Dairy Foods Symposium: Advances in bacterial exopolysaccharides—From production to applications in dairy foods and health

661 Advances in production of exopolysaccharides and simplified methods for their recovery and quantification. Luc De Vuyst* and Frédéric Leroy, *Vrije Universiteit Brussel.*

The capacity of strains to produce exopolysaccharides (EPS) is widespread among species of lactic acid bacteria, although the physiological role of these molecules is not clearly understood yet. When EPS are produced during milk fermentation, they confer technological benefits to the fermented end products, such as an improved rheology, a reduced syneresis, and an enhanced body and mouthfeel. In addition, some of these EPS may have beneficial effects on consumer health. This requires optimal and sufficient production of these molecules both in situ and ex situ not only to improve their yields but also to obtain a particular functionality. Therefore, appropriate methods of production and recovery should be established. One particular difficulty relates to the production and processing of the biomass of starter cultures when they produce high concentrations of EPS. All this requires a better understanding of EPS production and regulation mechanisms.

Key Words: lactic acid bacteria, exopolysaccharides, fermentation

662 Chemical modification of EPS to improve its health functionalities. Siqian Li and Nagendra Shah*, *The University of Hong Kong, Pokfulam Road, Hong Kong.*

Exopolysaccharides (EPS) from S. thermophilus ASCC 1275 (ST1275) were isolated, purified and lyophilized and sulfated using SO_3-pyridine complex and FT-IR was used to identify the characteristic bands in EPS and sulfated EPS. Changes in antioxidant activities after sulfate modification were examined by measuring FRAP, DPPH, superoxide anion and hydroxyl radical scavenging activities. Antibacterial activities and MIC tests of EPS and sulfated EPS were investigated against *S. aureus*, *E. coli* and *L. monocytogenes* by cylinder-plate diffusion method. Changes in anti-proliferative activities after sulfate modification were also examined on HepG2 and Caco-2 cells by MTT method, while changes in anti-inflammatory activities were examined in RAW264.7 macrophages. LPS was used to induce inflammation in RAW264.7 macrophages. Sulfate modification of EPS was achieved and the degree of sulfate modification, which was identified as the average number of oxygen-sulfate groups per residue in EPS, was 0.31. Additionally, bands in FT-IR spectra indicated that sulfate group was at the C6 position of the galactose skeleton in sulfated EPS. The results also revealed that the antioxidant activities of sulfated EPS were significantly ($P < 0.05$) improved compared with those of unmodified EPS in all the 4 antioxidant activities assays. Sulfated EPS had larger inhibition zone on *S. aureus*, *E. coli* and *L. monocytogenes* compared with those of unmodified EPS which indicated that the antibacterial activities of EPS were significantly ($P < 0.05$) improved after sulfate modification. Furthermore, sulfated EPS had lower MIC for *S. aureus*, *E. coli* and *L. monocytogenes*, which also suggested that the antibacterial activities of EPS improved after sulfate modification. Sulfated EPS had higher anti-proliferative activities on both HepG2 and Caco-2 cells. Also, pro-/anti-inflammatory (IL-6/IL-10; TNF-α/IL-10) cytokine secretion ratios of LPS-stimulated RAW264.7 macrophage were significantly ($P < 0.05$) decreased after sulfated EPS treatments at non-cytotoxic doses. In conclusion, our results indicated that antioxidant, antibacterial, anti-proliferative and anti-inflammatory activities of ST1275 EPS were improved after sulfate modification

Key Words: EPS, sulfate modification, antimicrobial activity

663 Advances in application of EPS in dairy foods, particularly in low-fat or fat-free yogurt, and low-fat mozzarella cheese. Donald J. McMahon*, *Western Dairy Center, Utah State University, Logan, UT.*

Exopolysaccharides (EPS) produced by bacterial cultures has a long history of usage in cultured dairy products such as yogurt for improving their texture and providing some of the unique attributes of these traditional foods. Depending of the organism that produces the EPS, the EPS material can be retained around the cell as a capsule or released into the surrounding medium. In some cases, the released EPS can form into clumps and strands of EPS and are these are considered to be ropey cultures. Investigations into use of capsular EPS+ cultures in cheese making became of interest 25 years ago as a means of improving the texture of low-fat cheeses and this still continues to be an area of research related to many different types of cheeses. A prime effect of using EPS+ cultures is the greater retention of moisture in low-fat cheeses either from using EPS+ starter cultures or by direct addition of an EPS mass into the cheese milk before renneting. Understanding the effect of EPS on both rennet and acid coagulated foods has depended on studies of the product's microstructure using electron microscopy and confocal laser scanning microscopy. The functional effects of inclusion of EPS into cheese and yogurt depends on the intrinsic chemical nature of the EPS such as sugar composition, extent of branching and charge. This presentation reviews recent findings related to biostructural analysis of fermented dairy foods containing EPS from a variety of EPS+ bacterial species.

Key Words: exopolysaccharides, microstructure, dairy

664 Beneficial effects of EPS on human health and gut microbiota. Hua Wei*[1,2], Zhihong Zhang[1], Xueying Tao[1,2], Feng Xu[2], Hengyi Xu[1], Cuixiang Wan[2], Qinglong Wu[3], and Nagendra P. Shah[3], *[1]State Key Laboratory of Food Science and Techonology, Nanchang, Jiangxi, China, [2]Jiangxi-OAI Joint Research Institute, Nanchang, Jiangxi, China, [3]The University of Hong Kong, Hong Kong, China.*

Recently bacterial exopolysaccharide (EPS) extracted from *Lactobacillus* spp. and *Bifidobacterium* spp. has received considerable attention, mainly due to the novel and unique physical characteristics and physiological functions. EPS contributes to biofilm formation and host healthy maintenance, it can be used as an instrument for probiotics to survive in harsh condition. In this review, we provide a fresh perspective and focus on the advancement of bioactivity and immune modulating capability of exopolysaccharide. Indeed, EPS from *Lactobacillus* spp. and *Bifidobacterium* spp. exhibit many beneficial bioactivity including anti-tumor activity, antiviral activity, radical scavenging activity and abrogate the cytotoxic effect. Therefore, it has great potential for further development as therapeutic agents or adjuvants for cancer. Furthermore, EPS binds to common surface receptors to elicit the immune response in host, it was able to reduce the secretion of the proinflammatory e.g., IL-6. Thus, the EPS seem to be critical in studying the physiology of *Lactobacillus* spp. and *Bifidobacterium* spp. and their interaction with the host.

Key Words: probiotics, exopolysaccharide, bioactivity