Cluster 2 – Progress Report for the Cluster 2 Science Advisory Body

1. CLUSTER PROJECT DETAILS

Project number: J-000551 - CL03-Pulse-Activity T3.P20.V1
Name of Project: Characterization of {tructure, thysicochemical and thysiological troperties of {tarch from Canadian Drown tulse /rops to 5evelop bovel Cunctional Cood Lngredients and Cunctional Coods for I uman I ealth .enefits
Project research period: September 2013 – March 2018
Period covered by this report: 2015-2016
Principal investigator and research collaborators: Qiang Liu (PI); Tom Warkentin; Michael Thompson; Ratnajothi Hoover; D.J. Bing; Frédéric Marsolais; Dan Ramdath; Rong Cao (Collaborators)

NON-CONFIDENTIAL ABSTRACT/SUMMARY

Starch is the primary source of calories in the human diet and serves as an important functional ingredient in many food and non-food products. There has been consistent scientific evidence to support the relation between how starch is digested and many chronic diseases including diabetes, cardiovascular disease, and obesity. Therefore, consumers, food manufacturers, and processors have shown increasing interest in low glycemic index food products. Pulse starches are identified as slowly digestible or resistant to hydrolysis compared with cereal starches. This property is attributable primarily to the high amylose content, as well as, molecular structure of glucan components. Many other influences including processing conditions, how the food is cooked, and the bacteria that live in our gut also seem to play a role in our metabolic process. In this context, understanding physicochemical properties of pulse starches and the molecular structure are prerequisite to enhance the required nutritional and functional quality by modification and processing techniques. In addition to starch content, as pulses are rich in protein, fibre, antioxidants, and vitamins, understanding the proteomics and characteristics of other components of pulse flour are key to screen and develop nutritionally diversified food products.

The key challenge to food researchers and the food industry is the production of consumer friendly foods which contain enough resistant starch (RS) and/or slowly digestible starch (SDS) to result in a significant improvement in human health, and how to evaluate or predict the nutritional properties using an effective model. Extensive research on cereal, potato, sweet potato, and cassava starches has made them readily available for use in food and non-food applications. However, there is a dearth of information on the molecular structure of pulse starches and effective processing and modification to manipulate starch structure.

The overall research objective for this activity is to understand how enhanced slowly digestible and/or resistant starch is formed through pulse variety selection and effective processing to manipulate starch structure, and to characterize the microstructure and functionalities of slowly digestible and resistant starch from Canadian grown pulses, using various modern analytical techniques including differential scanning calorimetry, dynamic mechanical analysis, rapid visco-analysis, Fourier transform infrared spectroscopy, optical and electron microscopy, particle size analysis, wide angle x-ray diffraction, ^{13}C cross-polarization magic angle spinning nuclear magnetic resonance spectroscopy, high performance anion exchange chromatography, and *in vitro* digestibility.

By investigating pulse starch structure, physicochemical, and physiological properties in this project, we will address the novel applications of pulse and pulse starches, to ensure that pulse crops are viable alternative to corn and potato starch. Other approaches are the identification of existing and newly released Canadian grown pulse crops to identify the source for enhanced resistant starch and slowly digestible starch and other bioactive compounds and modification of processing conditions such as using reactive extrusion to produce novel pulse starch and food with enhanced resistant starch and/or slowly digestible starch.

We expect to deliver new knowledge and a database on the chemical composition, granular and molecular structure, functionality, and nutritional properties of Canadian grown pulse flours and starches. We will also publish research discoveries in peer-reviewed scientific journals and present data at national and international conferences.