



## - Glucan

1. 2 8% - glucan  
(Prentice et al., 1980)  
1.0 2.5%  
Mixed linked - (1 3),(1 4)-D- glucan( (Newman et al., 1989, Lee and Lee, 1994)  
- glucan) - glucosyl unit (1 3)- 16% (Ullrich et al.,  
- (1 4)- 가 가 1986) 가 - glucan  
(homopolysaccha-  
ride) , , , 가 - glucan  
(Hockett et al., 1987, Xue et  
al., 1991, McIntosh et al., 1991, Ullrich et al., 1986)  
가 - glucan 가  
- glucan arabinoxylan - glucan (Xue et al., 1991,  
, glucomannans, cellulose, McIntosh et al., 1991).  
- Glucan - glucan  
(Bamforth, - glucan - glucan  
1985) 가 - glucan  
(Campbell and Bedford, 1992) ,  
(Andersson and Chen,  
1986, Klopfenstein, 1988, Newman et al.,  
1989, 1994) - glucan





- glucan 1N KOH  
 0.45 μm membrane filter  
 0.05 4.0% (w/w)  
 Cannon-Fenske (No. 200) crude - glucan 4.98%  
 25 ± 0.02 3.51% . 1  
 (specific viscosity,  $\eta_{sp}$ ) (intrinsic viscosity, [  $\eta$  ]) crude - glucan ammonium sulfate  
 aceton 2 - glucan  
 3. 4.46% 2.59% .  
 1 crude - glucan - glucan  
 3.1 - Glucan 가 59.15%, 가 62.91%

- glucan  
 가 5.3% 가 6.5% Forrest Wainwright (1977)  
 - glucan crude - glucan arabinoxylan  
 - glucan Table 1  
 가 5.54% 3.34% . 1 crude - glucan arabin-  
 - glucan % oxylan 30% ammonium sulfate

Table 1. Extraction yield and composition of -glucan isolated from nonwaxy and waxy barley

		Crude - Glucan		Purified - Glucan	
		Nonwaxy	Waxy	Nonwaxy	Waxy
Extraction yield (%)		3.34	5.54	2.29	4.46
Composition (% w/w)	β- Glucan	59.15	62.91	99.60	99.70
	Protein	9.98	5.74	0.46	0.48
	Moisture	11.57	10.43	0.1	0.1
Component sugar (mole%)	Ara			0.21	0.41
	Xyl			1.98	0.55
	Man			0.38	0.30
	Glc			97.43	98.64
	Gal			-	0.10
	Total			100.00	100.00

- glucan 가  
 85.2% , 63.0% 0.5%

99% 2 -glucan . 2  
 -glucan  
 arabinose, xylose, man- nose  
 97 99% glucose  
 -glucan  
 -glucan ,  
 .  
 3.2

Fig. 1, Table 2  
 . -glucan  $2.0 \times 10^5$   
 $9.3 \times 10^5$   
 -glucan  $5.4 \times 10^5$   $9.7 \times 10^5$   
 1.443 1.282 -glucan 가  
 . -glucan  
 $6.259 \times 10^5$   $7.986 \times 10^5$   
 -glucan ,  
 root-mean-square radius 86.2nm,  
 89.8nm -glucan

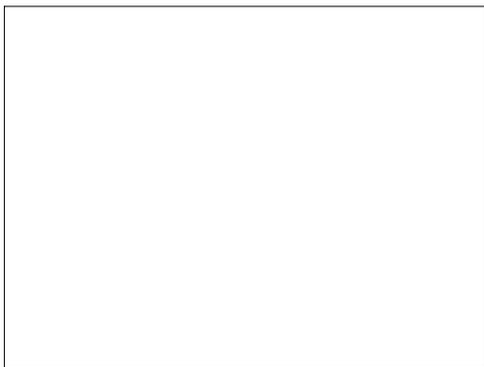


Fig. 1. Molecular weight distribution of -glucan isolated from nonwaxy and waxy barley

Table 2. Molecular characteristics of -glucan isolated from nonwaxy and waxy barley

	Mw ( $\times 10^{-5}$ )	$\langle r^2 \rangle^{1/2}$	Polydispersity
Nonwaxy -glucan	6.259	86.1	1.443
Waxy -glucan	7.986	89.8	1.282

-glucan . Gomez  
 (1997) -glucan  
 HPSEC-MALLS-RI system  
 $2.0 \times 10^5$   $5.7 \times 10^5$   
 $10^5$  가 1.26 1.67  
 , root-mean-square radius  
 confor- mation  
 . Varum  
 (1992) -glucan  $2 \times 10^4$   $1.4 \times 10^5$ ,  
 가 1.2 1.7 ,  
 Woodward (1983) -glucan  
 $2.1 \times 10^5$   $2.9 \times 10^5$ , 가 1.1 1.4  
 . Saulnier (1994) crude -glucan  
 HPSEC- MALLS-RI system  
 -glucan -glucan 2

3.3

-Glucan  
 methylation  
 . -Glucan methylation 가  
 acetylation  
 methyl alditol acetate .  
 GC GC-MS , Fig. 2  
 chromatogram  
 -glucan 2 peak

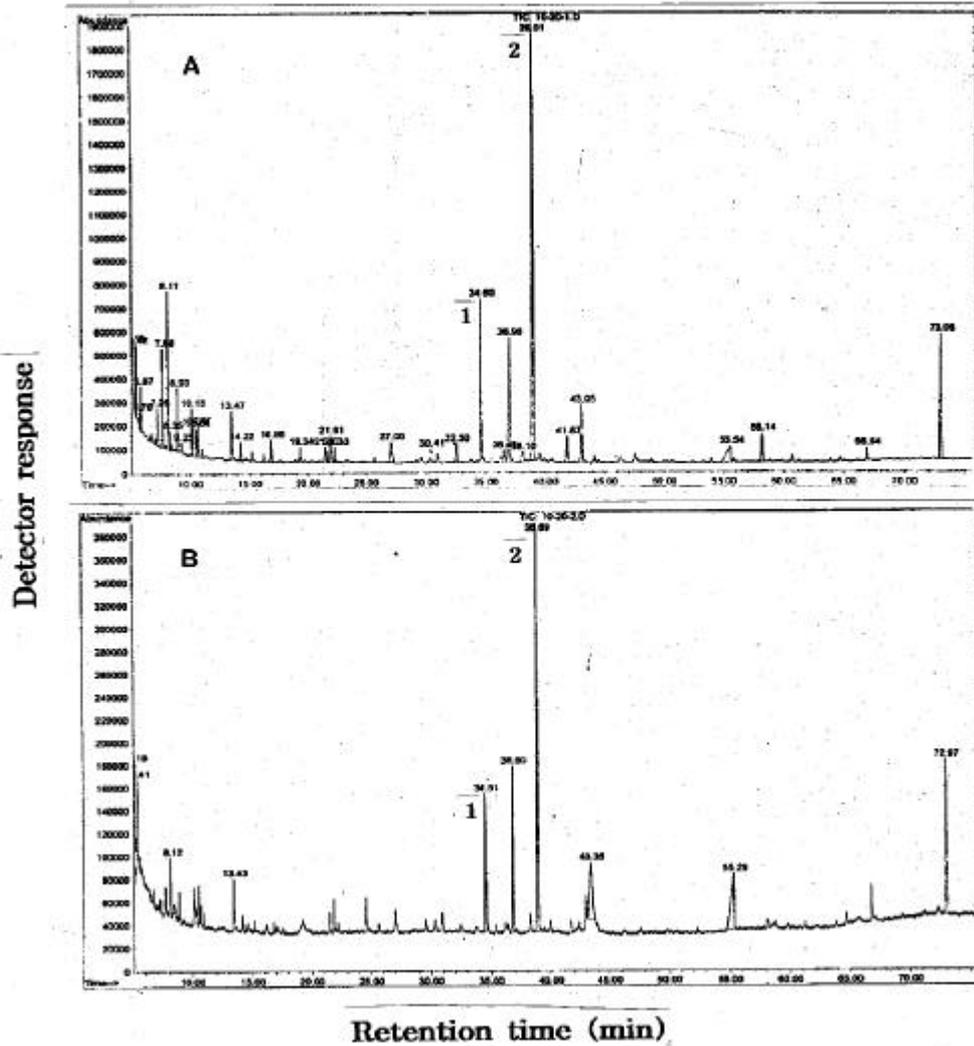


Fig. 2. GC chromatogram of permethylated  $\alpha$ -glucan isolated from nonwaxy (A) and waxy (B) barley

mass spectra (Fig. 3)

1,3,5-tri-O-acetyl-2,4,6-tri-O-methyl-D-glucitol - Glucan

1,4,5-tri-O-acetyl-2,3,6-tri-O-methyl-D-glucitol

-glucan - (1 $\rightarrow$ 3)-

- (1 $\rightarrow$ 4)-

terminal

1,5-di-O-

acetyl-2,3,4,6-tetra-O-methyl-D-glucitol - (1 $\rightarrow$ 4)-

Table 3

- (1 $\rightarrow$ 3)-

terminal -glucan

25.75%, 70.62%, 3.63%

-glucan 24.90%, 70.89%,

-, - (1 $\rightarrow$ 3)-

-glucan

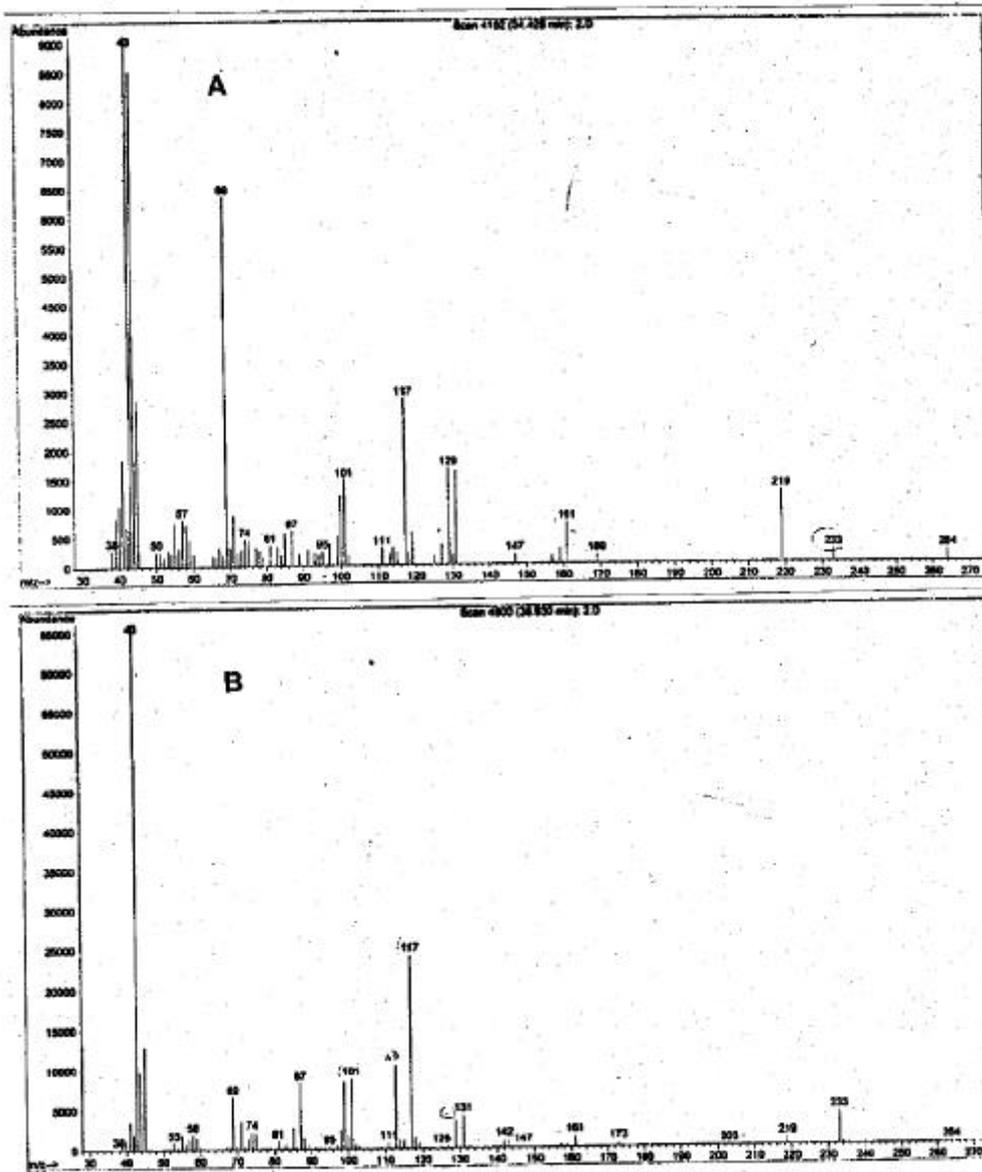


Fig. 3. Fragment ions on GC-MS of permethylated nonwaxy -glucan : A = 1,3,5-tri-O-acetyl-2,4,6-tri-O-methyl-D-glucitol, B = 1,4,5-tri-O-acetyl-2,3,6-tri-O-methyl-D-glucitol

1 : 2.74, -glucan 1 : 2.84 가 -glucan  
 -glucan methylation -(1 3)- -(1 4)- 가 1 : 2.6  
 가 . Bengtsson (1990) Dais Perlin (1982), Wood (1994),

Table. 3. Glycosyl linkage composition of nonwaxy and waxy -glucan

- Glucan	Glycosyl residue	Position of methyl group	Deduced glycosidic linkage	Mole %
Nonwaxy barley	Glucose	2,4,6	3)- Glcp - (1	25.75
		2,3,6	4)- Glcp - (1	70.62
		2,3,4,6	Glcp - (1	3.63
Waxy barley	Glucose	2,4,6	3)- Glcp - (1	24.90
		2,3,6	4)- Glcp - (1	70.89
		2,3,4,6	Glcp - (1	4.21

Woodward(1983)

3.4 NMR

- glucan 500MHz Spectrometer <sup>13</sup>C-NMR - glucan <sup>13</sup>C-

NMR spectra Fig. 4

signal - glucan (Dais and Perlin, 1982) signal

Table 4

- glucan 13 15 signal Dais Perlin(1982)가 . 6 (hexose) anomeric carbon 가 field

(Casu, 1985)

- glucan 103.35, 102.59

- glucan 103.60,

102.72 - anomeric glucose

signal . 103.35

103.60 signal 3-O-linked glucose

C- 1, 102.59 102.72 signal

4-O-linked glucose C- 1

, 103 signal single peak

, 102 signal double peak

3-O-linked glucose 4-O-

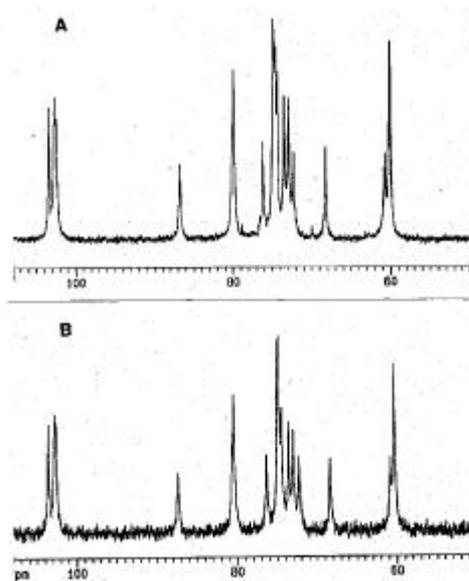


Fig. 4. <sup>13</sup>C-NMR spectra of nonwaxy(A) and waxy(B) -glucan

linked glucose 1 : (2 3) methylation

- glucan 86.75,

87.29 signal 3-O-linked

glucose C-3 79.85 80.30

signal 4-O-linked glucose C-4

79 80 single

peak 76 peak group(double)

Table 4. <sup>13</sup>C-chemical shifts of structural groups in nonwaxy and waxy -glucan

	Chemical shift	
	ppm	Carbon assignment
Nonwaxy barley - glucan	103.35	C- 1 of 3G
	102.59	C- 1 of 4G
	86.75	C-3 of 3G
	79.85	C-4 of 4G
	76.12	C-5 of 3G
	74.85, 74.74	C- 3 of 4G
	74.56, 74.30	C-5 of 4G
	74.42, 72.89	C-2 of 4G
	72.24	C-2 of 3G
	68.21	C-4 of 3G
	60.70	C-6 of 3G
60.11	C-6 of 4G	
Waxy barley - glucan	103.60	C- 1 of 3G
	102.72	C- 1 of 4G
	87.29	C-3 of 3G
	80.30	C-4 of 4G
	76.24	C-5 of 3G
	74.77	C-3 of 4G
	74.34	C-5 of 4G
	73.50, 72.91	C-2 of 4G
	72.16	C-2 of 3G
	68.27	C-4 of 3G
	60.77	C-6 of 3G
60.26	C-6 of 4G	

3G : 3-O- substituted glucose residue

4G : 4-O- substituted glucose residue

3-linked glucose    4-linked glucose    3-O-linked glucose    signal  
 가    1 : ( 2 3)    가    .    singlet    field  
 Table 4    4-O-linked glucose    3-O-linked  
 4-O-linked glucose    C-2, C-3, C-5    C-6    doublet    가  
 3-O-linked glucose    C-2, C-3, C-5    C-6    glucose laminarin  
<sup>13</sup>C-NMR signal    .    - (1 3)- ,

4-O-linked glucose 2 3 - (1 4)-  
 - glucan  
 NMR (Wood et al.,  
 1991, 1994, Lee, 1992, Dais and Perlin,  
 1982)

- glucan NMR

3.5

- Glucan - (1 3)-  
 oligosaccharide  
 - glucan lichenase  
 - glucan oligo-  
 saccharide ion chromatography

Fig. 5 Table 5 . Fig. 5

lichenase  
 oligosaccharide DP 3(celotriose) DP  
 4(celotetraose) peak DP 1, 2, 5, 6  
 peak , DP 7 peak  
 . DP 3 DP 47† 89 91%

lichenase

, DP 1 DP 27† 3 4%, DP  
 5 DP 6 5 6%  
 - glucan DP 3 DP 47† 63.08%  
 27.55% , - glucan 62.00%,  
 27.44% 2.29 2.26

Wood (1994)

2.11 . Wood (1994)

, , - glucan liche-  
 nase oligosaccharide

oligosaccharide oligo-  
 saccharide DP 3 DP 47† 91 92%,  
 DP 5 DP 6 2 4%, DP 7 DP 8 1%

DP 9

. 3%

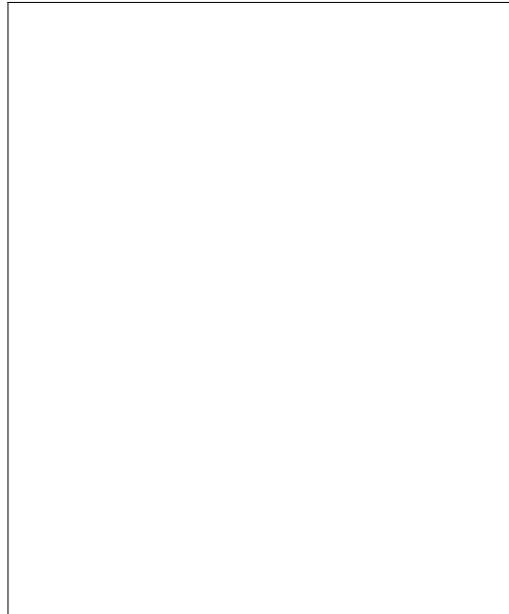


Fig. 5. Ion chromatogram of hydrolysates of nonwaxy - glucan treated with lichenase

Table 5. DP distribution of hydrolysates of nonwaxy and waxy - glucan treated with lichenase

DP	Nonwaxy - glucan (%)	Waxy - glucan (%)
1	1.11	1.12
2	3.21	3.44
3	63.28	62.00
4	27.55	27.44
5	3.44	3.87
6	1.61	2.17
100.00		100.00
DP (3+4)	90.63	89.40
DP 3/DP 4	2.29	2.26

oligosaccharide

DP 3

( 40%)

DP 7 15

- glucan DP 5, 6

6.04%

- glucan DP 5, 6 5.05%  
 Cameo Wa- xiro  
 - glucan Saulnier  
 (1994)  
 Waxiro DP 3 Cameo  
 DP 5 9  
 가 - glucan

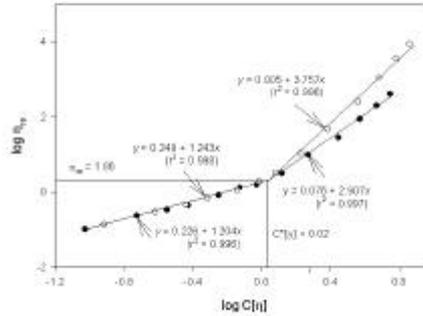


Fig. 6.  $\log \eta_{sp}/C$  vs  $\log C$  for waxy(-) glucan solutions

Buliga Brant(1986) DP 5  
 oligosaccharide가  
 - glucan (chain  
 extension)

- glucan C\* [ g/dL ]  
 sp가 0.02 1.86 가  
 [ ] C\* [ ]  
 (C\*) - glucan

3.6  
 (reduced vis-  
 cosity,  $\eta_{sp}/C$ )

1.15%,  
 - glucan  
 C [ ] < C\* [ ]  
 - glucan 1.204 1.243

0  
 - glucan 2.38dL/g - glucan  
 1.74dL/g 가  
 (1993) 2.59dL/g, 1.60dL/g  
 가

C [ ] > C\* [ ]  
 가 2.907 3.757 critical coil overlap  
 parameter 가 가  
 - glucan 가가  
 - glucan 가

가  
 (entanglement)  
 가 가 가  
 (reduced concentration,  
 C [ ])  
 Fig. 6

. C [ ] < C\* [ ]  
 가  
 (hydrodynamic volume)  
 1.0 1.4  
 C [ ] > C\* [ ]

critical coil overlap  
 parameter(C\* [ g/dL ])  
 (critical concentration, C\*)

(Launay  
 et al., 1986).  
 - glucan



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