



# Institute of Chemistry

Slovak Academy of Sciences



## Department of Glycomaterials



### Main topics:

### Plants as a resource of biopolymers and dietary fibers

- the occurrence, isolation and structural features of polysaccharides important agricultural plants or pseudocereals, plant residues, selected herbs and invasive plants
- functional properties and intermolecular interactions
- biological activities (antioxidant, antitusive, immunostimulation)
- modification- hydrophobization of chosen commercial and non-commercial polysaccharides

*"GOST FP0901 Meeting" Vienna, February 4 -5, 2010*

## Working Group:

WG 1: Biorefinery feed material sampling and characterization

We have intention to be continued in research aimed to:



- ▶ isolation polysaccharide fractions from actual secondary plant sources,
- ▶ selection of suitable methods of structural analysis,
- ▶ determination of the molecular and functional properties of the crude and purified polysaccharides and their derivatives,
- ▶ evaluation of the antioxidant activity of polysaccharides and polysaccharide-phenolics complexes using chemical methods.

At the national level, the COST Action is supported by the project:

**Natural and tailored hydrophobized polysaccharides with antioxidant and associative properties.**

Research project: VEGA, No. 2/0062/09, 2009-2012.

Head of project: Zdenka Hromádková

*"COST FP0901 Meeting" Vienna, February 4 -5, 2010*

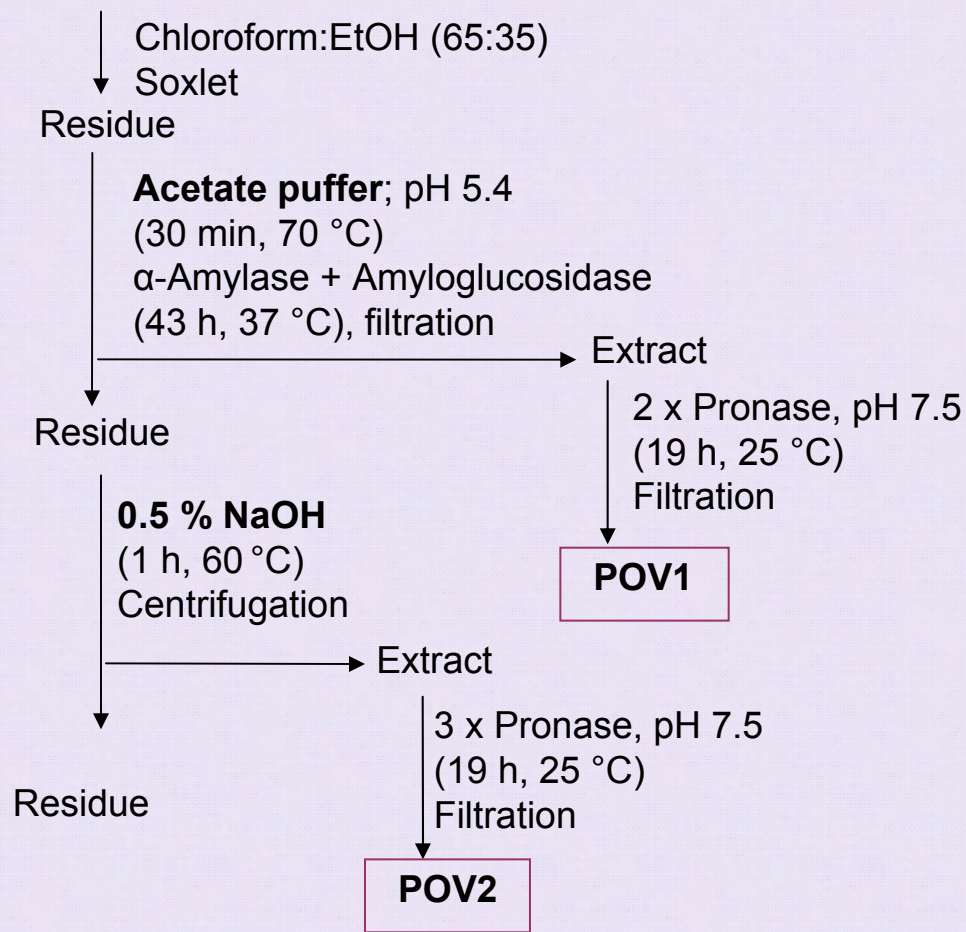
## Antioxidant effects and complement fixing activity of purified polysaccharides from wheat bran

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### Wheat bran



Wheat bran	Components (%)			
	Ash	N	Lignin	UA
PO	5.3	2.1	7.4	62
Neutral sugars (mol%)				
Ara	Xyl	Man	Glc	Gal
25	39	1	33	2

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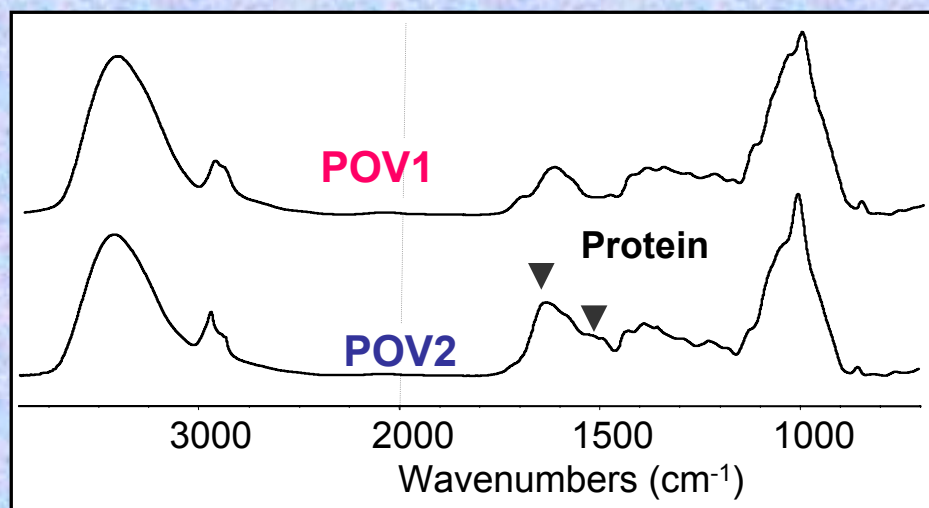
## Hemicelluloses from the wheat bran



	Components / %			Neutral sugars / mol %				
	TP <sup>a</sup>	N	UA	Ara	Xyl	Man	Glc	Gal
<b>POV1<sup>b</sup></b>	<b>2.2</b>	<b>0</b>	<b>2,8</b>	<b>44</b>	<b>27</b>	<b>3</b>	<b>11</b>	<b>15</b>
<b>POV2</b>	<b>4.4</b>	<b>1.5</b>	<b>2.4</b>	<b>45</b>	<b>50</b>	<b>1</b>	<b>2</b>	<b>2</b>

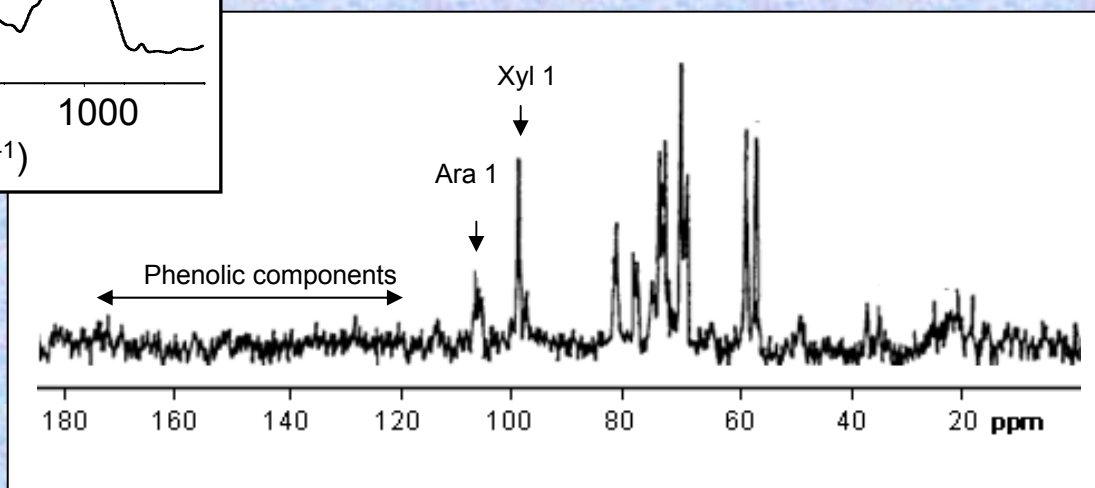
<sup>a</sup> water-soluble fraction of polysaccharides, <sup>b</sup> Rha, trace.

FT IR spectra



- acetate puffer and enyzmes
- dilute alkali

<sup>13</sup>C NMR spectrum of POV2



## Biological activities

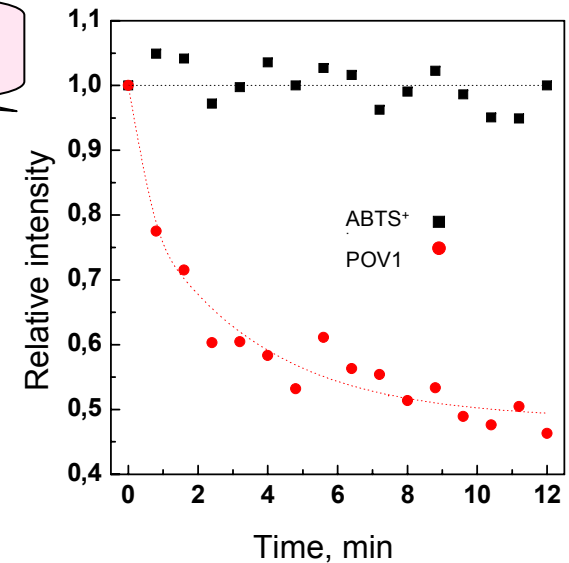
### Antioxidant activity

Technique of electron paramagnetic resonance

	POV1 (1 mg/mL)	POV2 (1 mg/mL)
DPPH (%)	46,4	84,4
FRAP (mmol/L Fe <sup>2+</sup> )	95,0	237,5

POV2 > POV1

1,1-diphenyl-2-picrylhydrazyl (DDPH)  
reduction (Fe<sup>3+</sup>) to (Fe<sup>2+</sup>) tripyridyl triazine (-TPTZ)  
2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonate) (ABTS<sup>+</sup>)

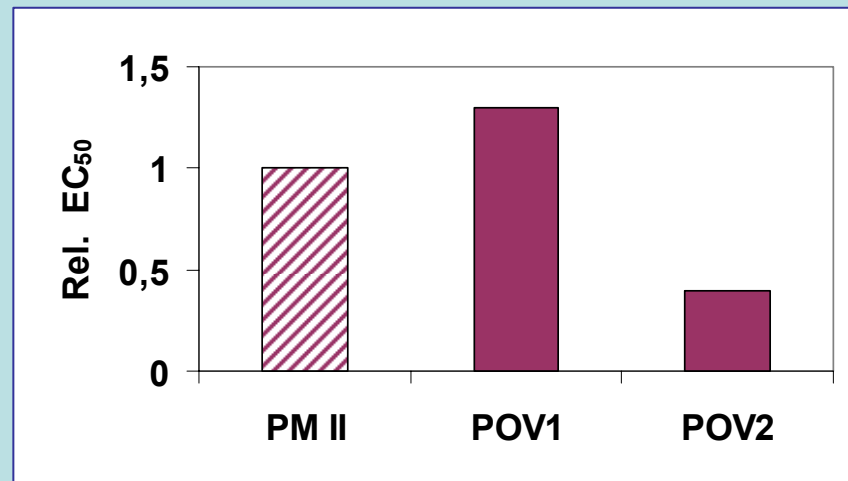


### Immunostimulating activity

#### Complement fixation test

PM II – as positive control  
(pectic polysaccharides from  
*Plantago major* L.)

POV1 < PM II << POV2



## Conclusions:

- Two purified polysaccharide fractions were isolated from wheat bran by sequential extraction with acetate buffer (POV1) in the I. step, and then by mild alkaline extraction (POV2) in the II. step. The chemical, FT-IR and mainly  $^{13}\text{C}$  NMR spectral data indicated that both fractions POV1 and POV2 contained predominantly high branched (glucurono)arabinoxylans.
- The water-soluble fractions from wheat bran (POV1, POV2) exhibited a significant antioxidant activity by several methods. Very high radical-scavenging activity of POV1 was undoubtedly confirmed by the DPPH- radical assay as well as by the electron paramagnetic resonance (ABTS-radical).
- Relationship between protein and phenolics contents and AOA was found. When we compared samples POV1 and POV2, the content of phenolics and protein was higher in the sample POV2 and also their antioxidant activity increased. Not all the phenolic substances are equally active.
- The complement fixation activity of POV1 obtained by sequential extraction with acetate buffer was lower than POV2 isolated by mild alkaline extraction. POV2 showed higher complement fixation activity than the positive control (PM II).