



ENCAPSEA2017
2ND INTERNATIONAL WORKSHOP
ON ENCAPSULATION TECHNOLOGY IN SOUTH EAST ASIA



6-7 July 2017 Nha Trang, Vietnam

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CONFERENCE PROGRAM

Location: Nha Trang University

Day 1: Thursday, 06 July 2017: Registration, Presentation of participants

Day 2: Friday, 07 July 2017: Presentation of participants, Discussion

Time schedule		
Day 1	Chairman: Assoc. Prof. Paul Heng; Assoc. Prof. Ngo Dang Nghia	
8:00 - 9:00	Registration	
8:45 - 9:00	Welcome speech	Assoc. Prof. Ngo Dang Nghia, NTU
9:00 - 9:30	Microencapsulation in feed processing for fish larvae	Assoc. Prof. Ngo Dang Nghia, NTU
9:30 - 10:00	Alginate encapsulation by spray drying	Assoc. Prof. Paul Heng, NUS
10:00 - 10:30	<i>Group's photo & coffee break</i>	
10:30 - 11:00	Natural flavors and colorants market	Nguyen Van Duy – Naman Groups
11:00 - 11:30	Encapsulation research from Buchi Switzerland	Dai Qing Qing, Tô Minh Tâm – Buchi
11:30 - 13:00	<i>Lunch</i>	
13:00 - 13:20	Effect of excipients and process parameters on preparation of liposome containing tamanu oil	Dr. Tran Van Thanh, University of Pharmaceutical, Hochiminh, Vietnam
13:20 - 13:40	Impact of strains and culture conditions on beta-carotene encapsulation using yeast cells as micro-container	Msc. Tran Hai Dang, NTU
13:40 - 14:00	Microencapsulation of Salmon oil by spray drying: Effects of wall materials and drying temperatures	Dr. Kha Chan Tuyen, Nong Lam University
14:00 - 14:20	Water – soluble microencapsulated lutein: preparation, physicochemical characteristics and applicability	Dr. Hoang Thi Hue An, NTU
14:20 - 14:40	Production of Gac oil -alginate bead on NeoDipper-V1 system	Huynh Thi Khanh, NeoCapsules – NTU
14:40 - 15:00	<i>Coffee break</i>	

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15:00 - 15:20	Synthesis of hybrid mesoporous materials for immobilization of enzyme	Assoc. Prof. Phi Quyet Tien, Institute of Biotechnology, VAST
15:20 - 15:40	Some factors affect stability of water-in-water emulsion (Dextran/PEO)	Dr. Nguyen Trong Bach, NTU
15:40 - 16:00	Formulation and evaluation of a lipstick using food dyes as a colouring agent	Dr. Ha Thi Hai Yen, NTU
16:00 - 16:20	Cordyceps production	Msc. Van Hong Cam, Good life – NTU
16:20 - 18:00	Free activities	
18:00	<i>Gala dinner</i>	
Day 2	Chairman: Prof. Paul Heng; Prof. Ngo Dang Nghia	
8:00 - 8:20	Antimicrobial activity of <i>Litsea cubeba</i> essential oil and application potentials in food and aquaculture	Assoc. Prof. Chu Ky Son, Hanoi University of Science and Technology
8:20 - 8:40	Antioxidative properties of ergothioneine from selected edible mushrooms and its application in fishery products	Dr. Huynh Nguyen Duy Bao, NTU
8:40 - 9:00	Surveying of bioactivities of in vitro medicinal plants	Tran Trong Tuan, Nguyen Hoang Dung, Institute of Tropical Biology, VAST
9:00 - 9:30	<i>Coffee break</i>	
9:30 - 11:30	Round table	
11:30 - 13:00	<i>Lunch</i>	
13:00 - 16:30	Round table	

Microencapsulation in fish larvae feed

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ABSTRACT

Aquaculture has increased significantly in the two last decades and it will be the main source for protein from aquatic animals, over the natural capture in near future. Going with the development of the farms, the feed requirement is accelerated which lead to industrialization of this sector. However, the feed for the fish larvae, that bases on the life feed, is still remained many challenges. The microencapsulation technique seems to be the good candidate with the advantages such as size control, water stable, biodegradable, ingestible and digestible. This article makes the review of the microencapsulation technique to deal with the difficulties in production of the feed larvae.

Keywords: Fish larvae, microencapsulation, feed, microdiet.

Alginate encapsulation by spray drying

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ABSTRACT

Alginates are available commercially as macromolecules for viscosity enhancement or to form gels. Attempts to use alginates for spray coating or drying are often fraught with many difficulties due to their high viscosity. Cross-linking alginates can convert the polymeric viscous alginate into an insoluble form, and potentially, by degradation, will allow the possibility of preparing a suspension that can be sprayed. The cross-linking of sodium alginate using calcium ions forms gel matrices that are highly viscous 3D structures. Thus, further matrix reduction is essential to ensure the processability of calcium alginate gels to be made a sprayable suspension. Matrix reduction by high pressure homogenization can open provide new formulation possibilities. In this presentation, the objective is to examine the impact of high pressure homogenization on gel matrix degradation. The homogenized gels are then used with modified starch for microencapsulation of volatiles by spray drying. The alginate gels largely experienced an exponential decay in viscosity when homogenized. These homogenized gels had been successfully incorporated in spray drying formulations for microencapsulation. Addition of homogenized gels did strengthen the microcapsules formed but only for a high wall to core ratio and low mass-load alginate gels could demonstrate observable differences. High mass-load gels weaken the microcapsules, exhibiting a higher volatiles release and wrinkling on the microcapsules surface. Acknowledgement of this research work to Pavan K. Inguva. Calcium alginate suspensions have also been successfully used for particle coating, in experiments to produce alginate-coated multi-particulates.

Food and microbiological processes (pam) joint research centre

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Founded on 1st January 2012, the 'Food and Microbiological Processes' (PAM) Joint Research Centre is spread across 4 sites: AgroSup DIJON, IUVV (Vine & Wine University Institute), INRA (National Agronomical Research Institute), and the Faculty of Pharmacy.

The PAM Joint Research Centre plays a major role in scientific and technological advances in the field of food and wine. The joint scientific focus of all the members is to understand the physical, chemical, and biological phenomena that determine food quality with the ambition of developing new products and new food processes.

The PAM Joint Research Centre manages two technical facilities: RMB facility (Rheology of Biological Materials) and PIMS facility (Spectroscopic Imaging Centre), and is a member of the Carnot Institute Qualiment[®], national centre of excellence for the promotion of research in the food industry.

There are also 4 cross-disciplinary areas:

- Area 1: Microbial stress (Dynamics of microbial response to environmental stress)
- Area 2: Water and structure (Hydration and biological systems)
- Area 3: Encapsulation and activity (Matrix structuring and vectorization)
- Area 4: Oxidation of food and wine

Area 3: Encapsulation and activity

Topic 3: Structuring of matrices and vectorization

Supervisors: **Prof. Odile Chambin** and **Prof. Yves Waché**

Study the structure of functional matrices by improving understanding of interactions between:

- Biopolymer matrices and active molecules
- Cellular entities and active molecules (encapsulating cells)
- Biopolymer matrices and cell entities (encapsulated cells)

Differents exemples of research projects:

1. PARI Alim+: Control the activity and functionality of macromolecules and microorganisms to improve nutrition
2. Encapsulation to protect fragile active molecules and to control their release/retention
3. Encapsulation of probiotics
4. Development of fluorescence imaging protocols for the characterization of cells encapsulated in matrices.

Preparation and characterization of liposomes encapsulating *calophyllum inophyllum* oil

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ABSTRACT

Calophyllum inophyllum oil, called Tamanu oil, is reported to treat a wide range of skin injuries such as wound, acne, eczema, psoriasis, herpes, hemorrhoids, etc. Liposomes, effective carriers for topical treatment of dermal diseases, could enhance the therapeutic efficiency of Tamanu oil. Thus, the purpose of the study was to formulate and characterize liposomes loading Tamanu oil. Liposomes encapsulating Tamanu oil with different ratios of Phospholipon 90G and L- -lecithin were prepared by using thin film hydration technique. Liposomal formulations were characterised in terms of aspect, particle size, size distribution, zeta potential and morphology by using light microscope and dynamic light scattering analysis (DLS), respectively. Furthermore, the best formulation was checked the storage stability after 30 days and Tamanu oil loaded in the liposomes was identified; as dictated in Vietnamese pharmacopoeia. The data demonstrated that average liposome diameter of 53 nm with a narrow polydispersity (0.289) was obtained at Phospholipon 90G to L- -lecithin molar ratio of 4:6 and Tamanu oil to phospholipid mass ration of 1:3 approximately. In addition, according to the DLS results, the particle size and the zeta potential were quite stable during 30 days of storage. The study achieved the promising result for develop a novel formulation containing Tamanu oil, which may be valuable to treatment for skin diseases.

Keywords: Tamanu oil, liposome, phospholipon 90G, l- -lecithin, thin layer hydration

Water – soluble microencapsulated lutein: preparation, physicochemical characteristics and applicability

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ABSTRACT

Lutein extracted from marigold flower (*Tagetes erecta* L.) is one of natural carotenoid pigments permitted to use as a food colorant. However, the applicability of lutein crystallin in food industry is limited due to its poor water solubility and low colour stability under the effects of air, light and acid. The aim of this research was to prepare water-soluble microencapsulated lutein using spray-drying technique with maltodextrine as a shell matrix. The obtained microencapsulated lutein powder had a high lutein encapsulation yield (86,4%), relatively good water-solubility (26,0% w/v at 30°C) and meet the food safety criteria. However, its colour stability was not very high, especially when being exposure to sunlight. Therefore, the microencapsulation lutein prepared in this work should only be used to coloring foodstuffs which are stored in cool and dark condition.

Keywords: lutein, microencapsulation, spray-drying, Tween, Span, maltodextrin

Impact of strains and culture conditions on beta-carotene encapsulation using yeast cells as micro-container

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ABSTRACT

Yeast cell was reported as an effective natural preformed material for use in encapsulation of hydrophobic compounds. The encapsulation process was normally considered as passive transfer through cellular wall and cellular membrane. Beside solubility of hydrophobic compound in phospholipid membrane or plasmolysis, membrane characteristics of yeast cell which are differed between strains and influenced by culture conditions are main factors involving the accumulation of hydrophobic compound into yeast cell. In this study, the conventional strain *Saccharomyces cerevisiae* and oleaginous strain *Yarrowia lipolytica* were cultured on nutritive medium and minimal medium under different agitation conditions to investigate (the) beta-carotene encapsulation capacity. The Box-Behnken model was also used to optimized culture conditions in case of highest encapsulation yield. *Y. lipolytica* expressed 4.7 – 326 times higher than *S. cerevisiae* in beta-carotene encapsulation depending on culture medium. Highest encapsulation yield was observed with *Y. lipolytica* cultured in minimal medium in all tested culture conditions and was optimized at 42.78 µg/g.

Keywords: Encapsulation, yeast, beta-carotene encapsulation, *Yarrowia lipolytica*, *Saccharomyces cerevisiae*, natural preformed material

Microencapsulation of salmon oil by spray drying: effects of wall materials and drying temperatures

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ABSTRACT

The objectives of this study were to determine the most appropriate type of wall material and inlet spray drying temperature on the encapsulation of salmon oil. The results indicated that the encapsulation efficiency (EE), peroxide value (PV), water activity (Aw), moisture content (MC), and water solubility index (WSI) of the encapsulated oil powder were significantly affected by the two investigated independent variables. Under optimal conditions (the combination of dried glucose syrup and sodium caseinate, and the inlet air temperature of 150°C), the dependent variables including the EE, PV, Aw, MC and WSI were obtained as 81.3%, 5.3 meq/kg, 0.25, 2.4% and 76.5%, respectively. In addition, the microparticles also had spherical shapes and were free of cracks and pores, which are important to effectively prevent the oil from oxidation and the undesired release of the oil droplets to the particle surface. It was concluded that the protein-carbohydrate matrix as the wall material was effectively used for spray drying encapsulation of Salmon oil.

Key words: Salmon oil, microencapsulation, spray drying

Production of gac oil – alginate bead using neodripper-v1 system

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ABSTRACT

Gac oil was successfully encapsulated into alginate bead by dripping the Gac oil – alginate emulsion into calcium bath using NeoDripper-v1 system. The alginate solution (2 %) was extruded from a single nozzle from height to form separated drops then dripped in CaCl₂ flow. The fresh beads were collected and analyzed for size, shape and texture through the bead's gel strength. Impacts of height of nozzle, extruded pressure, calcium flow speed on bead's characters were investigated. The most suitable condition was selected to produce Gac oil - alginate bead. Stability of Gac oil in alginate bead was also evaluated through carotene content, oil content and peroxide value during storage.

Keywords: Gac oil, carotenoids, encapsulation, alginate bead, dripping method.

Synthesis of hybrid mesoporous materials for immobilization of enzyme

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ABSTRACT

Mesoporous Santa Barbara Amorphous (SBA-15) and Mobil Crystalline Materials (MCF) materials were successfully synthesized via hydrothermal treatment using poly(ethylene glycol)-poly(propylene-glycol)-poly(ethylene-glycol) (Pluronic-P123) and 1,3,5-trimethylbenzene (TMB or Mesitylene) as template. Products were functionalized with 3-aminopropyltriethoxysilane (APTES) via post-synthesis grafting and sequently activated by glutardialdehyde. Functionalized materials were characterized by various techniques: XRD, IR and N₂ adsorption-desorption (BET) and Thermogravimetric analysis-Differential thermal analysis (TGA-DTA). From characterization results, it showed materials still maintained their structure after functionalization. The Fourier transform infrared spectroscopy (FT-IR) data demonstrated the existence of amino-aldehyde functional groups on the surface of functionalized samples. The D-amino acid oxidase (DAAO) enzyme immobilized on functionalized materials exhibited much higher catalytic activity and stability for conversion of cephalosporin C (CPC) as compared to those of non-functionalized ones. Effect of pore-sized on catalytic activity and stability was discussed and rationalized.

Formulation and evaluation of emulsified lipstick (water/oil) using food colouring

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ABSTRACT

Lipstick is a cosmetic product being used widely to enhance the beauty of women and to protect the lips. Typically, it is composed of oils, waxes, emollients and pigments. To satisfy the demands, lipstick is made with a wide range of colour. However, the amount of natural pigments is 10% of total amount. Therefore, the aim of this study was to fabricate emulsified lipstick water in oil using food colouring to reduce the mamount of colouring agent and to improve emollient and nutrient property of lipstick.

Keywords: lipstick, food, dye, colouring, emulsion, water in oil.

Surveying of the chemical components and bioactivities of *in vitro* medicinal plants

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ABSTRACT

Due to some natural challenges, some high value plants, like *Celastrus hindsii*, *Panax vietnamensis* Ha et Grushv., *Eurycoma longifolia* and *Anoectochilus* sp., have been researched in order to produce *in vitro* biomass. Afterwards, biomass of four these herbs were used to identify the chemical components and bioactivities. The extracts of these sample contains many phytochemical such as alkaloid, carbohydrate, saponin, phytosterol, phenolic compounds, tannin, flavonoid, fixed oil, fats, gum and mucilage and are considered as good source of antioxidants as observed in DPPH scavenging assay. Among all samples, *Celastrus hindsii* plant sample has the highest antioxidant activity. Other three samples are also potent proves to be consider as an accessible source of antioxidants. These results indicating that samples may be consider as a model for experimental studies including free radical induced disorders like cancer, diabetics aging and cardiovascular diseases.

Key words: *Anoectochilus* sp., *bioactivities*, *Celastrus hindsii*, *Eurycoma longifolia*, *Panax vietnamensis* Ha et Grushv.

***Yarrowia lipolytica* produced from tuna head's stickwater as micro-container for encapsulate Gac oil**

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ABSTRACT

Encapsulating ingredients is a trend in food technology that helps to facilitate food formulation and processing. In Vietnam this use is still new and of more interest in recent years. Among the many methods used for encapsulation, using yeast cells as the shell coating has not received the attention it deserves until now although this method has many advantages. One important factor is to consider the yeast strain. We have found an excellent yeast for encapsulation: The oleogenous yeast *Yarrowia lipolytica*, which can grow well on a medium rich in proteins and lipids. In addition, yeast cells are rich in nutrients for people (proteins, vitamins, minerals...).

Vietnam is an aquaculture products exporter (over 3.6 million tonnes in 2010, 6.56 million tonnes in 2015) and thus creates a large amount of waste. Khanh Hoa province is the main export area for yellowfin tuna in Vietnam. Stickwater and fish oil are products of the hydrolysis of tuna heads - a major by-product. This stickwater may be a good resource for *Y. lipolytica* biomass production.

Gac is a valuable Vietnamese fruit, which is also called the fruit of heaven. Gac oil is a good source of beta-carotene and lycopene which are beneficial for human health but too sensitive to heat and oxidation for direct use in foods or supplements. Encapsulation can help to protect and facilitate its handling in food processing, especially for foods for children and infants. Protamex (Novozyme, Denmark) was used for exploring tuna head hydrolysis. The most suitable hydrolysis condition to prepare stickwater for cell culture was chosen as pH 6.5 and 55°C. Biomass was collected at mid-log phase and yeast cell microcapsules were successfully produced with biomass cultured on stickwater with beta-carotene content was up to 90.5 µg/g of dried weight.

Keywords. Yarrowia lipolytica, yeast encapsulation, gac oil

Antioxidative properties of ergothioneine from selected edible mushrooms and its application in fishery products

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ABSTRACT

This study was conducted to investigate that ergothioneine from selected edible mushrooms have abilities to suppress oxidative deterioration of fishery products, including lipid and myoglobin oxidation in fish, and ***black spots formation in shrimps***. These results clearly showed that the mushroom ergothioneine is a promising source of natural antioxidants for application in fishery products.

In vitro and in vivo antimicrobial activity of litsea cubeba essential oil and its microencapsulation potential application in aquaculture and in food

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ABSTRACT

Using natural additives in food and aquaculture has become popular thanks to consumer demands for nature and safety. Antimicrobial activity is one of the most important properties in many plant essential oils (EO) to evaluate the potential of application. May Chang *Litsea cubeba* (Lauaceae family) is widely distributed in Vietnam and has been reported for its biological properties. The aims of this study were to characterize the main components, the *in vitro* as well as *in vivo* antimicrobial activity of *L. cubeba* EO. The chemical components of EO of *L. cubeba* were analyzed by gas chromatography couple with mass spectroscopy (GC-MS). Our results showed that EO were a complex mixture of numerous compositions with the dominant of limonene (17.13%), carveol (31.13%) and citral (39.25%). The inhibitory effects of antimicrobial agents (*L. cubeba* and oxytetracycline) were tested against *E. coli* and *Vibrio* spp. including 2 references and 6 isolated strains by using microbroth dilution assay in 96-well microplates. Higher inhibitory effect against isolated strains than references strains was observed. The Minimum Inhibitory Concentration (MIC) values ranged from 1.15 - 2.30 mg/mL and 5.53 mg/mL against isolated and reference strains, respectively. *L. cubeba* EO, as antibiotic, exhibited higher survival rates and lower bacterial concentrations of the whiteleg shrimp *Litopenaeus vannamei* than the control (EO and antibiotic-free). However, the application of *L. cubeba* EO in aquaculture is limited due to their own unique flavor, its toxicity, solubility and stability during the process. The microencapsulation of *L. cubeba* EO by β - cyclodextrin (heptakis (2,6-di-methyl)- β -CD (DM- β -CD)) was assessed by paste method. The microencapsulation yield and the ratio of loading oil were 97.0% and 58mg/g, respectively. The results of this study could be a great potential application of EO-based product in food and aquaculture production.

Keywords: *Litsea cubeba*, microencapsulation, antimicrobial activity, aquaculture, β - cyclodextrin

Research on the modulation of chlorophyll derivatives from marigold leaves for use in food

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ABSTRACT

The research has utilized the leaves of marigold to prepare chlorophyllin derivatives. The experimental results showed that 10 grams of marigold leaves mash in 30 ml of ethanol 96°C during 28h gave an alcohol extract which contained 13.089 mg of chlorophyll. Chlorophyll was then separated from alcohol using liquis – liquid extraction n-hexane and saponified with NaOH 0.06M. The Na-Mg-chlorophyll derivative was concentrated and precipitated with residual ZnSO₄.7H₂O 0.008M. The precipitate was filtered and washed with distilled water several times to remove excess ZnSO₄.7H₂O and resuspended in distilled water, using NaOH 2 M until completely dissolved. Na-Zn-chlorophyllin powder was obtained by spray-dry with maltodextrin. The antioxidant activity and the iron-reducing activity of the Na-Zn-Chlorophyllin derivative was shown to be higher than the Na-Mg-chlorophylline derivative.

Keywords: Marigold; Chlorophyll; Durable derivatives; Saponification; extraction.

Mycelium growth and fruit body formation on silkworm by *Cordyceps militaris*

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ABSTRACT

Cordyceps militaris (L.) Link is widely used as a traditional medicine in Asia because of its pharmacological functions. Cultivation of *C. militaris* and their biosubstances have been studied extensively. Inoculation protocol, temperature and light are an important factor for the mycelium growth, fruiting body and cordycepin production by *Cordyceps militaris*. In this study, the inoculation methods, temperature and light conditions for the *C. militaris* **G, M, N** strains on silkworm were evaluated on growth, fruiting body and the production of cordycepin. Our results showed that optimum temperature for mycelium growth, fruiting body of *C. militaris* were 15-25°C. The light from light-emitting diode (LED) white (800lux) with 24h/0h light/dark cycle was better for fruiting body in terms of height and amount of fruiting bodies but blue-white LED (800lux) with 12h/12h light/dark cycle was better for cordycepin production.

Keywords: Cordyceps militaris, fruit body, inoculation, silkworm, temperature, light.