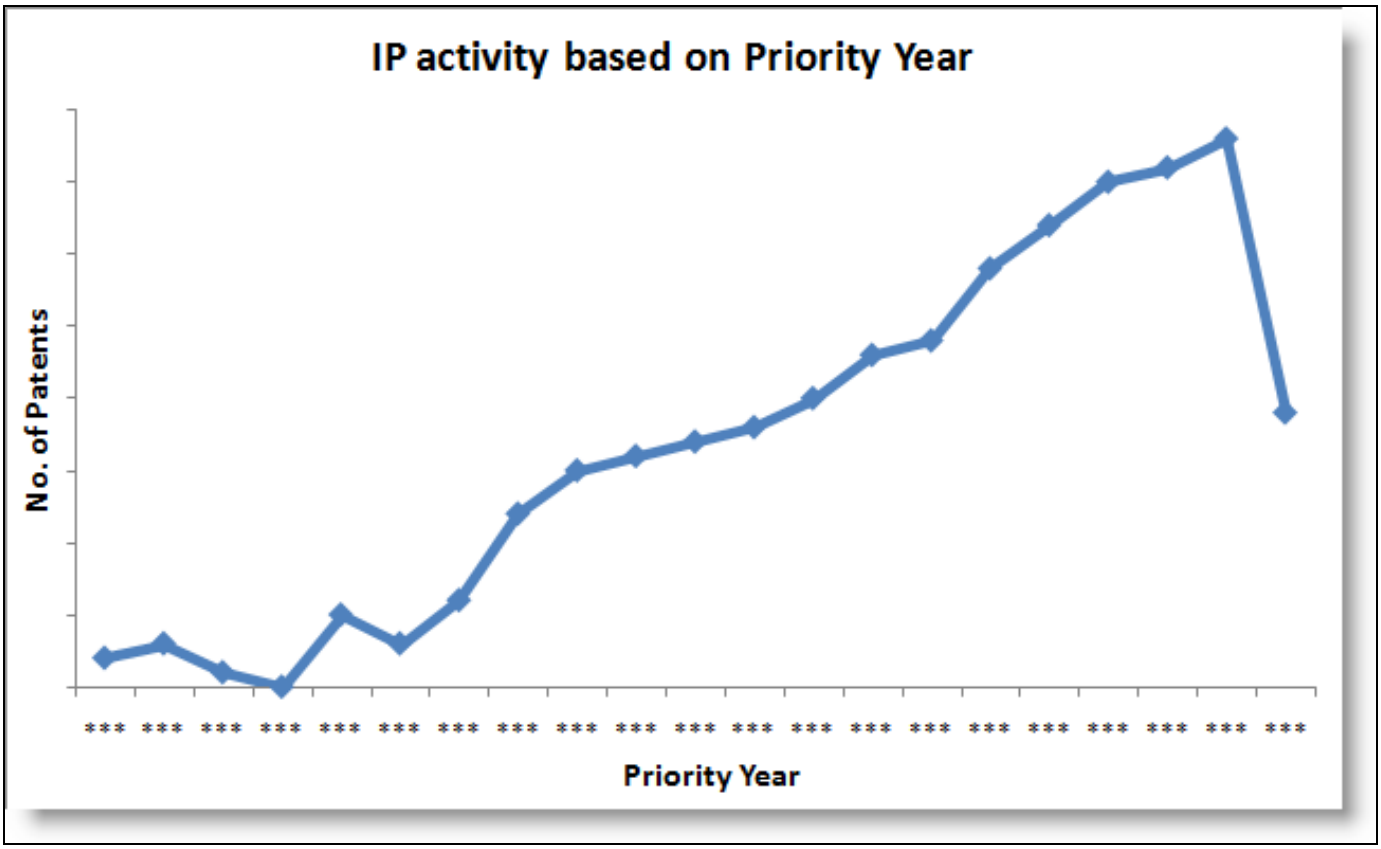


- **Geographical distribution of Assignees**

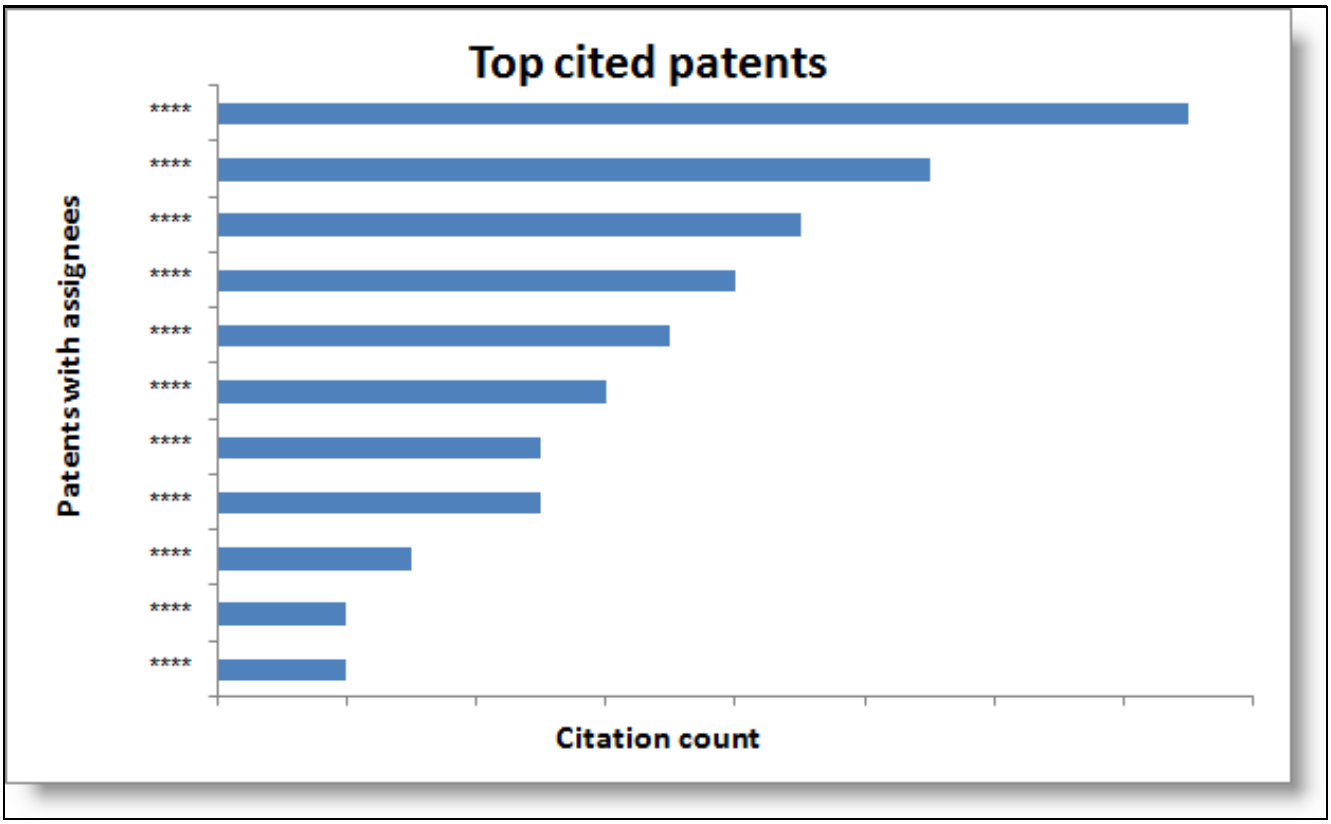


- **The graphs given below explain the IP activity in this technology area over the years.**





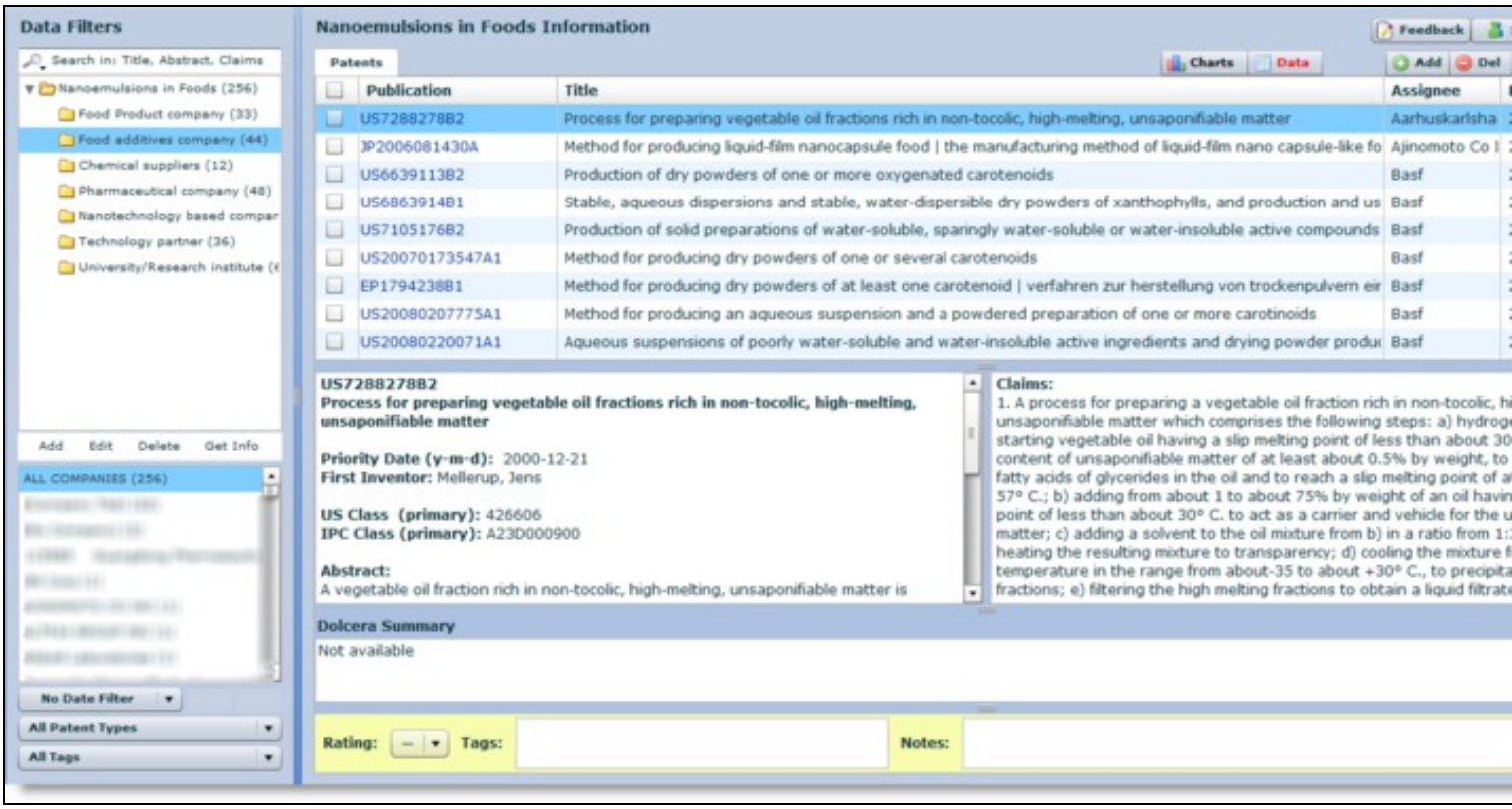
- Patents with the maximum number of forward citations were determined and the graph shows the top 11 patents with corresponding assignees.



Dolcera Dashboard

Assignees were categorized based on the type of their products viz. Foods,Food additives, Biotech, Pharmaceutical,Chemical and other industries, Research and Educational Institutions etc and their patents have been shown in the Dolcera Interactive Dashboard.

A data preview of the dashboard is shown below:



A chart preview of the dashboard is shown below:



Patent Product Mapping

- Some products with respect to this technology area were identified and mapped to the patents from their respective assignees.

S.No	Patent no.	Title	Assignee	Products	Product description by Company	Snapshot
1	US7182950	Nano-sized self-assembled liquid dilutable vehicles	Nutralease Ltd.	Flavors - ex-NSSL mint, NSSL orange Nurtition ingredients - NSSL CoQ-10, NSSL Lycopene, NSSL Lutein, NSSL Beta-carotene, NSSL Omega-3, NSSL Vitamin A, NSSL Vitamin D3, NSSL Vitamin E, NSSL Phytosterols, NSSL Isoflavones	Nutralease Ltd.	
2	US7994157	Method for dispersing plant sterol for beverage and a plant sterol-dispersed beverage, of which particle size is nanometer-scale in dispersed beverage	KIP Biotech	Dispersible Plant Sterols (DP Sterols)	KIP Biotech LLC	
3	US20090047388	Calcium fortified creamed honey	HONEYCAL	Honeycal® Calcium Fortified, Honey Spread	Global Nutrition, L.L.C.	

- Please click here for detailed Patent-Product highlight

Articles of Assignee Universities

Search strategy

Database: Scirus
Timeline: 2000 to 2012
Subject areas: Agricultural and Biological sciences, Chemistry and Chemical engineering, Engineering, Energy and Technology, Environmental sciences, Life sciences

S.No	Concept	Search string	No. of hits
1	Keywords based search	Food*	
2	Restricted based on affiliation	***	
3	1 AND 2		###

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