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Western Dairy Center Project Report

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Western Dairy Center
Project Report
Reporting Period January 1, 1997 — December 31, 1997

Principal Investigators: Donald J. McMahon, Utah State University
Co-Investigators: Dr. Jeffery Broadbent, Utah State University
Dr. Craig Oberg, Weber State University

Project Title: Improvement of Mozzarella Cheese Functionality by Understanding Exopolysaccharide Production in Thermophilic Starter Cultures

Institution's Project #: 97079

Project Completion Date: 12-31-99

Understand the impact of polysaccharide production by starter cultures in cheese quality and functionality.

Modifications to Project/Budget:
None

Project Objectives: (Include any revisions to objectives)
Understand the influence of microbial exopolysaccharides on Mozzarella cheese moisture status and the relationship of moisture to cheese composition and functionality.
Objective 1: Characterize the structure, molecular weight, and polymer properties of the exopolysaccharide produced by S. thermophilus 10JC.
Objective 2: Isolate and characterize the S. thermophilus 10JC gene cluster for exopolysaccharide production.
Objective 3: Transform EPS- Mozzarella starter cultures with the cloned gene cluster and evaluate the influence of these constructs on moisture level and functional properties of low-fat Mozzarella cheese.

Project Summary: (Suitable for inclusion in Center documents released to the public)
Mozzarella cheese functionality is significantly affected by cheese moisture level, and increasing moisture content has been used to improve the melting properties of low fat Mozzarella cheese. Previous work by our group has shown that exopolysaccharide (EPS)-producing starter cultures can be used to significantly increase the moisture content of lower fat Mozzarella cheese. We have identified a culture, Streptococcus thermophilus 10JC, that produces a large capsular EPS, and have shown that this capsule is involved in cheese moisture retention. Experiments are now underway to characterize the structure of the 10JC EPS and isolate the genes that encode its biosynthesis. This project will provide basic information needed to understand the influence of EPS on cheese quality and functionality.

1. Significant Progress against Objectives:
Research to date has addressed objectives 1 and 2. Compositional analysis of the 10JC EPS using GC-mass spectroscopy rindicate this polymer has a novel octomeric repeating unit composed of galactose, rhamnose and fucose in a 5:2:1 ratio. Methylation studies
have been used to obtain a preliminary structure that will now be confirmed by NMR. With respect to objective 2, efforts are underway to isolate and sequence the 10JC EPS gene cluster. The nucleotide sequence for the 6.5-kb region encoding epsA-F is nearly completed, and we have cloned and begun to sequence a 5-kb region that we believe encodes epsF-J. As that sequence is determined we will continue our efforts to isolate the rest of the 10JC EPS genes, and then use the nucleotide sequence to identify a useful strategy to clone the entire gene cluster. Once that is achieved, we will transform the cluster into EPS-Mozzarella starter cultures and evaluate the influence of these constructs on moisture level and functional properties of low-fat Mozzarella cheese.

2. Significant Conclusions:
Our data demonstrate that the S. thermophilus 10JC EPS is a novel polymer with useful commercial applications.

3. Anticipated Problems/Delays:
none

Publications:
none

Theses:
none

Published Abstract:

Presentations:

Broadbent, J.R. EPS production in Streptococcus thermophilus: physiology, biochemistry, and genetics. Invited oral presentation for the Marschall/Rhône-Poulenc Italian and Specialty Cheese Conference, Sept. 17-19, Madison, WI.

Patent/Invention Disclosures:
No patents/invention disclosures filed

Technology Transfer Activities Licensing this technology is underway
For information on licensing contact:
Jeff Broadbent

Visitors Hosted:
none
Confidential - For Center Director's Use Only
(Release of this information requires prior approval by principal investigator)

Provide summary of significant advances in project that you wish to remain confidential at this time. For example, new methodology that you do not wish to release until the current work is completed; information on invention disclosures or patents filed; activities conducted to transfer the technology to industry, or licensing agreements that are underway.

This information is important for meeting the contractual agreement under which your research was funded.

Invention Disclosures: (Title, Date)
none

Patents: (Title, Date, #)
none

Licensing Activities:
The 10JC culture has been provided to industry for pilot-scale testing as part of a preliminary licensing agreement.

Discoveries:
see above
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Licensing Activities:

Discoveries: