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Letter to Editor of "Carbohydrate Polymers"—comments on a recent paper by Onweluzo and Co-workers☆

We wish to point out that comments in the recent article by Onweluzo and co-workers (Carbohydrate Polymers **47** (2002) 253–257) entitled *Characterization of free sugars and xyloglucan-type polysaccharides of two tropical legumes* do not correspond exactly to our own experience and published work in this area. The object of the present letter is to elucidate some of these issues.

For example, the authors state in their introduction that *Except for some preliminary work* (*Onweluzo, Obanu, & Onuoha, 1994*), *no systematic study has been done on the chemical nature and structural feature of the highly viscogenic mucilaginous polysaccharides of these two legume seeds*. One of the materials the authors are referring to is a xyloglucan extracted from a seed flour, which is used traditionally as a food ingredient in Nigeria and other parts of West Africa for thickening soups and stews. The authors also refer to this plant as *Detanium* (sic, should be *Detarium*) *microcarpum*, although it is more correct to use the alternative Latin name *Detarium senegalense* Gmelin. *D. senegalense* is a leguminous plant belonging to the subdivision of Caesalpinoideae (Balogun & Fetuga, 1986) and is considered to be synonymous with *Detarium microcarpum* (Food and Agriculture Organisation, 1988).

It appears Onweluzo and colleagues have overlooked our previously published two papers on this material, one in *Carbohydrate Research* (Wang, Ellis, Ross-Murphy, & Reid, 1996) and one in *Carbohydrate Polymers* (Wang, Ellis, Ross-Murphy, & Burchard, 1997) which together, albeit arguably, constitute one of the most complete characterisations of a plant polysaccharide currently performed. Between them, these two papers included both chemical and biochemical structure determinations, and extensive viscometric, rheometric and light scattering structure measurements.

It may be that (a) the authors do not have regular access to either journal (although they certainly publish regularly in *Carbohydrate Polymers*), or (b) the authors did not appreciate that there is some confusion over the nomenclature used for the detarium plant. Despite this, some of the results for detarium xyloglucan from the current paper are in agreement with our own data, including the monosaccharide composition of this polysaccharide and the comments on chain branching. Thus, in our study, we were able to show the main sugar residues of the polysaccharide, extracted as one fraction by precipitation with 80% ethanol, were glucose, xylose and galactose in the ratio of 1.39:1.00:0.52 (Wang et al., 1996). This ratio is close to that produced by Onweluzo and co-workers for the main ethanol precipitated fractions obtained from their detarium sample, viz. for their DM-2 fraction, this was approximately 1.55:1.0:0.42. This is also close to the corresponding reported values for the storage polysaccharide of tamarind seed (*Tamarindus indica* L.) (Buckeridge, Rocha, Reid, & Dietrich, 1992).

On the basis of our initial sugar analysis results, we were able to suggest that the detarium extract was structurally similar to the xyloglucan group of cell wall storage polysaccharides. A more detailed examination of the polysaccharide, using biochemical methods, confirmed that it is a xyloglucan consisting of a cellulosic backbone with single-unit α-D-xylopyranosyl substituents attached to carbon-6 of the glucosyl residues, and with some of the xylose residues further substituted at carbon-2 by β-D-galactopyranosyl residues. However the fine structure differs subtly from tamarind xyloglucan (Wang et al., 1996). In this respect, our work goes well beyond the more recent paper by Onweluzo and colleagues, and demonstrates that, when describing such polymers, monosaccharide composition alone is clearly not sufficient.

Also in their paper Onweluzo and co-workers claim to have measured intrinsic viscosities although no data are given. We showed in the first of these papers (Wang et al., 1996) that sizeable values of this parameter were obtained (~ 8.9 dl g^{-1}). In the second paper we obtained reliable values of the (weight average) molecular weight M_w from light scattering ($\sim 2.7 \times 10^6$) by employing the pressure cell heating method of Aberle, Burchard, Vorwerg, and Radosta (1994). We were also able to analyse the angular dependence of the light scattering data, normally a very unpredictable exercise for water-soluble polysaccharides, at least using conventional methodologies. On the basis of these measurements we made, what we consider to be our most striking observation from the light scattering experiments. This is that the detarium xyloglucan appears not to be linear, but rather, is characterised by a small degree of long chain branching (Wang et al., 1997). We were able to

☆ Onweluzo, J. C., Ramesh, H. P., & Tharanathan, R. N. (2002). Characterisation of free sugars and xyloglucan-type polysaccharides of two tropical legumes. *Carbohydrate Polymers*, 47, 253–257.

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rationalise this observation in terms of biochemical function.

This finding, which was regarded by some as speculative, appears to be supported by some subsequent chemical derivative/non-aqueous solvent scattering work (Dentini, Kajiwara and co-workers, unpublished). More recently (Picout, Ross-Murphy, Errington, & Harding, 2003) we re-examined the light scattering behaviour of both this material and the related xyloglucan from tamarind. Here the evidence is less clear cut, and seems to be scattering model dependent. However it is interesting to see that Onweluzo and co-workers have provided data consistent with such a branched chain model.

Another statement we would take issue with in the paper by Onweluzo and colleagues is their somewhat tentative suggestion that *As a component of dietary fiber, xyloglucans may possess nutritional attributes of physiological significance and value*, when in fact there is already evidence in the literature to substantiate this. For example, tamarind gum, a xyloglucan seed extract of the tamarind plant is known to have beneficial effects on lipid metabolism in rats (Yamatoya, Shiakawa, Kuwano, Suzuki, & Mitamura, 1996). Our own group have performed a number of nutritional studies on the xyloglucan-rich detarium flour. In one animal experiment, the ingestion of detarium flour, as part of a semi-purified diet, was found to reduce fasting plasma cholesterol concentrations (Bell, Onyechi, Judd, Ellis, & Ross-Murphy, 1993). More recently, we reported that detarium flour, incorporated into foods such as wheat bread, significantly attenuated the postprandial rise in blood glucose and insulin concentrations in healthy human subjects (Onyechi, Judd, & Ellis, 1998). These reductions were substantially greater than those reported in studies where the subjects consumed guar gum or similar types of 'dietary fibre' at doses substantially higher than those used for the detarium study. Indeed, these impressive beneficial effects on postprandial glycaemia and insulinaemia have recently been repeated in a group of patients with type 2 (non-insulin dependent) diabetes mellitus (Ellis, Oneyechi, Judd, & Metcalfe, 1999). There is little doubt that leguminous sources of xyloglucan indigenous to Africa have enormous potential in the management of diabetes and hyperlipidaemia, particularly in urban areas of Nigeria (and other parts of Africa), where the prevalence of diabetes and heart disease is currently a serious health problem (Ellis, 1999; Johnson, 1991).

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