

DIFRUCTOSE DIANHYDRIDE-ENRICHED CAMELS: PREBIOTIC AND NUTRACEUTICAL PROPERTIES

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Caramelization commonly occurs when sugars, or products containing a high proportion of sugars, are heated either dry or in concentrated aqueous solutions, alone or in the presence of certain additives. Besides its traditional involvement in the preparation of home-made products, caramelization is an important industrial process used for the preparation of food products and coloring additives. Upon thermal treatment of sugars, dehydration and self-condensation reactions occur, giving rise to volatiles (principally 2-hydroxymethylfurfural, HMF), pigments (melanoidines) and oligosaccharidic material. In 1994, di-D-fructose dianhydrides (DFAs) were identified as the major components of the oligosaccharide fraction,¹ which also contains glycosylated-DFAs of different DP. While DFAs have been known for a long time, it was ignored that they are actually present in the human diet.

Up to 14 different DFA diastereomers have been identified in sucrose caramel, amounting for 10-20% of the non-volatile material.² The literature in the field points to a beneficial effect associated to DFA consumption. We have now developed a caramelization technology that allows producing caramels with up to 70-80% DFAs and glycosyl-DFAs by controlled heating of a commercial sugar precursor, preferentially D-fructose, in the presence of a heterogeneous acid catalyst.³ The composition of the products is determined by GC using pure standards obtained by chemical synthesis.⁴ Evaluation of the prebiotic properties of the new caramels has been carried out first in female Wistar rats. In healthy animals fed DFA-enriched caramels, the counts of lactobacilli in the colonic contents and short chain fatty acid production were slightly increased in comparison with untreated control rats. The absence of any toxic effect exerted by these products was also confirmed. Most interestingly, in animals with trinitrobenzenesulphonic acid-induced colitis, a model for human Crohn's disease, amelioration in the macroscopic colonic damage as well as a recuperation of the counts of the beneficial colonic bacteria in the intestinal contents were observed. More recently, in vitro experiments with the colonic content of pigs demonstrated an increase in the counts of bifidobacteria and lactobacilli accompanied by a decrease in enterobacteria and coliform bacteria, supporting a prebiotic activity.

¹ Defaye, J.; García Fernández, J. M. *Carbohydr. Res.* **1994**, *256*, C1-C4.

² Ratsimba, V.; García Fernández, J. M.; Defaye, J.; Nigay, H.; Voilley, A. *J. Chromatogr. A* **1999**, *844*, 283-293.

³ Rubio Castillo, E. M.; Gómez-García, M.; Ortiz Mellet, C.; García Fernández, J. M.; Zarzuelo Zurita, A.; Gálvez Peralta, J. J.; Duval, R. "New caramels with high content in prebiotic oligosaccharides, their preparation and use". ES/P200700675, **2007**; PCT/ES2008/000129, **2008**.

⁴ García-Moreno, M. I.; Benito, J. M.; Ortiz Mellet, C.; García Fernández, J. M. *Molecules* **2008**, *13*, 1640-1670.