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Nano-engineered dairy-based beverages with enhanced creaminess

Key external stakeholders:
Dairy Industry and retailers
Food and Ingredient Manufacturers

Practical implications for stakeholders:

This study has:

- **Demonstrated that high shear milk processing (microfluidization) significantly improves creaminess of yoghurt-based smoothies**
- **Developed a cost-effective method for extracting pectin from fruit wastes**
- **Formulated new Mango-based smoothies with high creaminess and shelf stability using a combination of microfluidization and pectin enrichment**

Main results:

- Fruit smoothies were produced from a yoghurt-base produced by a combination of high shear mixing (microfluidization) of milk and pectin enrichment.
- Significant improvements in creaminess were recorded for the smoothies when compared to yoghurt-based smoothies produced from conventionally homogenized milk.
- Microfluidization with pectin enrichment significantly improved product stability.
- A new vacuum concentration process was developed to produce pectin-rich ingredients from by-products from the cider industry.

Opportunity / Benefit:

New processing and formulations were developed to optimize the creaminess perception and shelf-stability of fruit flavor yoghurt –based smoothie products. In addition, a new sustainable process for producing pectin-enriched extracts from indigenous waste streams was developed.

1. Project background:

There is a market for reduced-fat food products promoting health, specifically those that tackle obesity and

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its related health issues such as cardiovascular disease. However, consumers also want products that taste as good as their full-fat counterparts and reducing fat whilst maintaining positive sensory attributes such as creaminess is a technological challenge. This one year FIRM+ project (DAFM project 13FP440) builds on previous FIRM-funded research, which showed that significant creaminess can be imparted to low fat dairy-based foods through a high dynamic pressure process called microfluidization. The scientific basis of this enhanced creaminess was the creation of unique fat-protein complexes at the nano- and micro-scales. This project will develop microfluidization as a process tool to produce creamier low-fat milks and milk-pectin premixes for incorporation into smoothie-type beverage products. The feasibility of exploiting pectin-rich fruit wastes from the indigenous food industry will also be investigated. These waste products include apple and orange fruit pulps and are rich in pectin, a natural soluble dietary fibre as well as other vegetable wastes. Pectin-rich food wastes will be microfluidized separately and together with the milks to investigate possible synergistic effects on product viscosity, stability and sensory perception. Fruit smoothies made of these two primary ingredients will be formulated, up-scaled to pilot plant and validated for taste and texture using a commercial consumer acceptance panel (n = 75). Taste comparisons with market leading competitor products will be done and data statistically analysed to confirm consumer acceptability and preference. The overall objective will be to produce a range of low fat fruit smoothies with enhanced creaminess and shelf stability.

2. Questions addressed by the project:

The objective of this project is to develop yoghurt-based smoothies with enhanced creaminess and shelf stability. An additional objective was to develop new pectin-enriched extracts from raw waste materials, notably apple pulp and add them to the smoothies to further improve texture.

3. The experimental studies:

- Pilot scale yoghurts containing 1.5 % or 3.5 % fat were produced using high temperature short time (HTST) pasteurizer and either conventional homogenized or microfluidized using the new Biofunctional Food Engineering facilities.
- Formulated fruit-based smoothies incorporating microfludized yoghurts and pectin extracts
- Analyse physical properties of products, in particular rheology (viscosity, gelation) and syneresis (water holding capacity
- Consumer acceptance sensory analysis

4. Main results:

- New mango yoghurt-based smoothies were produced using a combination of microfluidization and pectin enrichment.
- Significant differences in creaminess were recorded and confirmed that microfluidisation improves creaminess in yoghurt-based smoothies.
- Microfluidization with pectin enrichment significantly improved water holding capacity, reducing syneresis and gave firmer more stable products (14 day shelf-life tests) than conventionally homogenized samples.
- Sensory analysis (consumer acceptance) indicated a significant preference for the microfluidized and pectin-enriched samples when compared to the standard method of smoothie production (conventional homogenization)
- A new vacuum concentration process was developed to produce a pectin enriched liquid concentrate apple pulp, a by-product of the indigenous cider industry.

5. Technology transfer:

Invention disclosure forms have been prepared for the following:

- New microfluidization and pectin formulation and processing method improves smoothie creaminess
- Cost effective apple pectin extract method based on vacuum concentration to produce a pasteurised liquid pectin extract from raw apple pulp.

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