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STRUCTURAL FEATURES OF AN L-ARABINAN DERIVED FROM MUSTARD SEED MEAL

R. N. THARANATHAN, U. RAMADAS BHAT, G. MURALI KRISHNA and S. V. PARAMAHANS

Department of Biochemistry and Applied Nutrition, Central Food Technological Research Institute, Mysore-570013, India

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Abstract—Aqueous extraction of defatted mustard seed meal yielded an arabinan. Methylation analysis revealed a main chain of 1,5-linked L-arabinofuranosyl residues substituted at O-2 and/or O-3 with additional arabinose, both in furanoside and pyranoside forms.

INTRODUCTION

Several oil seeds are of commercial importance in the preparation of vegetable protein isolates [1]. Earlier studies [2] documented the existence of polymer–polymer associations in defatted ground nut meal as a result of which quantitative protein recovery was impaired. In continuation [3] of this work, we now report the structural features of a 'true' arabinan of mustard seed. Information is available on other species of mustard (*Brassica campestris*) [4] and rapeseed (*Brassica napus*) [5].

RESULTS AND DISCUSSION

The alcohol-insoluble residue (AIR) obtained from defatted mustard seed meal contained arabinose and glucose as the predominant sugars (30.7 and 49.0%) together with small amounts of xylose, galactose and uronic acid (11.0, 7.2 and 15.0%). Repeated extractions with water of AIR followed by acetone precipitation furnished in the supernatant a crude polysaccharide, which on pronase digestion yielded a material (CWSP-1) migrating as a single component on microzone electrophoresis. Sugar analysis of CWSP-1 revealed predominantly L-arabinose together with a little D-galactose ($\sim 11\%$).

Permethylation analysis of CWSP-1 followed by GC/MS gave 2,3,5- and 2,3,4-tri-, 2,3-di-, 2- and 3-mono-*O*-methylarabinose and free arabinitol in molar proportions of 1:0.18:0.49:0.15:0.38:0.18, respectively. 2,3,5-Trimethylarabinose suggests that the majority of the terminal arabinosyl residues are furanoside, although a small proportion of terminal pyranoside (2,3,4-Me_3-) arabinosyl residues (*m/z* 162, 118, 102, 101) are also detected. This, together with the identification in molar proportions of 2- and 3-*O*-methylarabinose as well as free arabinitol, suggests significant branching. The molecule thus appears to be an arabinan having a heavily substituted (at O-2 and/or O-3) (1 → 5)-linked arabinosyl backbone. Small amounts of *O*-methyl ethers of galactose (2,3,4,6-Me_4-, 2,3,6-Me_3- and 2,4-Me_2-) as well as 2,5-di-*O*-methylarabinose identified in MS may not be of any structural significance as far as the arabinan is concerned [6].

The presence of L-arabinopyranose in mustard seed (present study) is unusual. No reports are available on the occurrence in seed arabinans of L-arabinose in the pyranoside form. However, L-arabinopyranose is reported in a few root arabinans [7, 8].

Highly branched L-arabinans are of frequent occurrence in pectic complexes. These pectic arabinans are thought to be artifacts derived from eliminative degradations during the sample preparation. A relatively pure arabinan has been isolated from and characterized in white mustard seed (*Brassica hirta*) [9]. The arabinan described in the present study appears, in all probability, to be a non-degradative polysaccharide as the isolation procedures employed herein were extremely mild. However, pectic arabinan containing other covalently-bound sugar residues might also exist in mustard seed.

EXPERIMENTAL

General. Mustard seed (var. varuna) were obtained from Pantnagar Agricultural University, Pantnagar, UP, India. Neutral sugar analysis was performed by GC of the alditol acetates after hydrolysis either with the 72% H_2SO_4-solubilization method [10] or 0.13 M H_2SO_4 at 100° for 4 hr. Microzone electrophoresis of the dyed polysaccharide [11] was performed on a Beckman Microzone cell at 180 V for 30 min with acetate buffer (0.05 M, pH 4.8). The polysaccharide was permethylated [12], hydrolysed, reduced (1-$^2H_1$) and acetylated before identification by GC/MS [13].

Isolation of the polysaccharide. The 60-mesh powdered seeds were defatted by Soxhlet extraction using $CHCl_3$–petrol (1:1). The defatted meal (100 g) was repeatedly extracted with 70% EtOH at room temp. to remove soluble material and the resulting AIR was thoroughly extracted (5 × 250 ml) with H_2O and centrifuged. The combined extracts were filtered and the high molecular weight polysaccharide(s) in it were precipitated with Me_2CO and collected by centrifugation. The clear supernatant was concd (*ca* 50 ml) and re-precipitated. The precipitate was taken up in H_2O (10 ml) and lyophilized. Digestion with pronase [2] yielded protein-free polysaccharide (CWSP-1).

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