**Understanding of structural heterogeneities in the starch hydrogels**Trey, T. Koev1,2, Juan Carlos Muñoz García2, Fred J. Warren1 and Yaroslav Z. Khimyak2

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**Abstract**

As an easily accessible, renewable and environmentally friendly material, and a pivotal part of the human diet, starch holds great promise for a wide variety of structural, pharmaceutical and biomedical applications. Starch hydrogels are unique three-dimensional, semi-solid structures able to hold a large amount of water and other solvents with unique rheological, physicochemical and biochemical properties. As representatives of molecular gels, starch hydrogels simultaneously feature domains with highly distinct manner of organisation, packing and molecular mobility, which introduces considerable difficulties to their full experimental characterisation.

In this project, we have applied NMR methods specifically tailored to the identification of rigid and mobile components, such as 1H-13C CP and CPSP-MAS NMR1–6, which are novel to the field of starch hydrogels. Hydrogel materials were produced by different hydrothermal treatment methods using five separate maize cultivars, featuring different levels of composite glucans, degree of modification and resistant starch character.

Our initial investigations resulted in the identification of previously unpublished distinct carbon sites exhibiting increased mobility in low amylose starch hydrogels, when compared to their high amylose counterparts. Data obtained from these investigations were cross-referenced with rheological and thermal analyses of the maize hydrogels. These findings were hypothesised to be a consequence of the predominantly linear structure of amylose, compared to its highly branched glucan analogue, facilitating inter-chain association during the period of gelatinisation.

We aim to use our findings for the development of previously unexplored starch hydrogel-based materials for applications in the pharmaceutical and biomedical sphere, as novel biocompatible prosthetic implants and “smart” drug delivery methods as targeted, stimuli-responsive and controlled drug release loading materials.

References

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