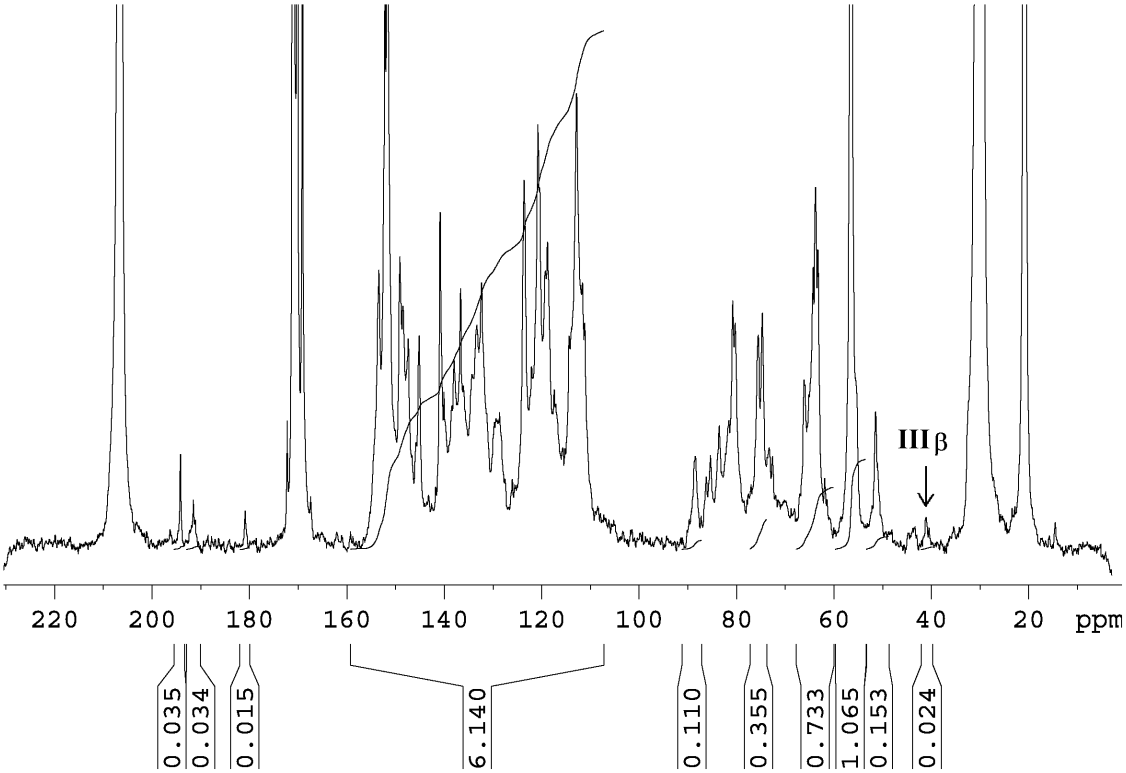
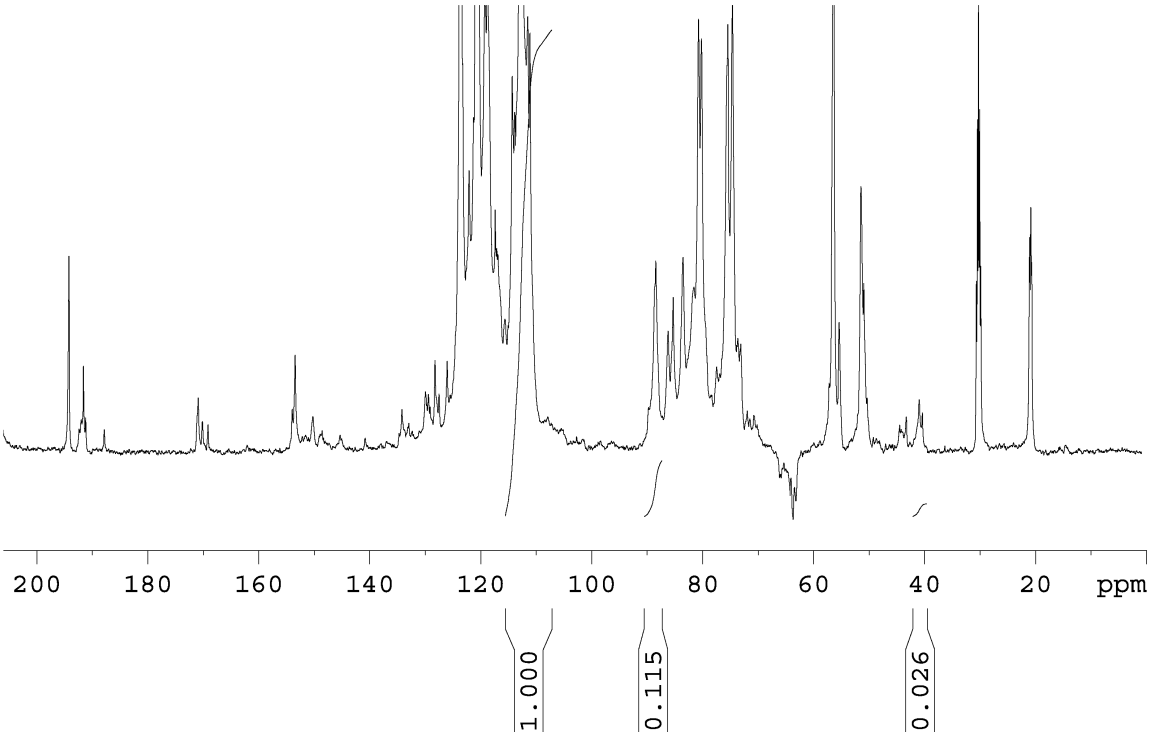
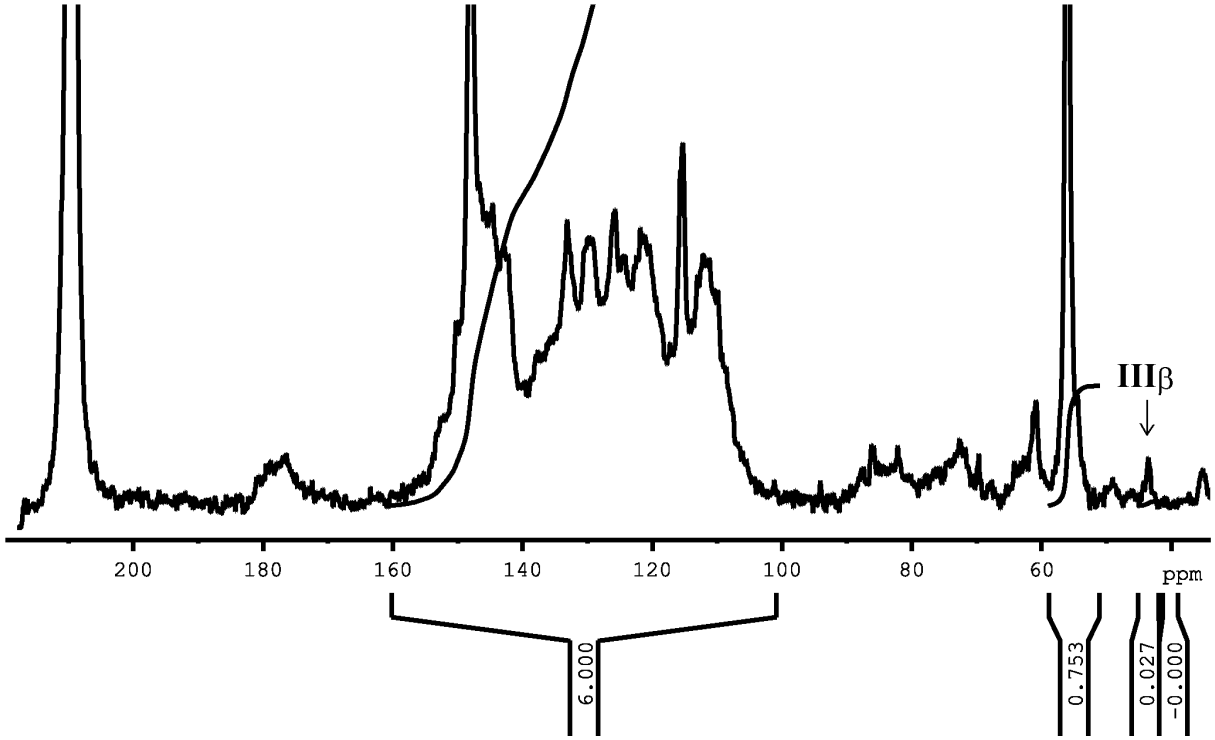


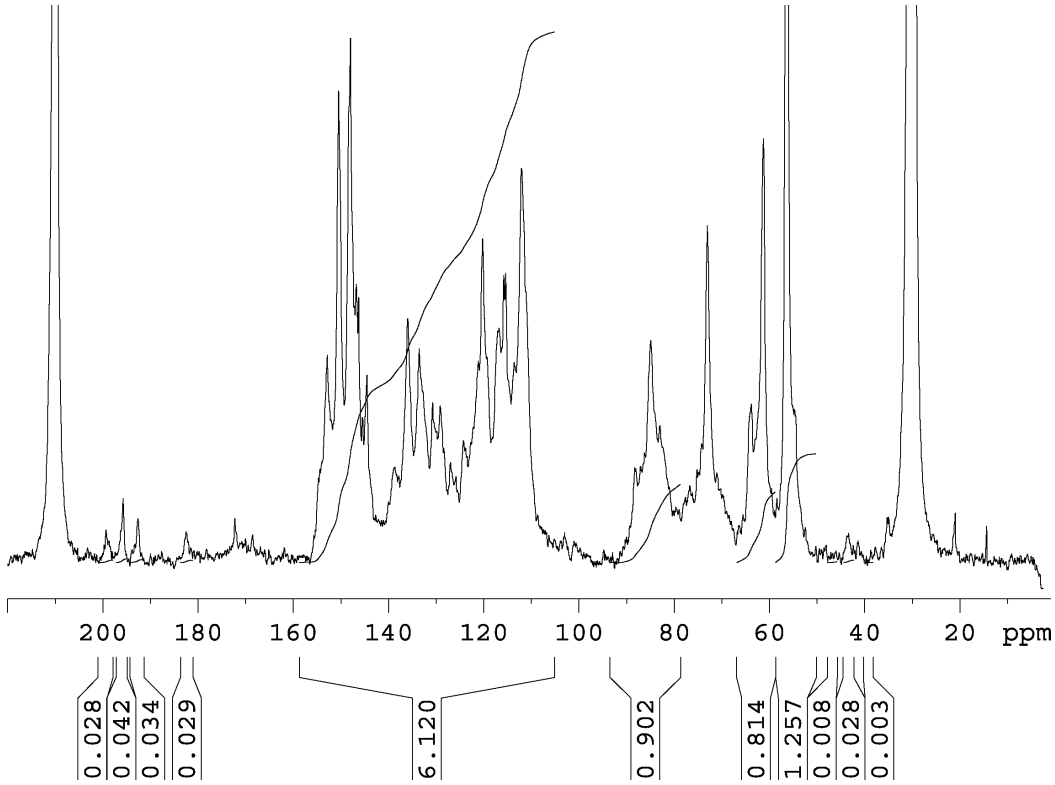
Quantitative ^{13}C spectrum of the acetylated spruce MWL. The signal for the Cβ (41.0 ppm) of the secoisolariciresinol structure in the lignin polymer could be observed and quantitatively estimated.



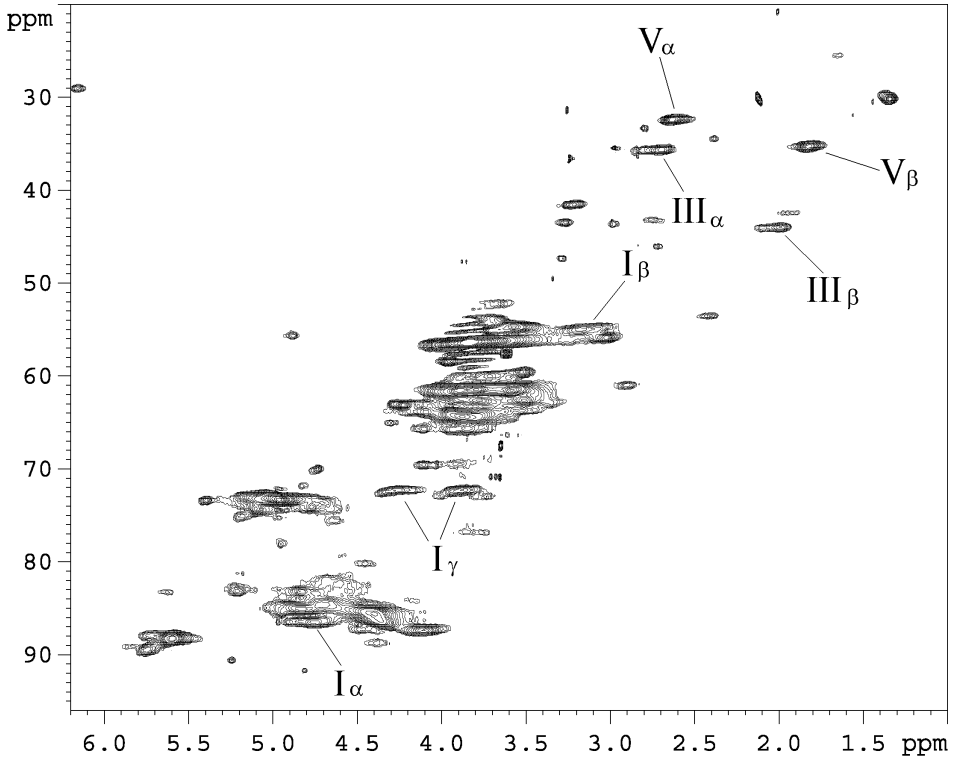
DEPT90 NMR spectrum of the acetylated spruce MWL. The signal for the Cβ (41.0 ppm) of the secoisolariciresinol structure is unambiguously observed.



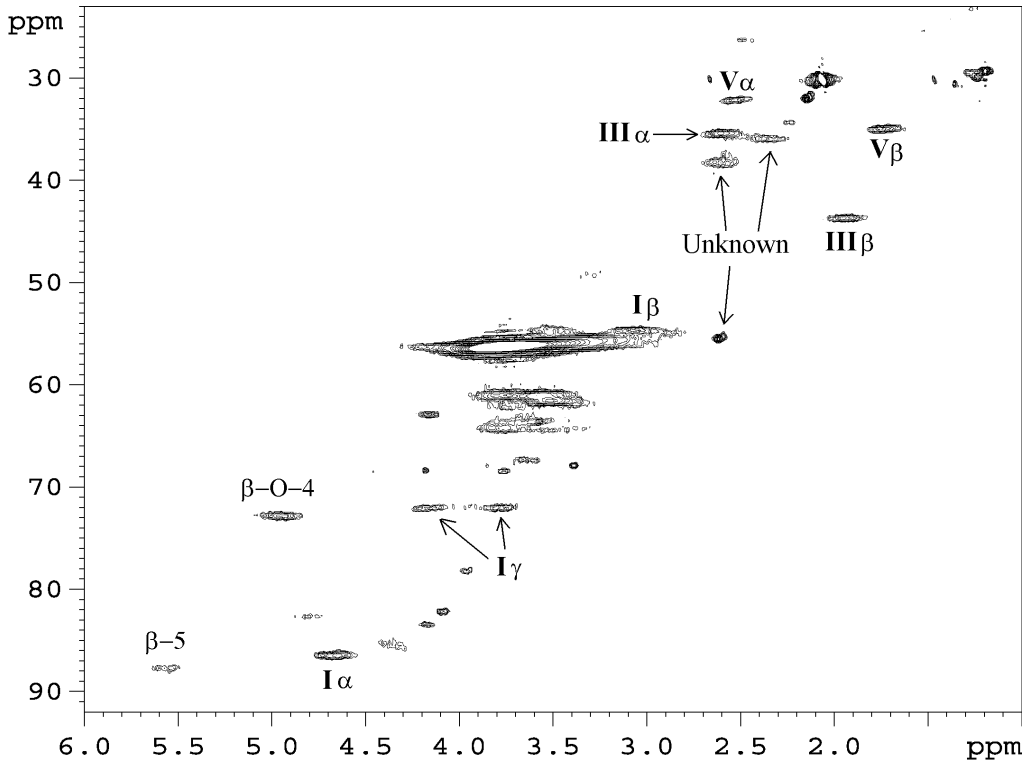
Quantitative ^{13}C spectrum of the purified softwood kraft lignin, the signal for the Cβ of the secoisolariciresinol appear at 43.9 ppm in the lignin sample (without acetylation).



Quantitative ^{13}C NMR spectrum of spruce enzyme MWL (without acetylation). The signal for the Cβ of the secoisolariciresinol appear at 43.9 ppm.



HSQC spectrum of spruce MWL (without acetylation). Signals for the secoisolariciresinol structure (**III**) and those for the dihydroconiferyl alcohol (**V**) can be observed. Notice that the acetylated and the non-acetylated samples give signals at different positions. In the region within 1.8 to 2.8 ppm in the proton dimension, some unknown signals are also present in addition to the signals for structure **III** and **V**, indicating that only according to the 1D proton NMR spectrum, it would be impossible to unambiguously assign the presence of the secoisolariciresinol structure in lignin.



HSQC spectrum of the softwood kraft lignin (without acetylation). Signals for the secoisolariciresinol (**III**) are almost as strong as those for the pinoresinol structure (**I**) and are stronger than those for the β-5 structure.