Analysis of pyrolysis oil derived from biomass using FT-IR and GC-MS

Biomass

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Advantage

- Not strict limitations to the size and type of raw biomass used
- Variable use of the resultant product
- Less pollution problem (ex. CO2 emission problem)

Application

- Direct combustion
- Gasfication
- Liquefacton
- Pyrolysis

Pyrolysis

- Conventional pyrolysis
- fast pyrolysis
- flash pyrolysis

Bio-oil

- water soluble phase
  Low molecular compounds (low molecular acids)
- water insoluble phase (Tar)
  High molecular compounds (aromatics)
  피치, 광택제, 시멘트, 방부제, 살균・소독제, 의약품

- main composition

catechol, phenol, guaiacol, cresol, creosol, methyl-cresol. phlorol, toluene, xylene, naphtalene 등

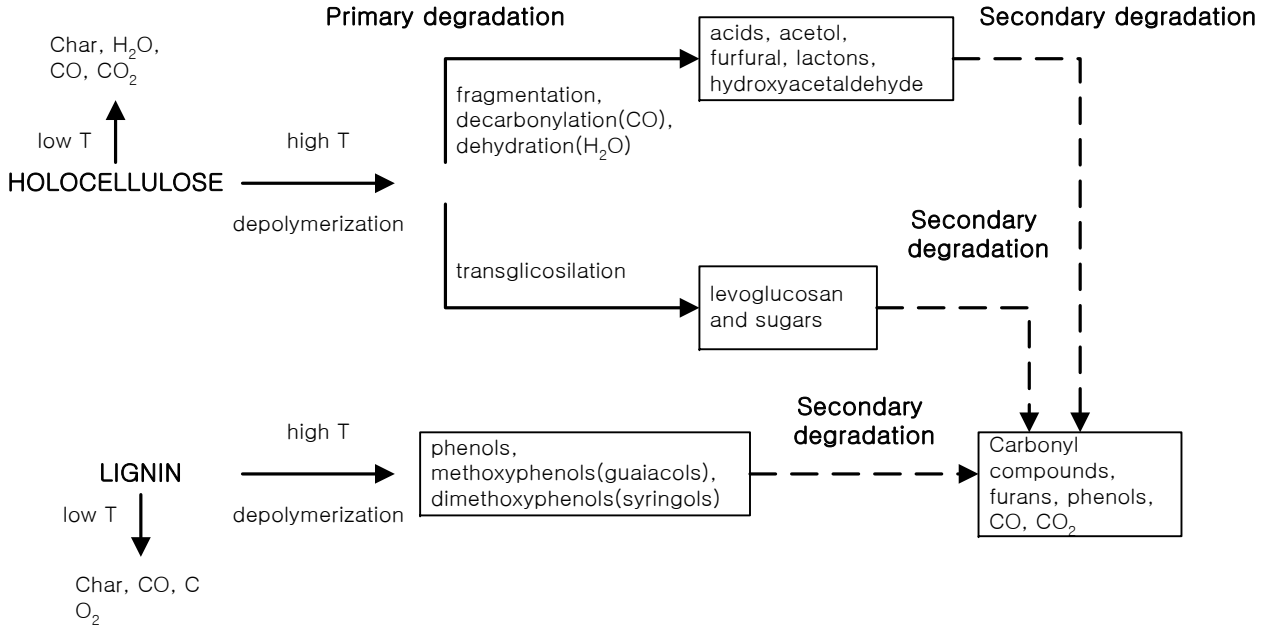

Table 1. A lumped Reaction Mechanism of Wood Decomposition (Branca et al., 2003)

Analysis

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❑ FT-IR & GC-MS analysis (1)

- FT-IR
  Hartman and Braun사의 Bomem-100

- GC-MS method (Sipila et al. 1998)
  1) whole oil
  Methanol을 solvent로 하여 희석시킨 후, 분석
  HP사의 5973-MS
  HP-5MS capillary column (30m×0.25 ㎜ i.d. ; film thickness 0.25 ㎛)

Analysis

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❑ FT-IR & GC-MS analysis (2)

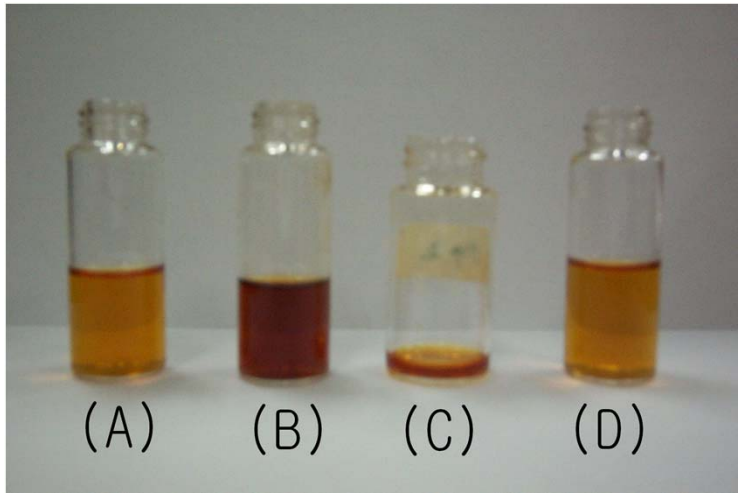
2) fraction

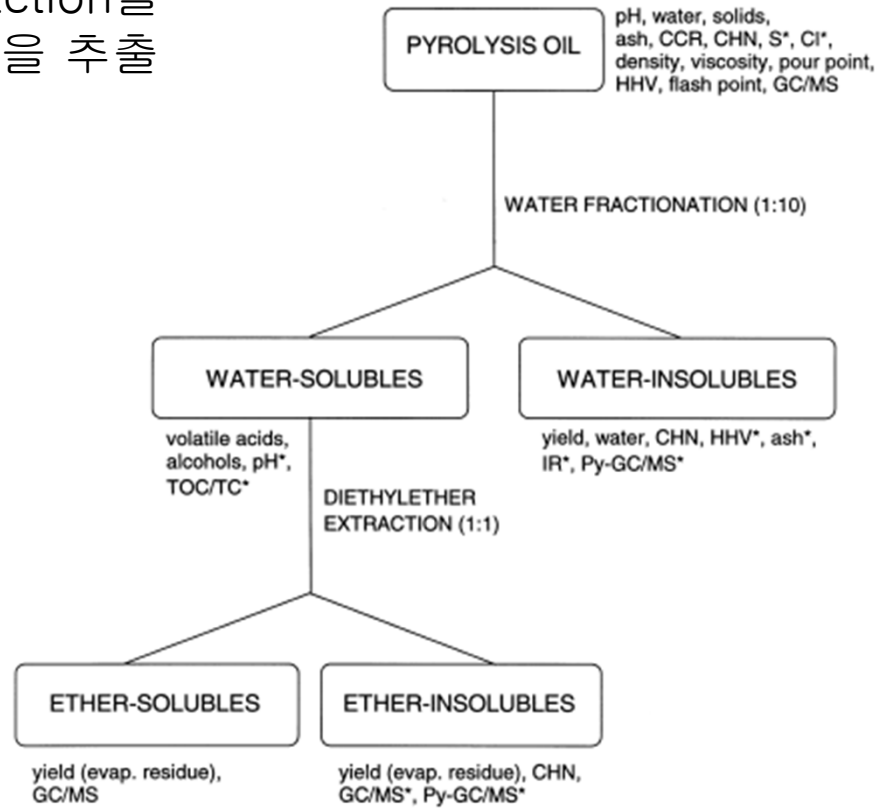
water soluble과 water insoluble로 fraction을 나눈 후, diethylether로 ether soluble을 추출

❑ sample

(A) water soluble (B) water insoluble

(C) ether soluble (D) ether insoluble





Fractionation scheme with basic and additional analyses for pyrolysis oils

Result & Discussion

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❑ FT-IR analysis

Groups	Wave number[cm-1]	Class of composition
O-H	3200~3400	Phenols, alcohols
C-H	3000~2800	Alkanes
C=O	1750~1680	Ketones, quinines, aldehyde groups
C=C	1645~1500	Alkenes
C-H	1450~1350	Alkanes
O-H	900~690	Aromatic groups

Result & Discussion

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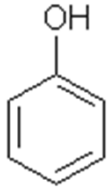
❑ GC-MS analysis

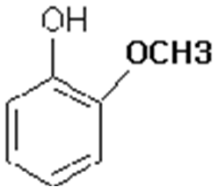
Peak identification & Classification : 분자구조 형태에 따라 분류

▪Furans

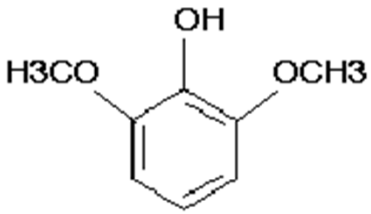
▪Phenols



▪Guaiacols (methoxyphenols)



▪Syringols (dimethoxyphenols)



Result & Discussion

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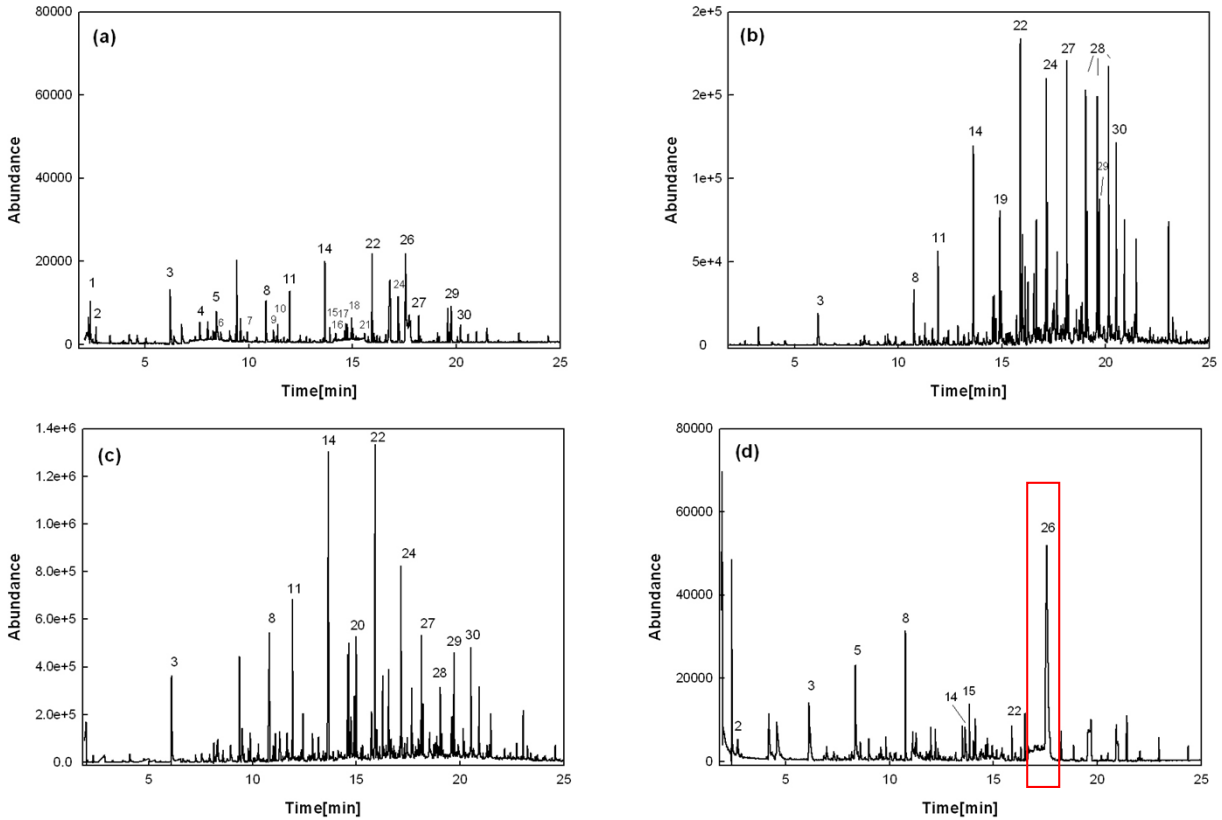
❑ GC-MS analysis



Total ion chromatograms of sawdust pyrolysis oil (a), water insolubles (b), and the diethylether solubles (c) and insolubles (d) of the water fraction of the oil.