

## Dairy Foods: Dairy Products II

**W243 Joint R&D prospects for dairy development in India.** J. Parekh\*, *Dairy Consultant, Mumbai, India.*

The Indian dairy industry is a top ranker in the global dairy bandwagon, with an incredible milk production 120 million tonnes last year. However, the success and statistics certainly do not satisfy India's need for self-sufficiency in production and supply of this essential commodity. There is room, a joint one indeed, to tap the big opportunities which lie in the dairy sector, and the apparent high potential of industry in the wake of growing global demand. In this rapidly changing world and a highly competitive globalized economy, there is a need to exploit the available resources to the maximum. The best technologies developed in India and abroad should be brought to use to cope with the rising domestic demand for dairy products. Second, more emphasis on improving productivity of cattle is needed. While a lot of attention is being given to the dairy industry, little effort has been made in improving the productivity of cow or buffalo. When it comes to productivity we are among the last. Whatever we see in terms of increased productivity is on account of increase primarily in numbers and to some extent increasing crossbred population. It is time for the policy makers to focus on right inputs in terms of genetic constitution, better feeding practices, improved fodder and ensure equitable opportunities to the private sector in the Indian dairying. The whole eco system around dairying lacks capacity of building the farmers toward better productivity, animal health, breeding practices, clean milk production and better use of animal wastes. The whole world is becoming more and more environment conscious, therefore, dairy emissions is an important area to be controlled through intensive knowledge sharing and dissemination. There is a need to strengthen the milk processing industry also in terms of technology, carbon foot print and water miles. The production levels could really make India the dairy basket of the world. Indian dairy industry incurs high costs of production due to lack of scale, poor product mix, high wastage, costly cold chain and lack of R&D in the sector for both products and packaging.

**Key Words:** India, dairy sector, R&D prospects

**W244 Improving the textural properties of non-fat yogurt by addition of milk-based protein additives.** B. Delikanli and T. Ozcan\*, *Uludag University, Bursa, Turkey.*

In recent years low fat and non-fat yogurts is becoming popular due to the increased demand for low calorie products. However, these products exhibit weak body, poor texture, and whey separation since fat and total solids contents are reduced. Thus, innovative practices and fortification of milk with some additives is essential to improve the textural properties of reduced-fat yogurts. The addition of dairy-based ingredients is a preferential technique to reduce syneresis in yogurt by increasing the density of protein matrix in the gel microstructure. The aim of this study is to investigate the effect of fortification with dairy-based ingredients on the textural properties of non-fat yogurts. These ingredients are sodium caseinate (Na-CN), calcium caseinate (Ca-CN), milk protein concentrate (MPC) and whey proteins; namely whey protein concentrates (WPC), whey protein isolates (WPI) and whey protein hydrolysates (WPH). Yogurt samples were manufactured with reconstituted skim milk using milk proteins at a level of 1%. Textural parameters (hardness, adhesiveness, cohesiveness, and springiness) were evaluated by TA-XT plus Texture Analyzer in yogurt samples at the 14th day of storage. Using milk proteins in yogurt manufacturing caused a more compact structure consisting of stiff casein particles and large aggregates along with

increased hardness which also increase cohesiveness and springiness values resulting in improved textural properties ( $P < 0.01$ ). Yogurts fortified with Na-CN, Ca-CN and MPC had higher values of textural properties than whey protein-based ingredients (WPC, WPI, WPH). The results revealed that the textural characteristics might be influenced by the differentiations within the milk protein ingredients that resulted from variations of composition, casein to protein ratios and production methods. It could be concluded that fortification of the milk base ingredients that increased gel matrix compactness might play a beneficial role in improving textural properties of set type non-fat yogurt and might be used to develop functional dairy products.

**Key Words:** yogurt, milk protein, texture

**W245 Viability of probiotic bacteria in lactose-hydrolyzed milk.** F. R. Zamariano, D. V. Tenan, P. C. B. Vianna, and C. M. V. B. De Rensis\*, *Universidade Norte do Paraná, Londrina, Paraná, Brazil.*

Hydrolysis of lactose by  $\beta$ -galactosidase is one of the main technologies applied in the production of dairy products with low lactose. There is a general agreement that probiotics dairy products relieve the symptoms of lactose intolerance, such as intestinal discomfort. The aim of this research was to evaluate the viability of probiotic bacteria in lactose-hydrolyzed milk pasteurized. Three types of lactose-hydrolyzed milk were produced: control (without probiotic), with *Lactobacillus casei* (LC) and with *Lactobacillus acidophilus* (LA). The hydrolysis of lactose from raw milk was carried out, with  $\beta$ -galactosidase enzyme at 40°C/4 h. The milk was pasteurized at 68°C/2 min and cooled to 4°C. Each block of design was repeated twice in a total of 6 experiments. The results for physicochemical composition were analyzed by ANOVA and Tukey's test ( $P < 0.05$ ). Glucose was quantified in diluted aliquots by employing the glucose oxidase colorimetric method. After 120 min about 98% of the lactose had been hydrolyzed. Pasteurized milk was evaluated on d 1, 7, 14 and 21 after manufacturing, by enumeration of probiotic bacteria, titratable acidity and pH. The physicochemical composition of milk was performed on the day of the manufacture and Difference from Control test was carried out after 3 d. Regarding the physicochemical composition, LC milk showed higher titratable acidity compared with the control milk. During refrigerated storage, there was an increase in titratable acidity for all treatments. Probiotics bacteria showed good viability in the milk with populations about  $10^7$  cfu/g and  $10^6$  cfu/g for LA and LC milks, respectively. For sensory analysis only LC milk was different from control milk. The probiotics bacteria remained viable throughout the storage period of the product with populations  $>10^6$  cfu/g. Therefore, this food would be a good vehicle for adding such bacteria. LA milk would be the most appropriate, since showed higher counts of viable bacteria and furthermore, no difference was detected when compared with milk without addition of probiotics bacteria by the sensory panelists.

**Key Words:**  $\beta$ -galactosidase, milk, probiotic bacteria.

**W246 Encapsulation yield, gastrointestinal resistance and storage stability of *Lactobacillus acidophilus* microencapsulated by spray-drying using sweet whey and skim milk.** G. M. Maciel, K. S. Chaves\*, C. R. F. Grosso, and M. L. Gigante, *Faculty of Food Engineering, University of Campinas, Campinas, SP/Brazil.*

The aim of this study was to evaluate the effect of the encapsulating matrix on the encapsulation yield, resistance to the passage through simulated gastrointestinal conditions and on the viability of *L. acidophilus* La-5 during storage. The samples were produced from solutions of reconstituted sweet whey or skim milk (30% total solids), inoculated with a suspension of *L. acidophilus* (1% vol/vol) and subjected to spray-drying at inlet and outlet temperature of 180°C and 85–95°C, respectively. The samples were packed, vacuum sealed, and stored at 4°C and 25°C. The encapsulation yield, moisture content and the resistance of the microencapsulated La5 compared with the free cells (control) during exposure to in vitro gastrointestinal conditions (pH 2.0 and pH 7.0) were evaluated. The probiotic viability was assessed at 0, 7, 15, 30, 45, 60 and 90 d of storage. All experiments were repeated 3 times and the data were analyzed by ANOVA and Tukey's test for the comparison between means ( $P < 0.05$ ). Using skim milk as encapsulating matrix and storing the particles at 4°C resulted in the best protection of the *L. acidophilus*. However, regardless of the encapsulating matrixes and the storage temperatures, the encapsulated probiotic presented counting values  $>10^6$  cfu/g after 90 d of storage, decreasing 0.43 cycles log, on average, after this period. The results indicate that both skim milk and sweet whey have technological potential for delivering spray-dried probiotic cultures without affecting its resistance to simulated gastrointestinal conditions, and also have the advantage of being able to be stored in room temperature. Acknowledgments: CNPq.

**Key Words:** probiotic, microencapsulation, gastrointestinal simulation

**W247 Selective methodology for enumeration of *Lactobacillus acidophilus* in yoghurt and Prato cheese.** K. S. Chaves\*<sup>1</sup>, C. Gebara<sup>1</sup>, M. C. E. Ribeiro<sup>1</sup>, A. L. N. Gandara<sup>2</sup>, and M. L. Gigante<sup>1</sup>, <sup>1</sup>Faculty of Food Engineering, University of Campinas, Campinas, SP/Brazil, <sup>2</sup>Technical High School of Campinas, University of Campinas, Campinas, SP/Brazil.

The choice of a suitable selective methodology for counting probiotic strains in combination with starter cultures depends on the microorganisms present in the product and its matrix. The aim of this study was to evaluate different methodologies for selective enumeration of *L. acidophilus* in probiotic yogurt produced with *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* and probiotic Prato cheese produced with lactococci starter cultures. The conditions used for the selective count of *L. acidophilus* were: MRS-bile agar and MRS-clindamycin agar, incubated at 37°C for 72 h under anaerobic conditions; MRS-sorbitol agar incubated at 37°C and 45°C for 72 h under anaerobic conditions. For counting of *L. bulgaricus*, MRS agar at pH 5.2 and RCA at pH 5.3 were evaluated, both incubated at 45°C for 72 h under anaerobic conditions. *S. thermophilus* was evaluated in ST agar incubated at 30°C for 72 h and M17-lactose agar at 45°C for 72 h, both aerobic conditions. The lactococci starter culture was evaluated using M17-lactose agar incubated at 30 and 37°C for 72 h under aerobic conditions. The methodologies were used for the enumeration of pure cultures, and probiotic yogurt and Prato cheese. The experiment was carried out in a randomized block design with 3 replications. The results showed that the selective medium for counting *L. acidophilus* in yogurt was the MRS-bile agar incubated at 37°C for 72 h, while in Prato cheese was the MRS-sorbitol agar incubated at 45°C for 72 h both under anaerobic conditions. For counting of *L. bulgaricus*, *S. thermophilus* and lactococci starter culture, the selective media were RCA agar at pH 5.3 at 45°C, ST agar at 30°C and M17-lactose agar at 30°C, respectively. Evaluation of selective media for the enumeration of probiotics in dairy products proves to be necessary, because the presence of different strains may affect the results and, therefore, lead

to erroneous conclusions about the presence of probiotics in products. Acknowledgments: FAPESP, CAPES.

**Key Words:** yoghurt, cheese, selective methodology

**W248 Effects of various chain lengths inulin on the properties of yogurt with *Lactobacillus rhamnosus*.** Z. Canbulat and T. Ozcan\*, Uludag University, Bursa, Turkey.

Probiotics can be defined as living microorganisms that have proved beneficial effects on health of the host and that improve the intestinal microbial balance. *Lactobacillus rhamnosus*, which is one of the widely known probiotics is frequently used in infants formulas and children's food due to preventive and curing effects on diarrhea, dental caries, allergy etc. Inulin is a prebiotic food ingredient that increases the activity of *L. rhamnosus*, increases calcium absorption and is a good source of dietary fiber. Polymerization degree of the inulin and probiotic bacteria strain affects the growth and viability of probiotic cultures in the probiotic fermented dairy products with inulin. The objectives of this study were to determine the effects of inulins with various chain lengths (short and long) on yogurt fermentation and survival of *L. rhamnosus* in yogurt during 28 d of storage. Inulins of short and long chain lengths were incorporated at 2% (wt/wt) of the yogurt mix and inoculated with *L. rhamnosus* and mixed cultures of *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus*. In this study, viability of *L. rhamnosus*, physico-chemical and sensory properties (appearance, body and texture, flavor, taste and color) in the yogurt samples were evaluated. Organic acid (e.g., lactic, acetic, citric and propionic) profile was determined using a HPLC method. The result indicates that viability of *L. rhamnosus* in probiotic yogurt was enhanced by using short-chain inulin. Increased degree of polymerization led to decreased rate of consumption of inulin by *L. rhamnosus*. Syneresis was increased with addition of short chain inulin with high titratable acidity but higher flavor and taste scores than the yogurt containing long-chain inulin. However chain lengths of inulins did not affect consistency, color, and appearance and organic acid profile. Long-chain inulin did not influence *L. rhamnosus* bacteria viability during the storage of yogurt than short-chain inulin. Therefore, it is not recommended to use inulin with long-chain to improve the viability of the probiotic strain and sensory properties of yogurts.

**Key Words:** yogurt, *L. rhamnosus*, inulin

**W249 Effect of chymosin on the functional and rheological properties of fresh Kou Wan Lao.** Guo Ling\*<sup>1</sup> and Jiang Yan<sup>1</sup>, <sup>1</sup>Key Lab of Dairy Science, Ministry Education, College of Food Science, Northeast Agricultural University, Harbin, Heilongjiang, China, <sup>2</sup>Key Lab of Dairy Science, Ministry Education, College of Food Science, Northeast Agricultural University, Harbin, Heilongjiang, China.

Kou Wan Lao (KWL, also called as Gua-nai by researchers in the United States) is a traditional dairy product in China, which was manufactured by the milk-clotting enzymes from Chinese wine cake culture raised on steamed glutinous rice (sweet rice). Its smooth taste and attractive flavor are preferred by many Chinese, but its soft texture and complex manufacture method limits its industrial production. This study investigated the contribution of adding chymosin as the same time to the functional and rheological properties of KWL to decreasing manufacturing time and improving the texture. KWL was manufactured from pasteurized, homogenized milk using a commercial Chinese wine cake culture. Chymosin was added at different levels. The functional and rheological properties were determined after 1 to 8 d of storage at

4°C. At all chymosin levels, KWL were bright white and pale yellow. The micrograph of environment scan electronic microscopy (ESEM) showed that structure of KWL was sandwich-like. The thickness of layers became denser with increasing chymosin concentration. The results will be useful in commercialization of this traditional dairy-based product with optimum quality.

**Key Words:** Kou Wan Lao, chymosin, rheology

**W250 Preliminary studies on the use of a novel electromagnetic fluid conditioner to modify the functional properties of nonfat yogurt.** S. Menard, S. Bala, J. K. Amamcharla\*, and K. Schmidt, *Department of Animal Sciences and Industry, Kansas State University, Manhattan.*

The present study evaluated the potentiality of a novel electromagnetic fluid conditioning (EFC) treatment to skim milk to modify the functional properties of nonfat yogurt. The EFC generates concentrated magnetic field that provides a temporary change in the physical properties in aqueous phase. It has been reported that the EFC alters the surface tension and interfacial tension of oil and water. Consequently, the EFC provides unique changes in functionality in dairy products that can be exploited to improve quality. Hence, the objective of the study was to evaluate the EFC on the functional properties of nonfat yogurt. For this purpose, commercial skim milk was obtained from the Kansas State Dairy Plant and divided into 3 sub-samples. Two of the sub-samples (E30+ and E30-) were treated using the EFC at 30VDC in positive and negative directions, respectively. The third sub-sample served as a control. The maximum magnetic flux density was found to be 3380 gauss at the center of the EFC. The control and magnetically treated samples were then heated to 90°C for 10 min, cooled to 43°C, and inoculated with a commercial yogurt culture. The milks were then incubated at 43°C. When the pH reached 4.5, the yogurt samples were stored at 4°C and performed water holding capacity (WHC), firmness, and syneresis using well established respective methods. Three independent replications were carried out on 3 different days. Titratable acidity and pH of the yogurt samples were not significantly different ( $P > 0.05$ ). Also, WHC of magnetically treated yogurt samples was not significantly different from control ( $P > 0.05$ ). However, syneresis of magnetic treated samples was significantly lower ( $P < 0.05$ ) than the control. Consequently, firmness of control was found to be significantly higher ( $P < 0.05$ ) than the treated samples. Based on the data obtained, EFC treatment of skim milk has potential to modify some functional properties of nonfat yogurt. However, further experiments are needed to study the intrinsic changes that are taking place in milk during the EFC treatment.

**Key Words:** electromagnetic fluid conditioner, nonfat yogurt, functional properties

**W251 Microbiological and physical-chemical characteristics of fermented milk beverages.** E. H. P. Andrade, M. O. Leite\*, M. M. O. P. Cerqueira, L. M. Fonseca, C. F. A. M. Penna, M. R. Souza, T. Roza, B. S. Assis, M. F. S. Resende, A. F. Drummond, and N. M. A. Silva, *Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.*

This work aimed to evaluate microbiological and physical-chemical characteristics of fermented milk beverages available in big supermarket chains in Belo Horizonte, Minas Gerais State, Brazil. A total of 40 samples of fermented milk beverages were collected at the market, being 8 samples from 5 brands. The samples were analyzed in the last week of their shelf-life. The parameters evaluated were: total and

thermotolerant coliforms, *Salmonella* spp. presence, coagulase positive staphylococci count, mold and yeasts count, total count of lactic acid bacteria, water and volatiles content, total solids, protein content, fat content, pH and titratable acidity. These samples showed satisfactory microbiological quality. The lactic acid bacterial counts were higher than the minimum required by the Brazilian legislation. The morphological and biochemical characteristics of the isolates suggested the presence of *Streptococcus* spp. and *Lactobacillus* spp., which was confirmed by PCR-ARDRA 16S-23S, in products from all brands. It was also possible to identify *Lactobacillus delbrueckii* in 3 brands. Means of fat content, protein content, titratable acidity, pH, water and volatiles content and total solids ranged from 1.24 to 1.98%, 1.88 to 2.22%, 0.54 to 0.66%, 3.91 to 4.16%, 81.18 to 83.25% and 16.75 to 18.82%, respectively. Means of protein content were higher than the minimum required by the Brazilian legislation.

**Key Words:** fermented milk beverages, microbiology, physical-chemical

**W252 Assessment of the viability of *Lactobacillus casei* in carbonated milk beverage.** C. S. Jidão, S. A. M. Floriano, C. M. V. B. de Rensis, G. A. N. Costa, and P. C. B. Vianna\*, *Universidade Norte do Paraná (UNOPAR), Londrina, PR, Brazil.*

The aim of this study was to produce a carbonated milk drink with probiotic and evaluate the viability of *Lactobacillus casei* during refrigerated storage. Milk beverage was produced with UHT milk and whey in the ratio of 70:30. Whey powder was reconstituted in water to 14% solids and then added to the UHT milk. The mixture was heated to 90°C/5 min, cooled to 10°C and added with 5% sugar and 5% passion fruit pulp, previously mixed and heated to 90°C/1 min. Milk beverage was then cooled to 4°C and divided into 2 treatments: (1) milk beverage added of *Lactobacillus casei* (2%) and without CO<sub>2</sub> addition; (2) milk beverage added of *Lactobacillus casei* (2%) and CO<sub>2</sub>. The CO<sub>2</sub> was bubbled directly into the sample and the concentration was monitored by the reduction of titratable acidity. *L. casei* was added after carbonation. After treatment the samples were packed in sealed PET bottles and stored at 4°C. The pH, acidity and *L. casei* count were evaluated after 1, 7, 15 and 30 d of refrigerated storage. Results were evaluated by ANOVA and Tukey's test at the 5% significance level. The pH and acidity were affected only by storage time. Regardless of the treatment was observed a decrease in pH and an increased acidity in milk beverages with and without CO<sub>2</sub> addition. It may indicate post-acidification caused by probiotic action. The *Lactobacillus casei* count was not influenced by treatments, storage time and the interaction between these factors. *L. casei* inoculum has a concentration of  $7.1 \times 10^8$  cfu/mL. The milk drink without CO<sub>2</sub> addition had initial and final *L. casei* counts of  $1.6 \times 10^7$  and  $1.1 \times 10^8$  cfu/mL, respectively. Carbonated drink milk showed values, for initial and final *L. casei* counts, of about  $5.2 \times 10^7$  and  $1.7 \times 10^8$  cfu/mL respectively, showing that CO<sub>2</sub> did not influence the probiotic count. Thus, the milk beverages can be considered probiotics, since presented *L. casei* count above  $10^6$  cfu/mL and this probiotic has remained viable during the storage time of the product.

**Key Words:** probiotic, carbon dioxide, milk beverage

**W253 Production and sensory evaluation of high  $\gamma$ -aminobutyric acid-enriched fermented milk by *Lactobacillus plantarum*.** T. Yan<sup>2</sup>, C. Man<sup>1</sup>, Y. Shan<sup>1</sup>, J. Wang<sup>2</sup>, X. Yang<sup>2</sup>, Y. Deng<sup>2</sup>, Y. Guo<sup>2</sup>, M. Guo<sup>\*3</sup>, and Y. Jiang<sup>1,2</sup>, <sup>1</sup>National Dairy Engineering and Technology Research Center, Northeast Agricultural University, Harbin, Heilongjiang, China, <sup>2</sup>Department of Food Science, Northeast Agricultural

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$\gamma$ -Aminobutyric acid (GABA) is a nonprotein amino acid that has been reported to reduce blood pressure in experimental animals and man. Dairy products such as functional probiotic-enriched fermented milk are good vehicle to transfer these beneficial microorganisms and valuable nutrients to consumers. The objective of this study is to produce fermented milk containing GABA by using *Lactobacillus plantarum* NDC75017 which isolated from traditional yogurt in Inner Mongolia of China. The fermentation parameters of *Lb. plantarum* NDC 75017 were optimized and the GABA content of yogurt was measured by high performance liquid chromatography (HPLC). Results showed that the maximum GABA concentration in fermented milk was 61 mg/100 g by the following conditions: 100 mmol/L L-sodium glutamate (L-MSG), 20  $\mu$ mol/L pyridoxal 5'-phosphate (PLP), 2% inoculation concentration, the ratios of *Lb. plantarum*, *Lb. delbrueckii* ssp. *bulgaricus* and *thermophilus* at 0.5:0.5:1.5 and 43°C incubation until desirable pH values of 4.5 were reached. Fermented milk was stored at 4°C until sensory evaluation by consumers on d 7, 14, 21. Viscosity, Viscosity index, gel firmness were measured as sensory properties parameters is 1466.54 g·s, 146.79 g·s, 44.55 g, respectively. Our result showed that the appearance, flavor, texture, viscosity, and overall quality of the functional yogurt were comparable and was similar to general yogurts in market. The results of the study suggested that the NDC 75017 possessed a prospect to be applied in dairy and other health products with high nutritive values and functional properties. This work was supported by National Science and Technology Project (2011AA100902), National Natural Science Foundation of China (31171718), and Key Project of Education Department of Heilongjiang Province (12511z005).

**Key Words:**  $\gamma$ -aminobutyric acid, *Lactobacillus plantarum*, yogurt

**W450 Sensory analysis of commercial packed vanilla ice creams using traditional sensory method and E-tongue in Taiwan.** C. H. Chang<sup>1</sup>, C.-S. Chen<sup>2</sup>, G. C. C. Chuang<sup>3</sup>, and B. K. Liou\*<sup>1</sup>, <sup>1</sup>Central

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The purpose of this study was to evaluate the sensory characteristics of 10 commercial packed vanilla ice creams, including 7 local and 3 foreign brand products in Taiwan market, using descriptive analysis, consumer test and e-tongue. The 10 products were evaluated 34 attributes by 12 well-trained panelists using a 15cm unstructured line in descriptive analysis, were performed with a 9-point hedonic test by 60 college students for consumer test and were tested using a-ASTREE E-tongue. The descriptive analysis using principal component analysis showed 5 products, containing 2 foreign products, had the stronger intensity in sweetness, milky candy flavor, margarine flavor, fineness, creaminess and viscosity, 4 products were a significant characteristic in milky flavor, coconut flavor, walnut flavor and mouth coating as well as a foreign product, claimed vanilla bean used, had the higher intensity in vanilla flavor, medical flavor and icy feeling. The first partial least square (PLS) regression, used to relate the consumer ratings and the descriptive analysis ratings, showed that consumers like the product had a strong characteristic in milky flavor, walnut flavor, coconut flavor, creaminess and fineness but dislike the higher intensity in sweetness, milky candy flavor and icy feeling. The second PLS regression, used to relate e-tongue ratings and the descriptive analysis ratings, revealed GA sensor was positively correlated with vanilla flavor, medical flavor, sweetness, cooked sugar flavor and milky candy flavor; BB was positively correlated with sweetness, cooked sugar and milky candy flavor; JE and CA were both positively with margarine flavor but negatively correlated with sweetness and cooked sugar flavor; JB could have a positive relationship with milky flavor. This study concluded that there is a significant discrimination between the foreign and the local products in flavor characteristics such as sweetness and coconut flavor, Taiwan's consumers prefer the stronger intensity in milky flavor instead of sweetness and milky candy flavor, and the e-tongue is capable to effectively discriminate ice cream products.

**Key Words:** ice cream, sensory analysis, E-tongue