Internet Appendix A52 Food Science

A52.1 Illustrative Pitch Template Example

Pitcher's Name	Sara Ghorbani Gorji	**FoR category**	Food Science	**Date Completed**	12/07/2015
(A) Working Title	Development of a microencapsulation technique for fortification of hydrophobic functional components using complex coacervation in acidic beverages.				
(B) Basic Research Questions	1. Can we develop a technique to fortify liquid acidic food products with hydrophobic functional components by using green delivery system such as complex coacervation of proteins and anionic polysaccharides? 2. Can our new technique improve the retention time of the nutrient in food and allow controlled release at specific times?				
(C) Key paper(s)	Y.D. Livney, "Milk proteins as vehicles for bioactives", Current opinion in colloid & interface science, 15 (2010) 73-83. A. Matalanis et al., "Structured biopolymer-based delivery systems for encapsulation, protection, and release of lipophilic compounds" Food Hydrocolloids, 25 (2011) 1865-1880.				
(D) Motivation/Puzzle	Some chemical compound classes (e.g. antioxidants and vitamins) can provide medical benefits. The value of these supplements led to their application in food fortification to prevent coronary heart disease, cancer and etc., but many of these nutraceuticals are lipophilic. The lipophilic nature of these compounds makes their incorporation into non-fat aqueous foods challenging. These compounds tend to degrade during storage of food. This motivated me to develop a new technique that can enable food producers to incorporate lipophilic nutraceuticals in aqueous food systems with higher storage stability and bioavailability. Next, the limited number of food grade encapsulation materials is problematic, so finding suitable delivery systems is of vital importance.				
THREE	**Three** core aspects of any empirical research project i.e. the "**ID**io**T**s" guide				
(E) Idea?	The main idea of this research project is to develop microencapsulation technique to obtain microcapsules of hydrophobic functional components using complex coacervation in an acidic fruit juice and dairy fermented drink. The central hypotheses would be: (1) We can produce green delivery systems in order to fortify liquid acidic food products with nutraceutical models: vitamin D, omega 3 and tocopherol. This fortification would be done by complex coacervation of milk protein (sodium caseinate), and vegetable protein (soy bean protein) and anionic polysaccharides (pectin). (2) The produced microcapsules are more stable than free nutraceuticals. Initially, optimum conditions (pH, protein to polysaccharide ratio and biopolymer concentration) for forming a stable complex between proteins and anionic polysaccharide should be determined. Secondly, encapsulation efficiency and particle size should be obtained. Thirdly, nutraceutical nanocomplexes will be used in the enrichment of fruit juice and dairy drink. Finally, after in *vitro* digestion, the bio accessibility of nutraceuticals will be assessed.				
(F) Data?	The data required to support our hypothesis is obtained via assessing several specific objectives: 1. The nature of the interactions between above-mentioned proteins and anionic polysaccharide. Outcome data: critical pH values such as pH_c, $pH_{\varphi 1}$, pH_{opt} and $pH_{\varphi 2}$. 2. The effect of pH on the binding ability of proteins to nutraceutical. This test gives us the idea to find the optimum pH of interaction between protein and nutraceutical. 3. The binding and diffusion of the nutraceutical using nuclear magnetic resonance. This test helps us understand the bioavailability of nutraceutical after encapsulation. 4. The chemical and structural characterization of microcapsules in order to find out the behaviour of nutraceutical after encapsulation in food.				
(G) Tools?	The major instruments required to conduct the necessary tests for this study are: 1. UV/visible light spectrophotometer: Critical pH values will be determined by turbidity measurement. 2. Isothermal titration calorimetry (ITC): ITC shows the enthalpic and entropic changes due to protein-polysaccharide interactions. 3. Particle size and zetapotential analyser. 4. Optical microscopy and Cryogenic Scanning Electron Microscopy: Microcapsules morphology will be analysed. The following procedures are also required: 5. Yield, encapsulation efficiency, encapsulation loading and morphology. 6. Sensory evaluation. 7. In *vitro* digestion model: to assess the behaviour of the nanocapsules on their exposure to simulated gastric and intestinal fluid.				

TWO	**Two** key questions
(H) What's New?	The novelty in this idea is to develop a new microencapsulation technique for hydrophobic functional components using complex coacervation. Not only the technique I will use in this project is new, but also the final product has not been developed before. Moreover, this innovative technique will allow industries to produce a commercially available fortified fruit juice and acidified dairy drink in a way which is health promoting without any adverse sensory properties.
(I) So What?	Fortifying food products is challenging for food producers because of several difficulties such as: 1. There are only a limited number of food grade ingredients which can be used as the encapsulation materials. 2. There are very limited number of techniques for encapsulation of hydrophobic functional components. 3. Although some techniques may work in theory, in practice, commercialisation of these food products need sensory acceptability. In this research I will address these problems and I will find a way to overcome these obstacles which will simultaneously benefit food producers and consumers.
ONE	**One** bottom line
(J) Contribution?	This research will have several significant contributions to science and industry: 1. A new microencapsulation technique will be introduced to food science. This technique has major benefits: (1) being applicable in other fields including pharmacy, (2) the material used in this technique is green. 2. Nutraceuticals will be more stable during storage. 3. We will improve the bioavailability of these nutraceuticals. 4. A health promoting food product will be produced which is sensory acceptable, and so the consumers will choose to consume them enthusiastically.
(K) Other Considerations	Collaboration is needed from a food-industry company in order to help produce the final product. The results from this research will be published in high impact-factor journals such as: Molecular Nutrition & Food Research and Food Hydrocolloids. No result risk: low, literature shows the high possibility of success for this technique. Competitor risk: low, as complex coacervation is a new technique the odds of implementing the same technique and producing the same microcapsules by other researchers is very low. Obsolescence risk: low, making this technique commercially available has not been done before.