



Contribution ID: 75

Type: Oral

Heavy Starch: Biosynthesis and Characterisation of Deuterated Glucans

For the first time, starch biosynthesis in genetically modified yeast has been used to produce deuterated starch by growing the yeast in deuterated media at the National Deuteration Facility (NDF) at ANSTO.

Current deuteration methods target the outer starch granule structure, or destroy the layered granular structure entirely. Our methods of deuteration targeted the entire structure of the granule, keeping the structure in-tact. Successful deuteration of the whole starch granule allows for an entire suite of new starch SANS, NMR, and digestion kinetics experiments to take place further elucidating the complex structure of starch and its role in biochemical systems.

The modified yeast strain used in this experiment was grown on deuterated raffinose as the main carbon source, which was metabolized into starch granules. This work includes the first report of raffinose deuteration, performed at the NDF. The cells were lysed and the starch was collected, purified, and analyzed.

FTIR and SEM were used to confirm the starch-like identity of the granules, with the “fingerprint region” of the FTIR spectrum matching those of commercial starches, and the SEM images matching those reported by Pfister et al. Mass spectroscopy results on amyloglucosidase-digested samples revealed approximately 27% average deuteration of the granules. Solid-state NMR also showed that deuteration was not distributed evenly throughout the sample. SANS analysis showed approximately 30% average deuteration of the granules, and revealed two main features at $Q = 0.05 \text{ \AA}^{-1}$ and $0.405 \text{ \AA}^{-1}$, the first corresponding to a lamellar repeat size of approximately 13 nm, and the latter indicating the likely presence of B-type packing in the crystalline regions of the granules.

Presenter Gender

Woman

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

Students Only - Are you interested in AINSE student funding

No

Level of Expertise

Student

Pronouns

She/Her

Which facility did you use for your research

National Deuteration Facility

Primary authors: Ms CARUANA, Lillian (UNSW); Dr RUSSELL, Robert (NDF, ANSTO); Prof. GILBERT, Elliot (ACNS, ANSTO); Dr RAWAL, Aditya (Mark Wainwright Analytical Centre, UNSW); Dr YEPURI, Nageshwar Rao (NDF, ANSTO); Dr DARWISH, Tamim (NDF, ANSTO)

Presenter: Ms CARUANA, Lillian (UNSW)

Session Classification: Biomedicine, Life science & Food Science

Track Classification: Biomedicine, Life science & Food Science