Research Summary Sheet

Summary of Deliverable 4.1 /4

Biotechnological and physical-chemical optimized strategies to extract and convert biomolecules from agro-wastes:

Potato starch processing waste

Context and Challenges

China is the largest producer of potato in the world. Potato is commonly used in starch processing, which results in a large quantity of waste pulp. In China, approximately 4.5–5.0 tonnes of fresh potato pulp are generated for every tonne of starch produced. However, while a small amount of the potato pulp byproduct is used as low-value animal feed, most of it is disposed, which means that it is a major contributor to environmental pollution. Previous studies have indicated that potato pulp consists of starch (37%), pectin (17%), cellulose (17%), hemicellulose (14%), and protein (4%) (dry basis), and potato pulp is rich in pectin which can be used as a good raw material for pectin extraction, however, there is little information about potato pectin.

The acid extraction method is often used to extract pectin in the food industry because of its convenient and easy operation. Several studies have indicated that the use of different acid extractants can have different effects on pectin yield, structure, and physicochemical properties. In recent years, some studies have mainly focused on the application of endo-polygalacturonase and KOH/NaOH to extract the RG-I domain from potato pulp. As far as we know, few studies have reported the effects of different types of acids on the yield, structure, and emulsifying properties of potato pectin.

IAPPST carried out the study about the effects of three mineral acids (HCl, H2SO4, and HNO3) and two organic acids (citric acid and acetic acid) on the yield, structure, and emulsifying properties of potato pectins. The purpose of this study was to provide a theoretical basis for the industrial extraction of pectin from potato pulp, and to evaluate the potential of potato pectin as a natural emulsifier in the food industry.

The project leading to this application has funding from European Union's Horizon 2020 research and innovation programme under grant agreement No 688338.

Results and Applications

Results showed that the highest yield (14.34%) was obtained using citric acid, followed by HNO_3 (9.83%), HCl (9.72%), H_2SO_4 (8.38%), and acetic acid (4.08%). The degrees of methylation (37.45%) and acetylation (15.38%), protein content (6.97%), and molecular weight (3.207×10^5 g/mol) were the highest for pectin extracted using acetic acid, and (galactose+arabinose)/rhamnose was 33.34, indicating that it had a highly branched rhamnogalacturonan I domain. Fourier transform infrared spectroscopy showed a specific absorbance peak at 1064 cm^{-1}, which corresponds to the acetyl groups in potato pectins. SEM showed that all potato pectins are morphologically different. The emulsifying activity (EA, 44.97%–47.71%) and emulsion stability (ES, 36.54%–46.00%) of the pectins were influenced by acid types, and were higher than those of commercial citrus and apple pectin.

Breakthroughs, benefits and added value

The results suggest that potato pectin may be useful as a potential emulsifier in emulsified food products. The solid residues obtained will be valorized as potential reinforcing agents in polymeric matrixes. Therefore, the achieved results demonstrate that potato processing waste can be fully valorized, without residues.

Further information on NoAW project: http://noaw2020.eu

IAPPST: Taihua Mu, e-mail: mutaihua@126.com

INRA (Coordinator): Prof. Nathalie Gontard, e-mail: nathalie.gontard@inra.fr

The project leading to this application has funding from European Union's Horizon 2020 research and innovation programme under grant agreement No 688338.