

Accepted Manuscript

Toughening and stiffening of starch food extrudates through the addition of cellulose fibres and minerals

C.G. Skamniotis, Y. Patel, M. Elliott, M.N. Charalambides



PII: S0268-005X(18)30140-1

DOI: [10.1016/j.foodhyd.2018.06.004](https://doi.org/10.1016/j.foodhyd.2018.06.004)

Reference: FOOHYD 4481

To appear in: *Food Hydrocolloids*

Received Date: 25 January 2018

Revised Date: 11 May 2018

Accepted Date: 3 June 2018

Please cite this article as: Skamniotis, C.G., Patel, Y., Elliott, M., Charalambides, M.N., Toughening and stiffening of starch food extrudates through the addition of cellulose fibres and minerals, *Food Hydrocolloids* (2018), doi: 10.1016/j.foodhyd.2018.06.004.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Toughening and stiffening of starch food extrudates through the addition of cellulose fibres and minerals

C. G. Skamniotis^a, Y. Patel^a, M. Elliott^b, M. N. Charalambides^a

^a Department of Mechanical Engineering, Imperial College London, London SW7 2AZ, United Kingdom

^b Mars Petcare, Oakwell Way, Birstall, Batley, WF17 9LU, UK

E-mail: c.skamniotis13@imperial.ac.uk; m.charalambides@imperial.ac.uk

ABSTRACT

Pet food, one of the largest type of commercial packaged foods, continuously sets new challenges, amongst them the possibility to enhance palatability via adjusting product composition. This will optimise texture perception across consumer groups of diverse chewing capabilities, as well as improve food oral breakdown efficiency with further impact on metabolic health and nutrient bioavailability in the digestive process. Our aim is to pioneer new methods of controlling texture by answering longstanding questions such as the impact of nutrients on the mechanical properties of foods. The impact of cellulose fibres and minerals on the fracture toughness and stiffness properties of starch food extrudates is investigated for the first time through employing tensile tests and two fracture toughness tests namely Essential Work of Fracture (EWF) and cutting, on four different compositions. Fibres alone are found to increase stiffness (stiffening) and toughness (toughening) whereas minerals decrease stiffness (softening) with a minor influence on toughness. Interestingly, fibres and minerals combined maximise toughening at 28% compared to pure starch, due to the synergistic effect of fibre-matrix de-bonding and fibre breakage mechanisms at the crack tip. These new results indicate that texture can be significantly altered through the addition of minerals and short fibres. Such information is critical in the design of products that need to satisfy both nutritional and textural criteria.

Keywords: starch food extrudates, cellulose fibres, minerals, toughening mechanisms, essential work of fracture, orthogonal cutting

1 Introduction

Like all carnivores, dogs display sharp, pointed teeth, and have short gastrointestinal tracts designed for meat consumption (Ockerman and Hansen 1999). However, over thousands of years, dogs have managed to adapt and survive on meat as well as non-meat food waste and now can be fed a variety of foods (Ockerman and Hansen 1999, Axelsson, Ratnakumar et al. 2013). The pet food industry has been continuously growing over the past four decades, producing products for domesticated animals that are formulated according to their nutritional needs (Arenofsky 2018). These typically consist of meat, meat by-products, cereals, grain, vitamins, and minerals (Hand, Hefferren et al. 1995). As long ago as in 1974 in the United States (US) about 300 manufacturers were producing more than seven million tons of pet food per year, already indicating one of the largest categories of any packaged food (Nutrition 1974). Owners could choose from more than 3000 products, including dry, canned, semi-moist types as well as

Download English Version:

<https://daneshyari.com/en/article/6985551>

Download Persian Version:

<https://daneshyari.com/article/6985551>

[Daneshyari.com](https://daneshyari.com)