

Figure 1. At top, aspect of the different wheat bran fractions (from left to right): coarse, fine and middlings. At bottom, percentage of the different fractions obtained in the citrus juice extraction process (courtesy of Grupo Leche Pascual).



Figure 2. Wheat Bran Fractionation Protocol to derive fibre concentrates, oligosaccharides and ferulic acid.

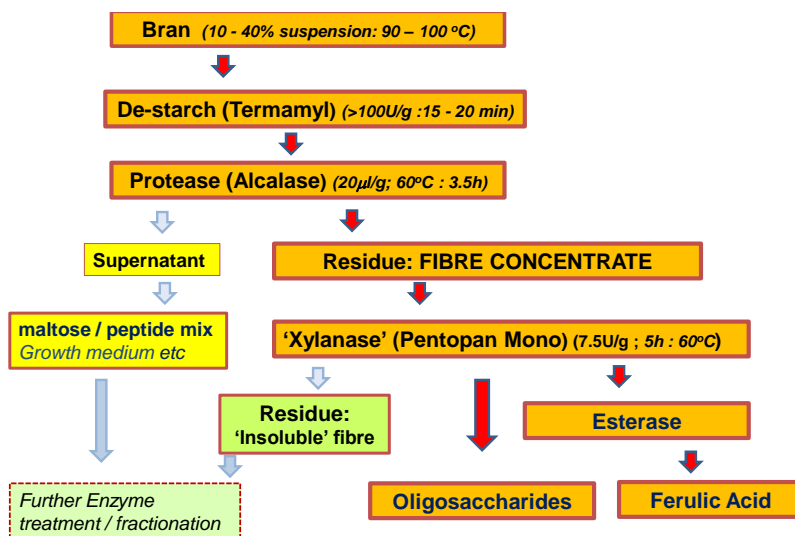


Figure 3. Untreated bran, bran fibre concentrate and oligosaccharide extract.



Figure 4. NSP content and composition of fibre prepared from wheat milling fractions. ara = arabinose, xyl = xylose, man = mannose, gal = galactose, glc = glucose, uronic = uronic acid. AB2 (Germ). Names on the x-axis identify the location of the wheat fraction sampling point in the flour milling process.

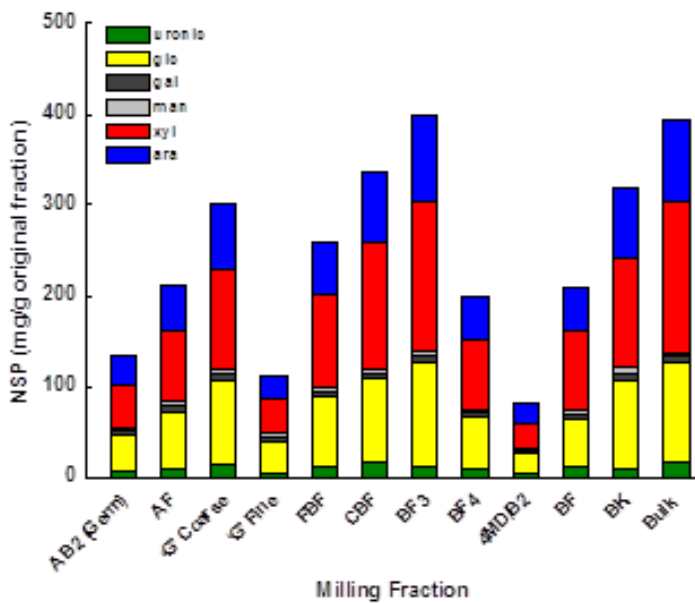


Figure 5. Yield of Pentopan-soluble material from milling fractions and corresponding Prebiotic Index (PI). PI positive control (FOS) = 3.7 and negative control = -1.8.

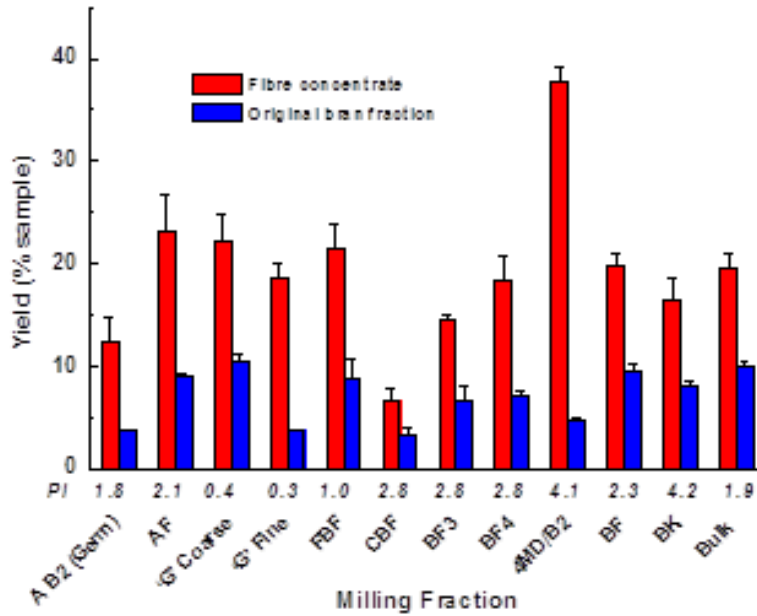


Table 1. Summary of technological advantages and sensory screening for oligosaccharides in food products.

Food product	Intended application	Advantages	Sensory screening
Bread roll	fibre enrichment	The dough rises quicker.	Acceptable
Rye loaf	fibre enrichment	The dough rises quicker.	Acceptable
Rye bar	fibre enrichment	The dough rises quicker.	Acceptable
Natural yoghurt	fibre enrichment	Thicker texture of the yoghurt	Not acceptable
Flavoured yoghurt	fibre enrichment	Thicker texture of the yoghurt	Acceptability flavour dependant

Figure 6. TAC of ethanolic and aqueous extracts of wheat samples. TAC = Total antioxidant capacity. TE = Trolox equivalents.

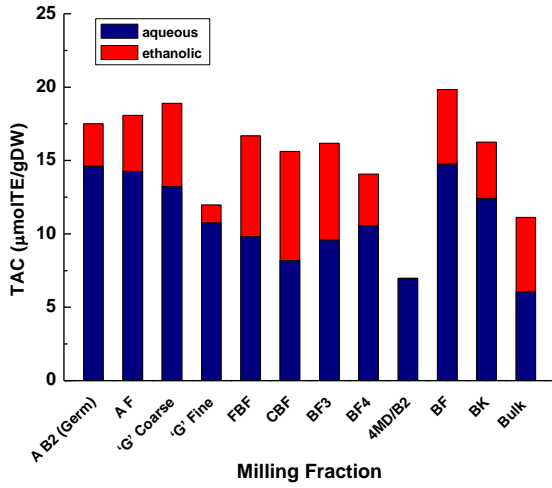


Figure 7. TAC of hydrolysed/fermented wheat bran. TAC = Total antioxidant capacity. TE = Trolox equivalents

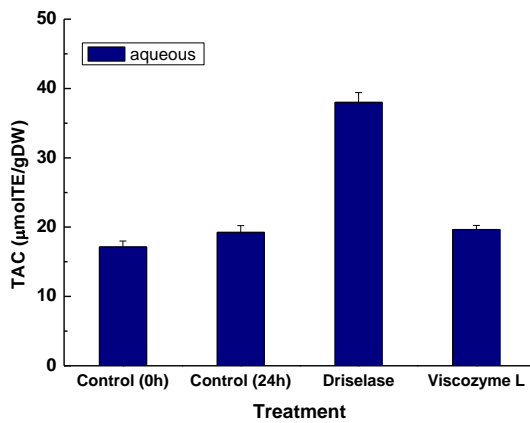


Figure 8. Bioconversion with *Pseudomonas fluorescens* BF13-1p of (A) food-grade ferulic acid in buffer (pH 7) and (B) ferulic acid recovered from wheat bran after removal of reducing sugars and its re-suspension in buffer. \times : Ferulic acid; \blacktriangle : Vanillin; \blacksquare : Vanillic acid.

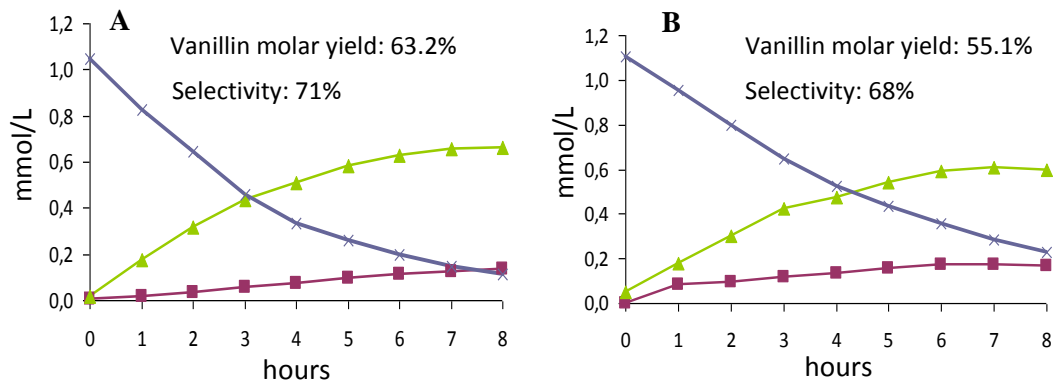


Figure 9. Protocol for the integrated processing of citrus pomace. MW: Microwave drying, DIC: Instantaneous Controlled Pressure Drop, SE: Solvent Extraction, USE: Ultrasound Assisted Solvent Extraction, CO₂: Supercritical CO₂ extraction.

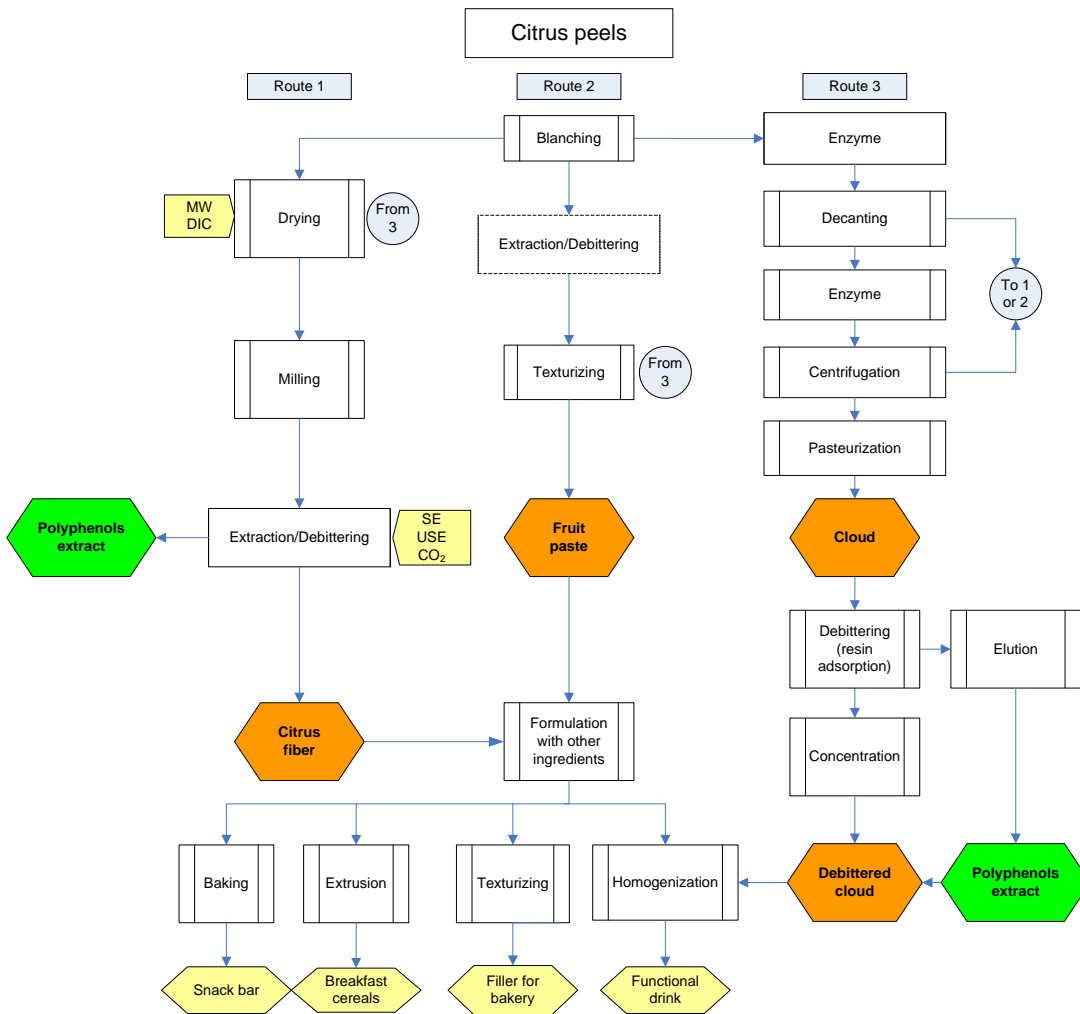


Figure 10. Colour of the non-debittered and debittered orange fibre obtained (right) compared with the commercial reference fibre (left); commercial is the whiter.



Figure 11. Visual comparison of the NAMASTE cloud obtained from the acid water (right) with commercial orange cloud (centre) and the commercial cloud analogue lipid emulsion (left)



Table 2. Summary of the technological advantages and sensory screening for citrus fibres

Citrus fibre addition	Intended technology application	Advantages	Sensory screening
frozen potato croquette	Less fat absorption, fibre enrichment	More stable dough, (easier to handle, less sticky, less loss during production)	Acceptable
frozen potato dumpling	Less fat absorption, fibre enrichment	More stable and less sticky dough, more convenient to prepare at home	Acceptable
frozen filled potato dumpling	Fibre enrichment	More stable and less sticky dough, more convenient to prepare at home	Acceptable
cottage cheese dumpling	Fibre enrichment	More stable dough, more convenient to handle at home	Acceptable
meat roll	Meat replacer, moisture control, lower fat content / fibre enrichment	Replacement of 16-20% meat can be achieved	Acceptable
Doughnut	Fat, oil, moisture control, fibre enrichment	To avoid fat absorption during frying	Improvement needed
bread roll	moisture control, flour replacer, fibre enrichment	Replacement of 15-20% flour can be achieved	Acceptable
sweet roll filled with jam	Moisture management Thickening agent (filling), Flour replacer, fibre enrichment	Replacement of 15-20% flour can be achieved in the dough	Improvement needed
		Thicker filling can be achieved	Not Acceptable

Citrus fibre addition	Intended technology application	Advantages	Sensory screening
salad dressing	Thickening agent	Thicker dressing, even distribution of herbs, more even surface distribution	Not Acceptable
yoghurt based salad dressing	Thickening agent	Light yoghurt (1.5%) becomes thicker; improved distribution of herbs on vegetable surface	Not Acceptable
red fruit sauce (yoghurt sauce)	Thickening agent	Light yoghurt (1.5%) becomes thicker; improved surface distribution on fruits	Not Acceptable
batter mix	Egg replacer, fibre enrichment	Replacement of eggs	Acceptable

Figure 12. Citrus ingredients based beverages: samples elaborated with experimental clouds vs reference sample (left), samples of fibre enriched orange juice sent for consumer's testing (center) and polyphenol enriched nectar (right).



Figure 13. Example of the plot of the Principal Component Analysis of the results of the sensory evaluation of the juice samples enriched with the NAMASTE fibres (debittered and non-debittered) vs three commercial juices that claim content in pulp or whole orange.

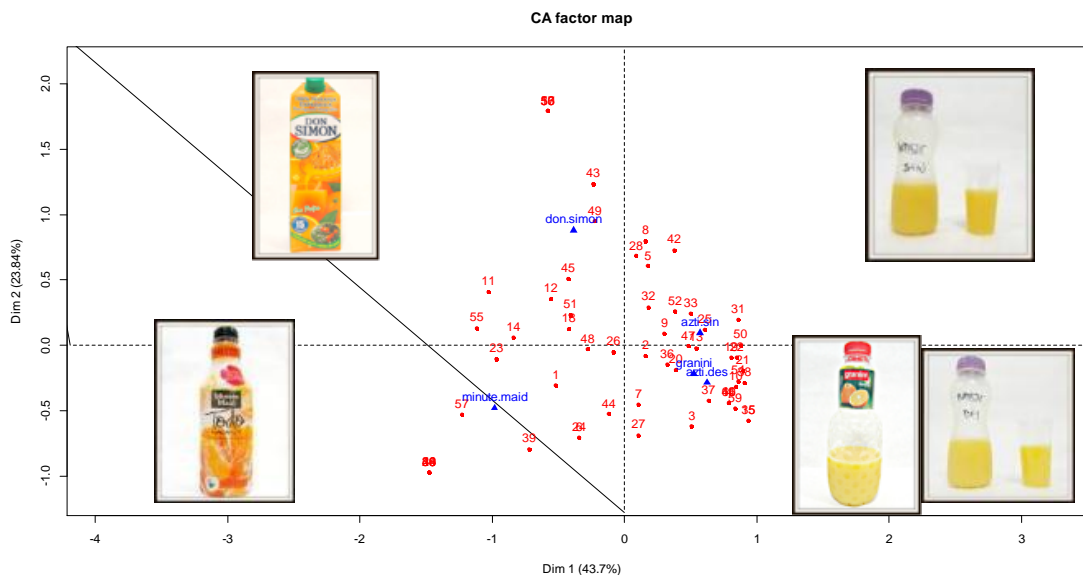


Figure 14. Food products produced by using wheat bran and citrus by-products.



Figure 15. Effect of HPH treatments on color and appearance of the HPH-citrus-based formulations.



Figure 16. Scavenging activity of doughs added with raw or pre-fermented bran (before (t0) and after (tf) sourdough fermentation. From left: 1=Sourdough; 2=no bran added; 3=Raw (untreated) bran; 4=bran pre-fermented with *L. casei*; 5=bran pre-fermented with *L. sakei*; 6=bran treated with Driselase® and pre-fermented with *L. casei*; 7= bran treated with Driselase® and pre-fermented with *L. sakei*; 8=ascorbic acid 1 mg/ml).

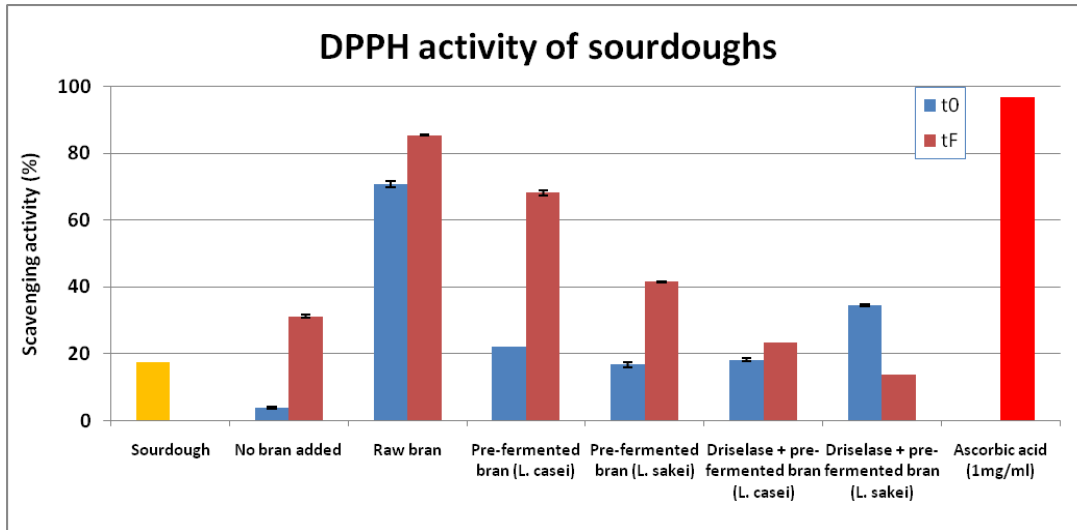


Figure 17. Fibre content increase (g/100 g) of the NAMASTE bread due to the enrichment with the different milling fractions and NAMASTE bran (white bars) and total fibre content of conventional bread and wholegrain bread (grey bars).

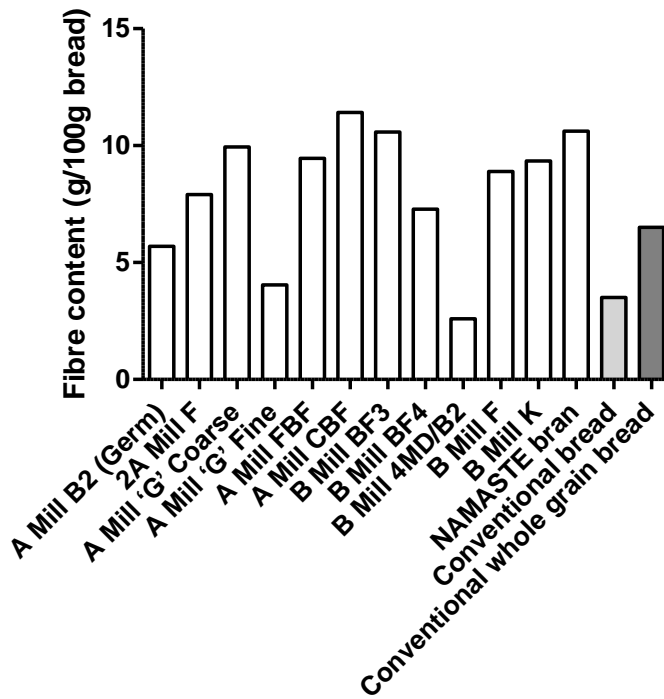


Figure 18. Theoretical TAC increase ($\mu\text{mol TE}/100\text{ g bread}$) of the NAMASTE bread due to the enrichment with the different milling fractions and NAMASTE bran. TE = trolox Equivalent.

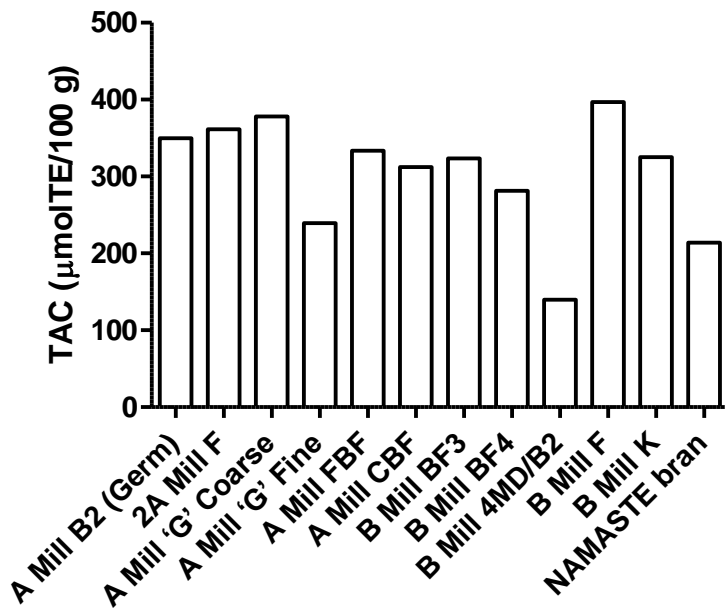


Figure 19. Visual differences observed in feeding trial in orange molly using citrus by-products fractions.

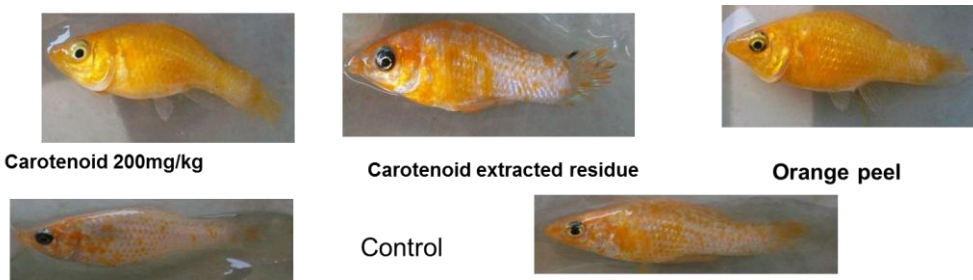


Table 3. Comparison of the different NAMASTE products for their selection for assessment in WP5.

Product (ingredients)/process	Note	Exploitability and Feasibility
Pre-fermented Bran	Interesting results were collected also on rice bran. It has antioxidant capacity and probiotic effects. The same enzymes were tested on rice and wheat with similar effects.	It is of sure industrial interest, but not within the consortium. Not enough quantities are obtained in the laboratory trials due to low yields.
High Pressure Homogenization (HPH) applied on citrus fibre	It is an innovative application of HPH. It is very interesting for citrus fibres and for fibres in general. The main applications of the products obtained from the application of HPH on Citrus could be in the preparation of snack filler or beverages (to be evaluated)	It is patentable if possible applications are described. GLP and JRS (limited to the powder) are interested for the exploitation. SELECTED for WP5
Citrus Fibre	A screening of possible applications is needed for debittered and non-debittered formulation	The patentability has to be evaluated in association with JRS. SELECTED for WP5
Cloudy Agent	To be evaluated also in association with the polyphenol crude extract	Not patentable but GLP is interested. SELECTED for WP5
Concentrated bran fibre	GLP is available to test the product	GLP is not interest in the product. IP member interest should be evaluated. Actual facilities are not food grade.
Oligosaccharide fraction	Same as above	Same as above
Natural Vanillin	The complete production process starting from bran is not available. RTD addressed to improve ferulic acid release from bran will be carried out at the laboratory scale in close cooperation with IFR	Difficult to evaluate; very probably, given the low rate of ferulic acid release and in turn of vanillin production achieved, the results can be of none industrial interest. They will be mostly published on international journals.