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Toddler Milk

Teagasc and University College Cork (UCC) researchers have developed a method for production of a low-protein milk product, in reduced and full-fat formats, based on adaptation of cow's milk to meet toddlers' nutritional needs but usable by the whole family. We are seeking a commercial partner within the infant nutrition/dairy industry to optimise and commercially exploit this technology.

Summary

Levels of childhood obesity continue to increase as part of the European obesity epidemic. Toddlers in the Western World typically have a far greater intake of protein than they need, and studies have shown a significant association between high protein intake in early childhood and a later risk of obesity.

To address potential issues for toddlers with high protein intake, Teagasc/UCC researchers, in collaboration with key opinion leaders in the infant nutrition space, have developed a process that adapts cow's milk to meet such toddlers' nutritional needs, but which can also cater for the whole family.

Problem Addressed

Dairy products play an important role in toddler nutrition and are by far the lowest cost source of dietary calcium and riboflavin. However, studies have shown that infants in the Western World have an average protein intake of approximately 2.5g/kg of body weight/day, which exceeds the recommended intake of 1–1.5g/kg of body weight/day. Documented observational data increasingly indicates a link between high protein intake during early childhood and a risk of obesity in later life. Many such toddlers are fed formulated toddler milk with altered nutritional and taste profile when compared to natural milk, and at a premium cost to consumers. To date there has been an absence of natural milk product alternatives in this growing and premium toddler market, which this technology aims to address.

Solution

This invention relates to a process enabling the production of a novel natural reduced-fat, or full-fat, low-protein dairy product from cow's milk, which has been tailored to meet a toddler's typical nutritional needs. As the product is based on cow's milk, it has a superior taste that is much closer to natural cow's milk than competing formulated toddler milk. Hence this novel product should represent an opportunity for the producer, purchaser and end-user to benefit from such an innovation.

Competitive Advantage of Technology

1. Through the application of mild processing technologies, a natural low-protein alternative to cow's milk tailored to the nutritional profile of toddlers' needs, but without altering the great taste of cow's milk is possible.
2. As this toddler milk, which is producible as both full-fat and reduced-fat products, tastes just like regular cow's milk, it can be consumed by the whole family.
3. This resulting milk product can be produced in fresh, Ultra-High Temperature (UHT) and powder formats, and is easily scalable.
4. This product is suitable as a carrier for fortification of other nutrients not naturally abundant in milk, but often lacking in toddlers' diets, for example iron.

Stage of Development

A prototype has been developed to a pre-commercial scale, with positive consumer feedback on taste. Available in fresh, UHT and powder formats.

Opportunity

Teagasc, as lead, wish to partner with a company in the infant nutrition and/or dairy industry in optimising and commercialising this process and resulting product, through a collaborative/licensing arrangement.

Intellectual Property Status

A patent application was filed by Teagasc and UCC in 2015, claiming a novel dairy product, based on cow's milk, suitable as a substitute milk for a toddler.

Funding

Food for Health Ireland (Enterprise Ireland)

How to Proceed

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Rapid Detection of Toxin-Encoding *Bacillus Cereus*

Teagasc is seeking partners within the diagnostics industry to exploit a novel qPCR-based test capable of rapid, simultaneous detection of all *Bacillus cereus* toxin encoding genes ("CereusToxTest"), of benefit to the food industry.

Summary

Teagasc researchers have developed a novel q-PCR based assay capable of rapid, simultaneous detection of all *Bacillus cereus* toxin encoding genes. This assay offers significant advantages in time and specificity compared to what is currently commercially available.

Value Proposition

Rapid and reliable detection of this target species is necessary to identify B.cereus-contaminated food and thereby reduce/prevent such food poisoning outbreaks in consumers, and lessen economic losses and reputational damage to food producers, caused by such recalls and/or outbreaks.

Bacillus cereus is a pathogenic, spore-forming soil-dwelling bacterium that is commonly encountered in raw milk and subsequent dairy products. It is resistant to industrial pasteurisation processes due to the presence of endospores and is therefore a major concern for the dairy industry. The various strains of B.cereus produce several potentially pathogenic substances, linked to foodborne emetic and diarrhoeal syndromes and are known causative agents of food poisoning for over forty years. The emetic syndrome is caused by cereulide, (synthesised by a non-ribosomal peptide synthetase encoded by the ces gene), while the diarrhoeal syndrome is caused by at least three known heat-labile enterotoxins.

No commercially available kits (immunoassays or molecular kits) are capable of simultaneously detecting the 4 toxins produced. Existing assays either detect only a subset of toxins or do not reliably distinguish between B.cereus and closely related, harmless bacteria, leading to false negatives and positives, which this assay circumvents.

Solution

CereusToxTest is a probe-based qPCR approach to simultaneously detect and quantify levels of each of the 4 toxin gene types. It is a multiplex assay based on bespoke fluorophore-labelled probes, whereby detection and quantification of the 4 toxins is possible in a 2 –hour real-time PCR run.

Competitive Advantage of Technology

- Addresses the issues associated with the non-specificity (leading to false positives) or excessive specificity (detection of a subset of toxins only, leading to false negatives) of other tests.
- More rapid than existing assays and avoids the need for downstream analysis, such as melting curve analysis and monitoring of PCR replicon size.
- Offers simultaneous detection and quantification of all 4-toxin encoding gene types in a high throughput single assay. Toxin profiling may allow for more informed treatment options.

Status/Development Stage

Fully functional multiplex real-time PCR assay, available through licensing of know-how

Fields of Application

Development of kits for molecular biology/DNA-based diagnostics for testing of food production and processing environments, raw materials, foods and food ingredients to ensure food safety.

Funding

WP Walsh Fellowships Programme

Irish Dairy Board

How to Proceed

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Detection of Cause of Pink Discolouration Effect in Cheeses

Teagasc is seeking partners within the diagnostics industry to exploit a novel qPCR-based test for supply of assay/kit for detection of the bacterial cause of pinking discolouration defect, to the dairy and cheese industry.

Summary

Teagasc researchers have developed a novel q-PCR based test capable of detecting the bacterial cause of pinking discolouration defect in the dairy and cheese industry for the first time. This technology helps to solve a significant problem for the global dairy industry and will be of interest to the diagnostics industry.

Value Proposition

Pinking discolouration defect, primarily in cheese, is a global problem for dairy producers. Such pinking defect, which can manifest itself in various forms, on block surfaces or below the surface, can lead to downgrading or rejection of cheeses, and hence significant economic losses to the producer. To date, the cause of the defect has been unknown, but subject to much debate. By understanding and being able to identify the cause and origin of such a defect, this would facilitate removal/ treatment of the cause at the source, thereby significantly reducing the occurrence of costly pinking defect discolouration events and increasing efficiencies and quality of cheese manufacturing plants. This hasn't been possible to date, as the cause of such discolouration defect remained unknown.

Technology & Opportunity

By discovering the source of pink discolouration to be bacteria not associated with cheese production, and developing an assay to identify sources of such defect through identification of the causing bacteria, this invention provides a method of assaying cheese manufacturing plants, at ingredients and cheese processing plants level to identify the source of the pinking defect. Such testing of cheese systems, for the risk of pinking in cheese, will allow timely treatment of either ingredient or machinery/plant surfaces to eliminate the bacteria, before the defect arises, thereby minimizing/avoiding the occurrence of such pinking discolouration defects at commercial scale.

Competitive Advantage of Technology

- A novel method of determining presence in cheese sample of source of pink discolouration defect.
- A method of testing a cheese manufacturing system for a risk of pinking discolouration, allowing modification of system to remove/ treat the origin of the defect.
- Resulting qPCR assay, and/or a kit comprising a diagnostic reagent, to detect the source.

Opportunity

This technology would be a valuable addition to laboratories providing diagnostic solutions to dairy industry to develop kits/assay based on this invention, and is available to licence.

Intellectual Property Status

A patent application was filed in 2014, (UK Application No. 1410948.2), claiming a method to determine the presence of such a source, due to the presence of the novel bacteria.

Funding

icos

WP Walsh Fellowships Programme

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Highly Efficient Protein Recovery from Food By-products

Teagasc is seeking commercial partners within various food processing industries to exploit a novel technology for extracting proteins from solid by-products or waste from food (fish, meat, poultry), with over 95% protein recovery, based on improved sequential isoelectric solubilisation.

Summary

Teagasc researchers have developed a highly efficient protein recovery technology from food by-products with greater than 95% protein recovery. This technology is ready for scale-up and Teagasc is seeking companies to exploit this novel technology.

Value Proposition

This technology addresses the issue that almost 50% of the total weight of fish is considered a waste or a low-value product, composed mainly of heads, internal organs, tail, fins, frames and skin. Protein content and amino acid profile in these by-products are similar to that in fillets hence there is a significant amount of high quality protein currently not harnessed. As most by-products from fish processing are used in composting, pet food or animal feed, so provide a very low value-add, there is a desire to generate alternatives with a higher value-add. This represents an opportunity to such industries to significantly increase total protein recovery from such waste, with significant costs implications, through increased profits through generation of protein-based added-value products.

This novel technique, allows solubilisation of more than 95% of total proteins, a significant improvement compared to the previous 65% reported. Furthermore, reagent consumption is not increased despite the additional step of extraction, and no expensive equipment investment is required, since regular equipment are employed in the process (tanks, centrifuges, blenders, stirring and pH probes), rendering this easily transferable to industry.

Technology

This invention is based on a substantial modification of isoelectric precipitation-solubilisation (ISP) methodology, whereby protein from by-products are extracted in alkaline conditions and the remaining insoluble proteins are subsequently extracted under acidic conditions. Finally, both solutions are mixed to reach a pH close to 5.5 where all proteins precipitate and thus can be easily recovered by centrifugation or filtration. The process yields purified protein and a precipitate formed by scales and bones.

Competitive Advantage of Technology

- 95% of total proteins extracted from fish by-products, significant improvement from 65% previously.
- No expensive equipment required, or increased reagent consumption.
- Should be easily scalable and transferable to industry, and can be combined with other extraction processes.

Fields of Application

Although specifically developed using fish by-products, this could be applied to solid by-products or meat processing and poultry wastes and is ready for scale-up.

Intellectual Property Status

An EPO patent application was filed by Teagasc (July 2015), claiming a novel method of sequential isoelectric solubilisation of animal by-products.

Funding

NutraMara

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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LABocol: Cholesterol Lowering Probiotic Yogurt

Teagasc and UCC researchers have developed an invention which allows a novel Lactic acid bacterial (LAB) strain, Lactobacillus mucosae, to be used in a nutritional approach to lowering cholesterol, e.g. in a probiotic yogurt. Teagasc and UCC seek a commercial partner in the functional food space to further develop this technology with a view to commercialisation and further validation of the supporting health claims.

Summary

Globally, a third of ischemic heart disease is attributable to high cholesterol, with raised cholesterol estimated to cause 2.6 million deaths annually.

Teagasc and UCC researchers have produced scientific data showing that a novel probiotic yogurt containing novel exopolysaccharide (EPS) producing *Lactobacillus mucosae* DPC6426 can lower blood cholesterol, a risk factor in the development of coronary heart disease, by 53% in 12 weeks.

Problem Addressed

The invention broadly relates to a LAB strain that has been found to express an EPS and confers cardio-protective properties when consumed. It provides for the use of DPC 6426 as a possible nutritional approach to lowering cholesterol.

LAB strains are widely added as starter cultures in the dairy industry and have a long history of safe use. The presence of EPS in dairy products improves texture, decreases the risk of syneresis (whey separation) and improves the techno-functional properties of the products. It has been suggested that EPS produced by LAB interacts with cholesterol in a manner like dietary fibre.

Significantly increased cholesterol excretion was found for the probiotic yogurt fed group.

Competitive Advantage of Technology

1. LAB are generally regarded as safe (GRAS) according to the FDA.
2. In-situ production of EPS throughout storage resulted in higher quality yogurt with improved textural and rheological qualities compared to other yogurts.
3. Blood cholesterol reduced by 53% in 12 weeks.

Opportunity

There is an opportunity to partner with Teagasc/UCC in developing and commercialising a cholesterol lowering probiotic yogurt, including:

- Establishing the efficacy of the cholesterol lowering properties and effects on plaque stability of the probiotic in animal studies.
- Determining the mechanism of action and benchmarking against plant sterol esters and oat beta-glucan.
- Conducting a human intervention trial to compile a dossier to support a health claim application.

Intellectual Property Status

A patent application was filed by Teagasc and UCC in 2012.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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Whey-less Cheese Manufacture Based on Novel Cheese Technology Platform (NCTP)

Teagasc is seeking industrial partners within the ingredient and retail cheese industry to assist in refinement of NCTP for innovative cheese ingredient solutions and health cheeses tailored to specific customer requirements.

Summary

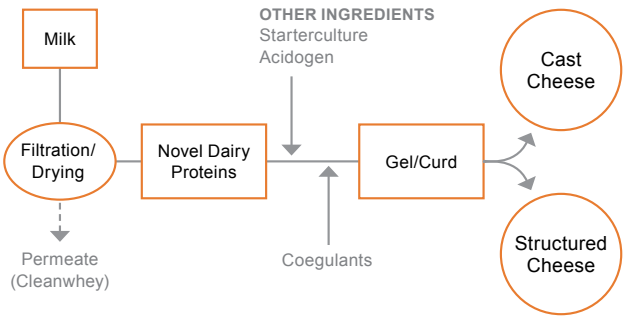
The rapidly growing market for ingredient cheese is currently being served by sourcing traditionally-manufactured table cheeses. Teagasc has developed a dedicated 2-step process for direct manufacture of ingredient cheese tailored to customer requirements. Without the need for whey expulsion it lends itself to the development of new generation health cheeses and increased control of cheese characteristics.

Problem Addressed

Conventional manufacture of natural cheese is quite limited in terms of cost-competitive, customised ingredient solutions, reliance on a source of fresh milk and a large volume of 'unclean' whey, i.e. loss of added materials (e.g., prebiotic materials). Until now, it has not been possible, due to technological constraints and functional limitations, to reconstitute available dairy ingredients in the concentrated form that corresponds to the final compositional specification of targeted cheese types, thereby allowing increased control of ingredient cheese solutions.

Solution

This NCTP provides a platform for design and manufacture of cheeses with varying dry matter content and customised properties using three basic steps. The concept relies on customising the functionality of a milk protein-based ingredient and its subsequent transformation into cheese according to demand. Resultant cheeses may be either cast cheese (<48% dry matter, DM) formed by rennet/acid treatment of re-assembled milk in final package and/or structured cheese (up-to 60% DM) formed by further curd treatment (see figure below).



Competitive Advantage of Technology

1. NCTP capable of making cheese without fresh milk source.
2. No (or very limited) whey expulsion (cast cheeses)
3. Complete retention of any added materials, with potential for development of new generation health cheeses.
4. Greater opportunity to design/control cheese characteristics of ingredient cheeses.

Opportunity

This technology allows the development of a novel range of prototype, functional, casein-based ingredients whereby the pH, buffering capacity and casein-to-whey protein ratio of the resultant cheese can be targeted.

The aim is to link up with relevant cheese ingredient manufacturers to prepare and evaluate prototype cheeses (at moisture levels > 53% with functionality suitable for ingredient cheese applications) with a view to licensing this technology.

Intellectual Property Status

PCT patent Application WO 2009/1 50183.

Funding

ENTERPRISE IRELAND

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Probiotic Cocktail as Animal Feed Additive ("Live5")

Teagasc and UCC researchers are seeking a commercial partner within the animal feeds industry to exploit a new technology. Based on a natural probiotic mix, for growth and good health promotion in animals (specifically pigs), the objective is to develop stable and commercially relevant probiotic product prototypes ready for market.

Summary

The microbial feed additive (or direct-fed microbial), is based on a five strain mix "Live5". It is a natural probiotic mix that can be used as an alternative to chemicals and antibiotics in pig husbandry, both as a means of controlling pathogen carriage and improving growth rate and feed conversion. The five live beneficial bacteria help maintain a healthy intestinal balance for optimum animal performance.

Problem Addressed

Antibiotic growth promoters are currently being phased out of use because they impose a selection pressure for bacteria that are resistant to antibiotics. There is a need for alternative solutions that do not depend on antibiotic usage.

Subclinical salmonellosis is a relatively common problem in pigs, usually causing no obvious animal health problems. Affected pigs are carriers of *Salmonella*, and can excrete large numbers of *Salmonella* organisms intermittently, and particularly when stressed. *Salmonella* in pigmeat has long been associated with outbreaks of foodborne illness.

Solution

The mixture (*Lactobacillus murinus* DPC6002 and DPC6003, *Lactobacillus pentosus* DPC6004, *Lactobacillus salivarius* DPC6005 and *Pediococcus pentosaceus* DPC6006) has been shown to be effective in reducing *Salmonella* shedding in pigs, in protecting against the clinical signs associated with *Salmonella* infection, and in improving growth rates. Live5 has also demonstrated the potential to modulate host immunity in pigs.

Competitive Advantage of Technology

Live5 offers huge potential for use in pig production; in enhancing health status, reduction of subclinical carriage of pathogens (gram negative *Salmonella* and *E.coli* in particular) and in acting as an alternative to antibiotic therapy. Furthermore, one of the Live5 microbes, *L. salivarius* DPC6005, produces a heat stable, two-component bacteriocin, Salivaricin P, which is highly active against a number of gram positive bacteria, including *Enterococcus* sp. and *Listeria innocua.*

Opportunity

It is in the interests of both industry and consumers to reduce the significance of *Salmonella Typhimurium* as a pigmeat-associated food borne pathogen.

The potential fields of applications in animal health include:

- Microbial animal feed additive.
- Alternative to antibiotic growth promoters.
- Therapeutic application.

Intellectual Property Status

A patent application was filed by Teagasc and UCC and the patent "Probiotic composition suitable for animals" was recently granted in the US and Europe.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

ENTERPRISE IRELAND

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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Enhanced Derivatives of Nisin

Teagasc and UCC are seeking commercial partners within the food and pharmaceutical industries to further develop and commercialise superior derivatives of nisin bacteriocins, for applications in the food areas of bio-preservation and medical devices.

Summary

Teagasc and UCC have developed foodgrade derivatives of nisin A, and producers thereof, with greatly enhanced antimicrobial activity. This offers potential in a greater range of food products and other products within medical/ medical device areas, when compared to commercial nisin A.

Problem Addressed

Nisin A is an antimicrobial peptide which is used as a natural food biopreservative in over 50 countries. Nisin and nisin-producing foodgrade *Lactococci* are extensively used in food nisin is the only peptide to have been added to the European food additive list (E234) and approved by the US Food and Drug Agency (FDA) and World Health Organisation. Despite its success, its application is limited in some instances due to its relative inactivity against particular target species and strains and/or its poor activity at non-acidic pHs.

Solution

Recently developed foodgrade derivatives of nisin and its producers have been found to display greatly enhanced antimicrobial activity against problematic pathogenic and spoilage microbes. They are also active at non-acidic pHs and are effective not only against a broader range of gram positive bacteria but also some gram negative bacteria. With the added benefit of being effective at non-acidic pH, this ingredient has the potential to be applied in a greater range of food products. The availability of enhanced forms of nisin could result in the replacement of nisin A and make other applications a reality.

Competitive Advantage of Technology

1. Enhanced antimicrobial activity.
2. Active at non-acidic pHs.
3. Extended applications of nisin.

Opportunity

This technology would be of interest to companies in the fields of food biopreservatives and medical devices and it is currently being evaluated by a company in the animal health field. Companies are invited to discuss this technology with a view to further development in the following areas:

- Demonstration of safety of variants.
- Demonstration of shelflife extension properties.
- Development of foodgrade applications.
- Scale-up manufacturing.

Intellectual Property Status

Patent applications on the various nisin derivatives have been filed by Teagasc and UCC.

Partners

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University College Cork, Ireland

Funding

ENTERPRISE IRELAND

SFI Science Foundation Ireland

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Probiotic-based Treatment of Mastitis

Teagasc and University College Cork researchers are seeking a commercial partner within the animal health industry to exploit a novel technology involving the treatment of bovine mastitis with foodgrade probiotic bacteria – a natural and effective alternative to antibiotic therapy.

Summary

This technology represents a biological approach to mastitis prevention and is based on live foodgrade cultures of probiotic bacteria, specifically a proprietary strain of *Lactococcus lactis*, effective in treating animal and human infectious diseases and proven to be at least as effective as antibiotics, in the treatment of mastitis.

Problem Addressed

Current treatments for mastitis rely heavily on antibiotics, both for prophylaxis and therapy. This strategy is costly and frequently ineffective. Additionally there are concerns regarding the overuse of antibiotics in veterinary medicine, as it may contribute to the increased spread of antibiotic resistance to human and animal pathogens. Recent legislation in the EU curtailing the use of antibiotics in animal feed should lead to greater controls and limitations in their use. Use of antibiotics may be limited to situations where they are deemed critical.

Solution

There are several advantages to this treatment regime. The bacterium can be produced cheaply in large quantities and it is a foodgrade organism with GRAS status and hence should not require significant with-holding periods for the milk produced by recovering animals, as in the case of treatment with antibiotics.

Competitive Advantage of Technology

1. Natural, effective alternative to antibiotic therapy for treatment of both mild and severe mastitis. Effective against mastitis caused by gram positive and negative bacteria.
2. Using live preparation, cure rates of subclinical and clinical infections were comparable to standard antibiotic therapy
3. Based on use of a foodgrade organism, significant withholding periods should not be required for milk produced by recovering animals, thereby reducing milk losses.
4. Could improve milk quality from clinically infected quarters.

Opportunity

Mastitis causes significant economic losses to the dairy industry. Economic loss in Ireland is estimated at €189.56 per cow, in severe cases, and €45.31 in mild cases. Taking the average incidence of mastitis as 25%, a mean economic value per case of mastitis of €71.84 is estimated (EBI 2007). With an Irish dairy herd population of 1.1m, this gives an estimated annual cost of €20m in Ireland alone.

This represents a significant opportunity for an animal health company to validate and commercialise this technology.

Intellectual Property Status

Patent granted in US and in selected European countries, “Use of Probiotic bacteria in treatment of infection”.

Partners

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University College Cork, Ireland

Funding

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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