
(MWL)
(DFRC)

*

(// : // :)

(MWL) (DFRC) " - "

DFRC (GPC) GC-MASS FT-¹³CNMR

(Populus nigra)

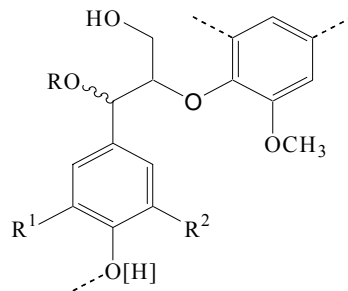
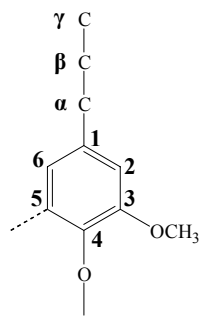
β-O-4) γ (

.DFRC (MWL) :

(Lai et al., 1971)

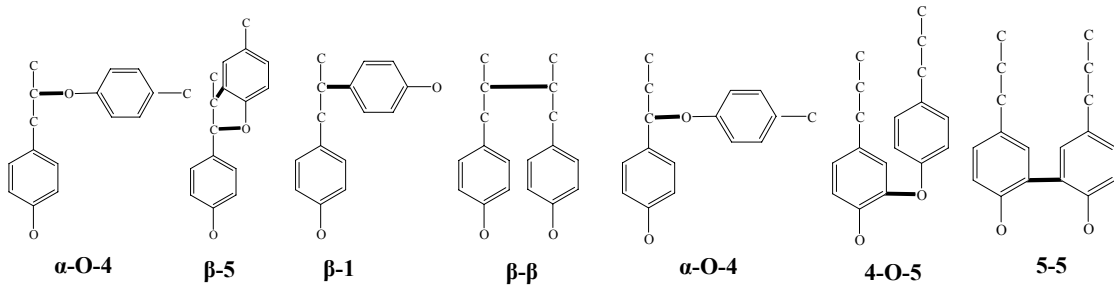
() β β β -5 β -O-4 (C
) (OCH₃)
 (Bagby et al., 1973) () .(

p
 .()

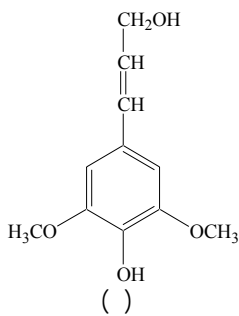


R= H or Aryl

() ()
 (:

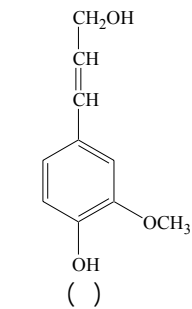


(Adler, 1977)



()

(

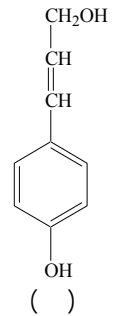


()

p (:

()

(



()

- α

- β

Ikeda et)

(al., 2002

(Adler & Hemestam, 1955 Sederoff et al., 1991)

()

Holtman et Gellerstedt & Northey, 1989)

(Chang et al., 1975 al., 2004

(Bjorkman, 1954)

(Chang et al., 1975)

MWL

Fujimoto et al.,)

(Ikeda et al., 2002 2005

³ Cellulytic

¹ Bjorkman

² Milled Wood Lignin (MWL)

... (MWL)

/ (Brauns & Brauns, 1960)

(Lu & Ralph, 1997) (DFRC)

(MWL)

()

/

(MWL)

()

Lawther et al.,) ()

.(1996

(: ml/g)

(Bjorkman, 1954)

T204 om-)

(97

HCl () ()

³ Lawther
⁴ Ball-Mill

¹ *Populus nigra*
² Bjorkman

MWL

%

(MgSO₄) /

/ /

%

()

-

(GPC⁴)

(Lu & Ralph, 1996)

/

: /)

(AcBr) /

(AcBr) .

AcBr

:

(

/

::

GPC

NH₄Cl

CH₂Cl₂

pH .

% HCl

A^o

⁴ Gel Permeation Chromatography

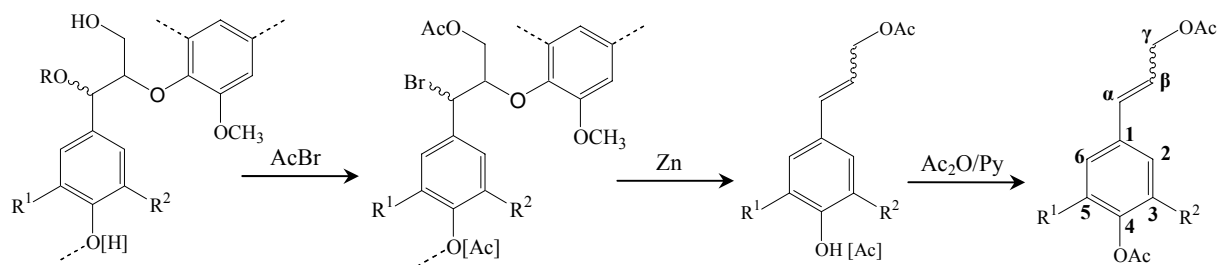
⁵ Shimadzo

⁶ Refractive Index Detector (RID)

¹ Derivatization Followed by Reductive Cleavage (DFRC)

² Fachung Lu

³ Ralph



DFRC

(GC-MASS¹)

(¹³C NMR⁵)

DFRC

(¹³C NMR)

(Rio et al., 2001)

MWL

DFRC

/ DFRC

(Capanema et al., 2005)

BRUKER 400MHz

/

(CDCl₃)

MWL

(GC-MASS)

DFRC

()

DFRC

(\overline{M}_w)

⁵ Carbon Nuclear Magnetic Resonance

¹ Gas Chromatography-Mass Spectrometry

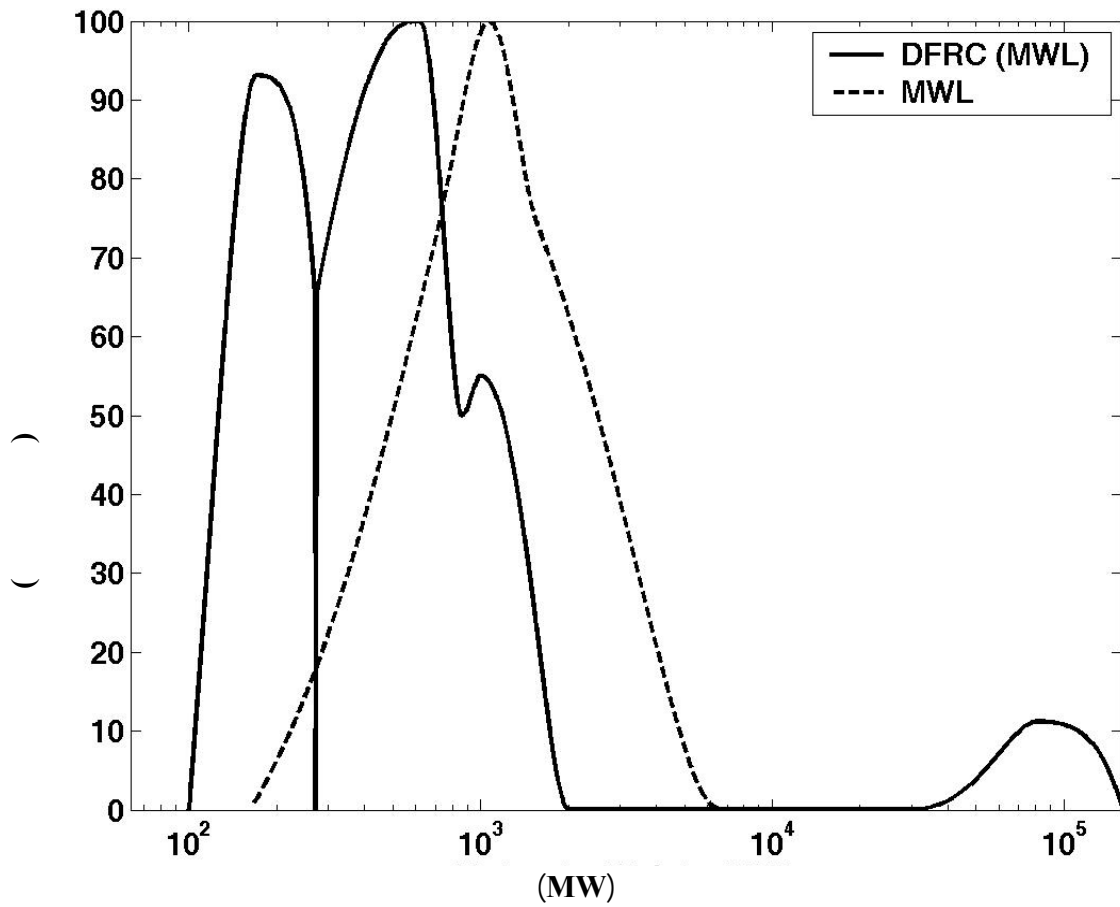
² NIST

³ Wiley

⁴ VARIAN-QUADRAPOL 1200

(D)

(\bar{M}_n)



DFRC

MWL

DFRC

MWL

GPC

()

($D = \bar{M}_w / \bar{M}_n$)

(\bar{M}_n)

(\bar{M}_w)

/

/

/

/

/

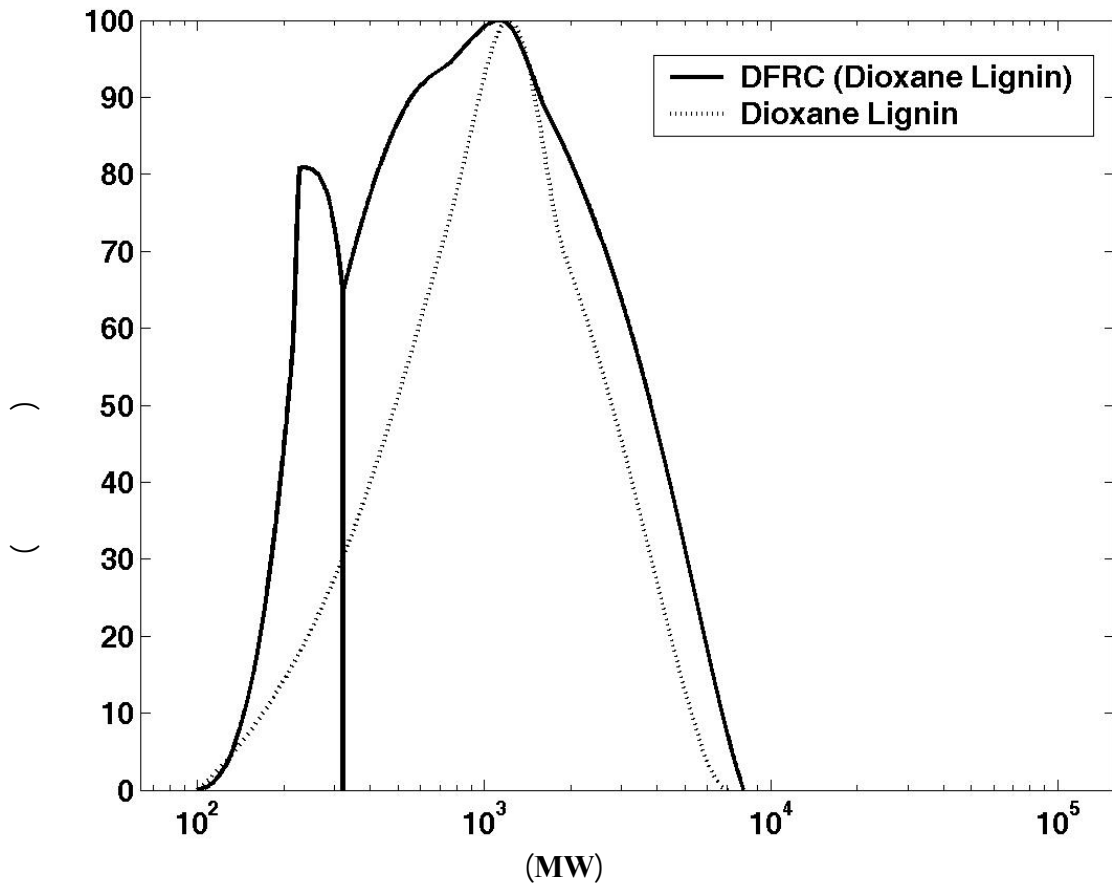
/

(DFRC)

... (MWL)

DFRC

DFRC



DFRC

DFRC		GPC	
()	($D = \bar{M}_w / \bar{M}_n$)	(\bar{M}_n)	(\bar{M}_w)
/	/		
/	/		
/	/		

(DFRC)

GPC

(¹³C NMR)

MWL

DFRC

¹³C NMR

DFRC

MWL

: (ppm)

β α

/ - /

- /

/ / - /

γ α

/ /

(GC-Mass)

(γ) CH₂ / - /

(α) CH / - /

GC-Mass

(β) CH /

/ - /

/ - /

α

¹ Part per million

^{*} DFRC

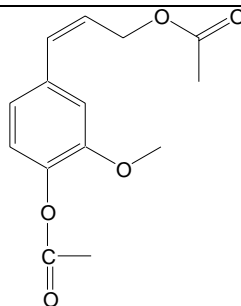
MWL

()

()

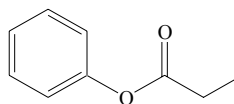
MWL

/ +



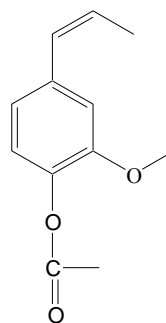
A

/ +



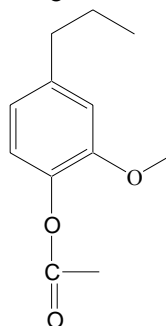
B

/ +



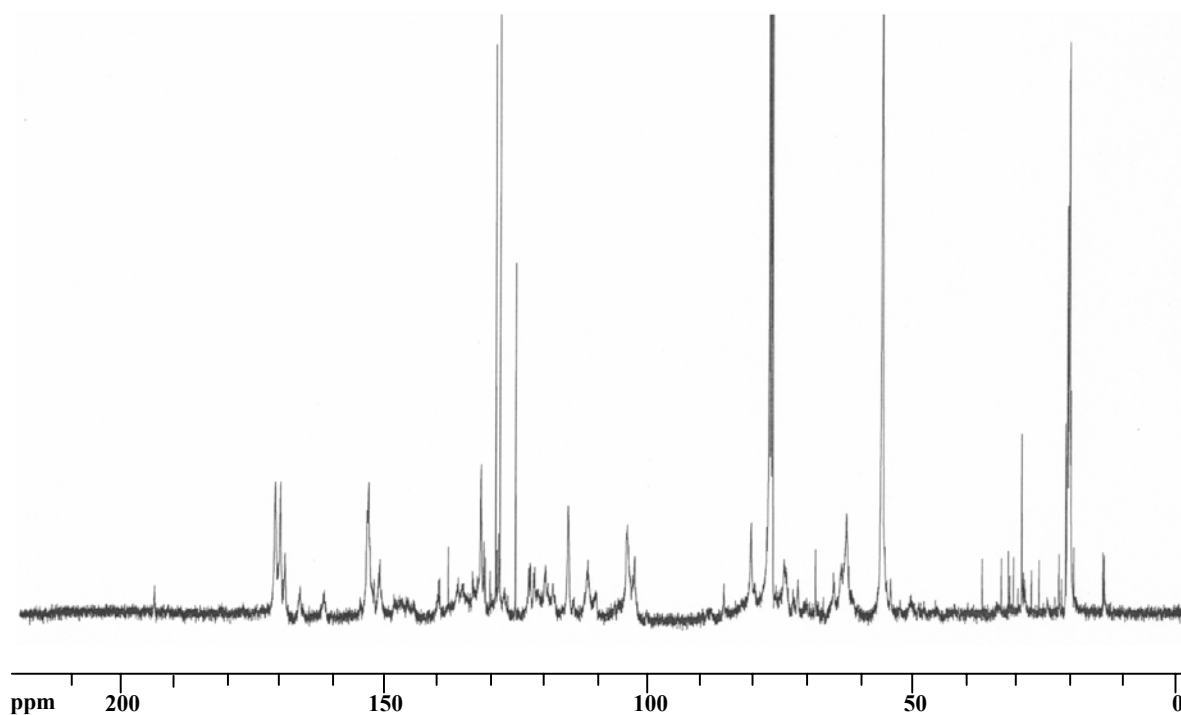
D

/ +

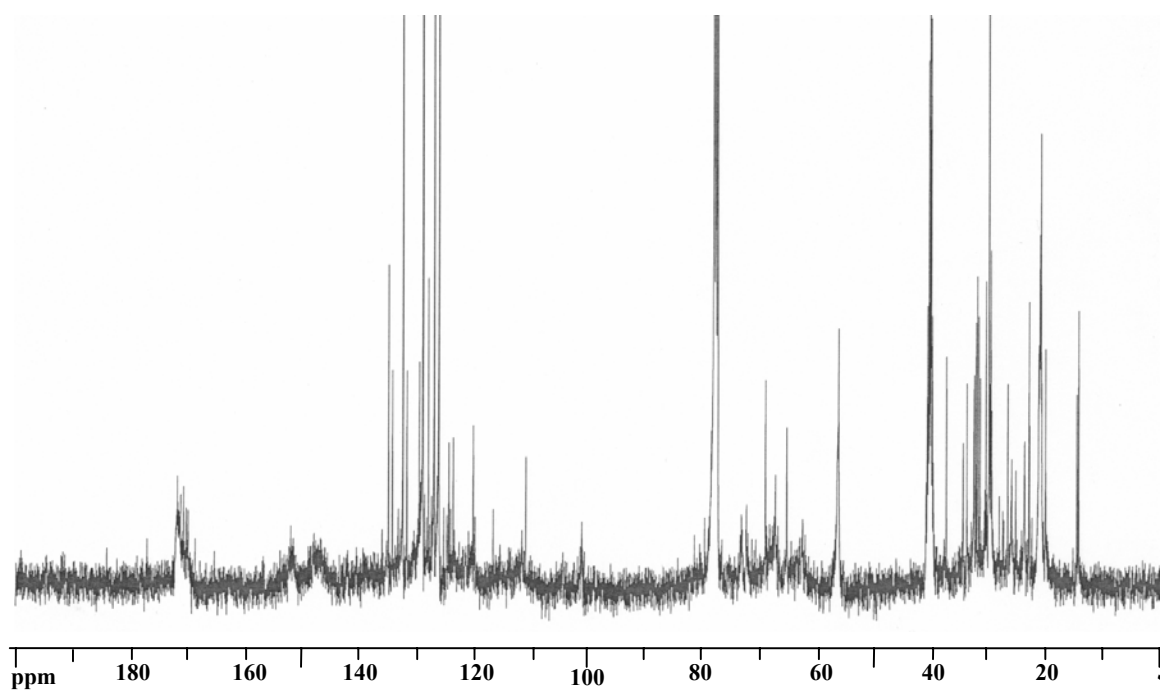


E

... (MWL)



()



()

DFRC (.DFRC (: MWL. ¹³C NMR

DFRC		MWL	13 C NMR	
)	(()	
(ppm) DFRC	((ppm) DFRC		
/	/	/	/	α
/	/	/	/	β
/	/	/	/	γ
/	/	/	/	γ CH ₂
/	/	/	/	α CH
/	/	/	/	β CH
/	/	/	/	β α
/	/	/	/	()
/	/	/	/	α
/	/	/	/	γ

¹³C NMR

DFRC

DFRC

¹³C NMR

:(ppm)

DFRC

¹³C NMR

(γ)

/ /

β

/ /

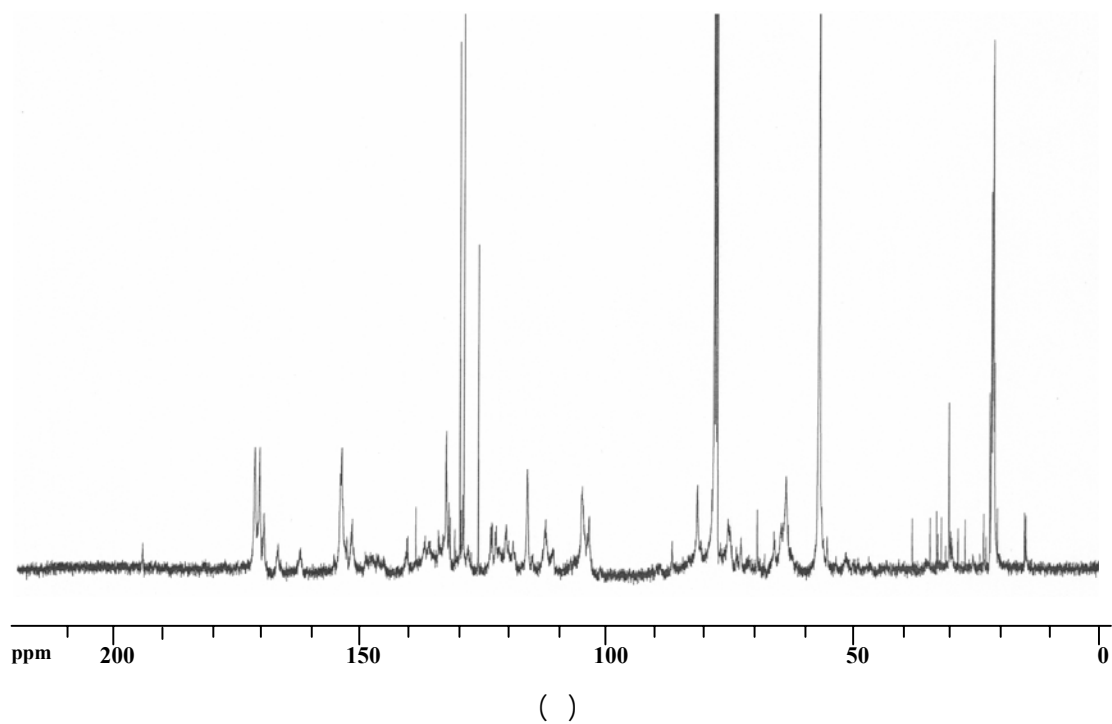
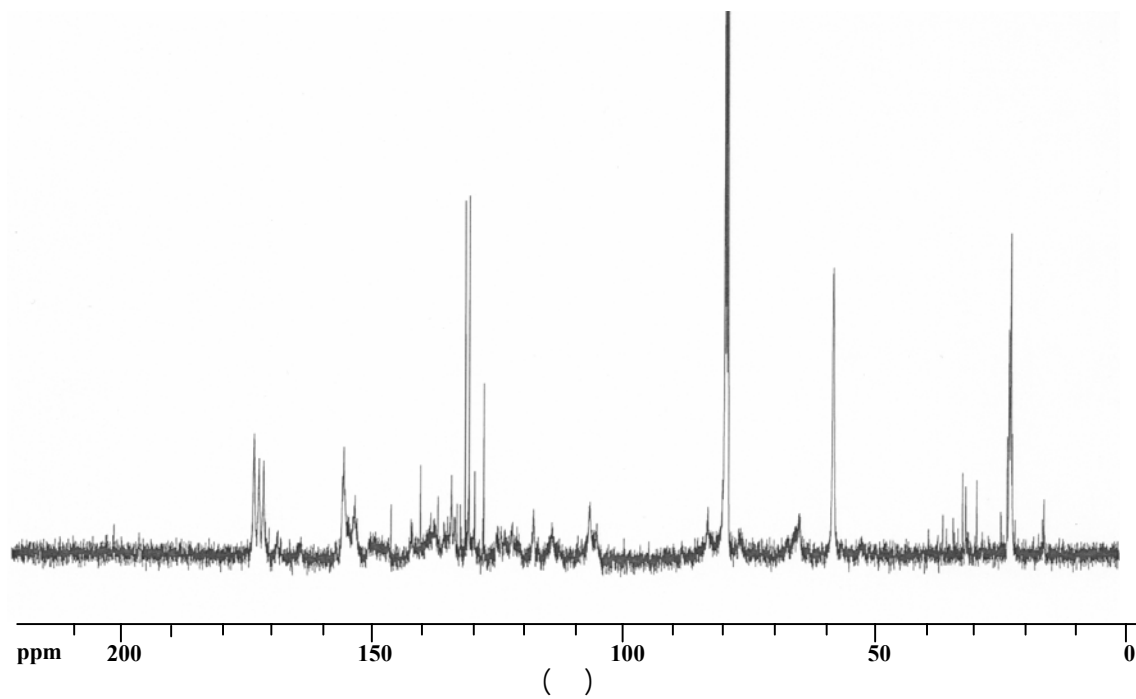
/ /

/ -

() β α

/ / /

... (MWL)



DFRC (.DFRC (: ^{13}C NMR

DFRC		¹³ C NMR	
(ppm) DFRC	()	(ppm) DFRC	()
/	/		β (γ)
		/ - /	α
			β
/	/	/ - /	
		/ - /	γ α
/	/	/	
	/	/	γ CH ₂
	/	/	α CH
	/	/	β CH
/			β α
/	/		()
		/	
		/	γ
		/	α

:(GC-Mass) (GPC)

:

:

MWL

β-O-4

MWL

MWL

() B A β-O-4 MWL

DFRC

E D DFRC

()

β-O-4

... (MWL)

(Casey, 1981 Adler, 1977 Lai et al., 1971)

D

DFRC

γ

γ- γ- CHO

β-O-4

DFRC

CH₂OH

Lu &)

(Ralph, 1997

(MWL)

β-O-4

:(¹³C NMR)

β α

DFRC

MWL

γ

β-O-4

¹³C NMR

γ

)

NMR

(

DFRC

β-O-4

β α

γ

DFRC

(-CH₂OH-→ CH₃)

¹³C NMR

DFRC

¹ Fachung Lu

² Ralph

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Structural Study of Milled Wood and Dioxane Lignin of *Populus nigra* using DFRC Method

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(Received: 30 October 2010, Accepted: 24 October 2011)

Abstract

In this study, Derivatization Followed by Reductive Cleavage (DFRC) method is used to investigate the structures of milled wood and dioxane lignin of *Populus nigra*. After carrying out DFRC reactions, the structures of constituents resulted from these two kinds of lignin were investigated by using several spectral methods such as NMR, GC-MASS and GPC. The results obtained from chromatography and spectroscopy studies of these methods have been compared. These comparative results show that the dominant structural components of these two kinds of lignin are obtained from cleavage of β -O-4 bonds. The main components obtained from dioxane lignin and milled wood lignin are 4-hydroxy-3,5-dimethoxy-1-phenyl propene and 4-hydroxy-3,5-dimethoxy-1-phenyl- γ -hydroxy propene (syringyl structures), respectively. Also, there are some guaiacyl structures in these components.

Keywords: *Populus nigra*, Milled Wood Lignin (MWL), Dioxane Lignin, Derivatization Followed by Reductive Cleavage Method (DFRC).