

Appendix 2 –APP Foam

2.1. DSC Repeat Analyses

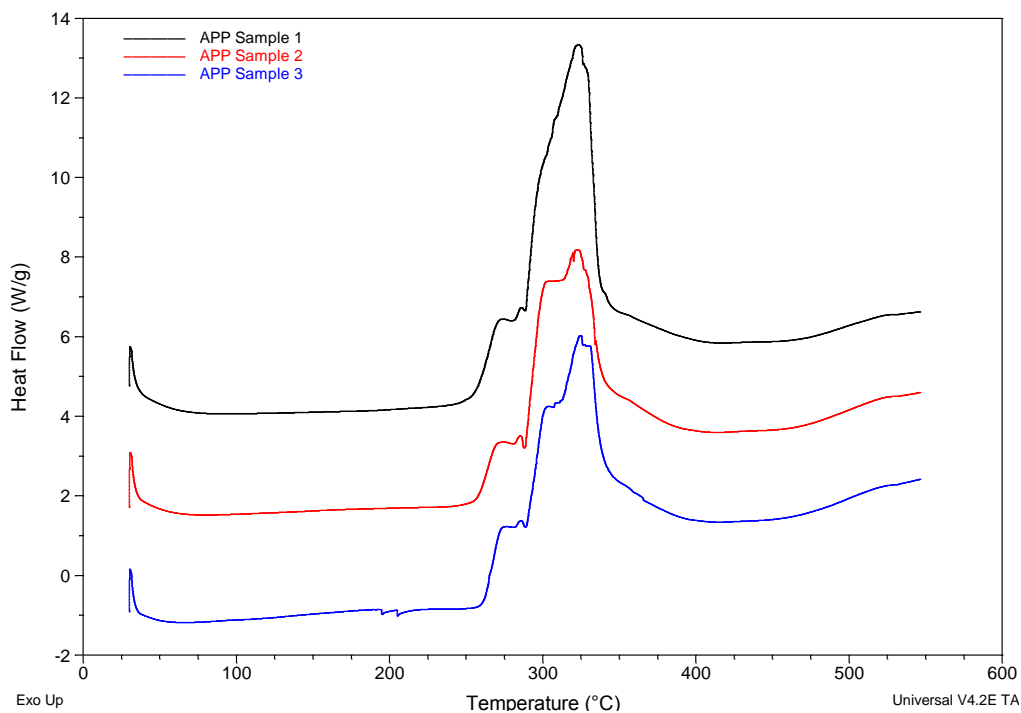


Figure 1: DSC analysis of APP foam in air

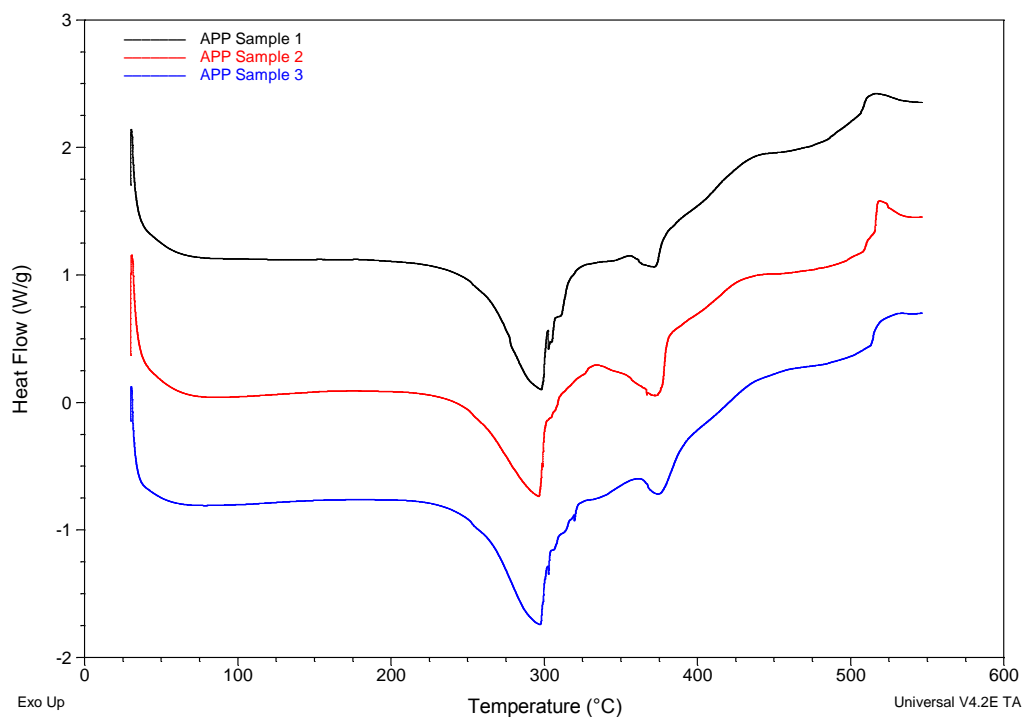


Figure 2: DSC analysis of APP foam in N₂

2.2 Dynamic TVA Study

2.2.1 Non-condensables

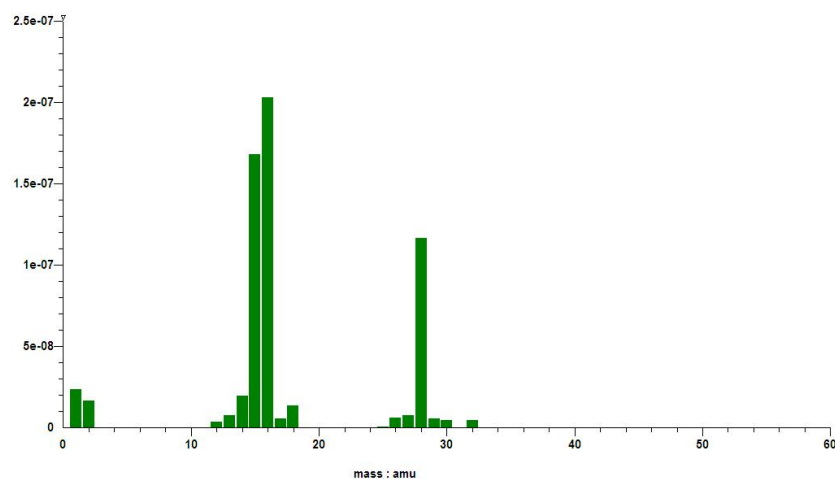


Figure 3: MS of the non-condensable volatiles from the APP foam

2.2.2 Cold-ring Fraction

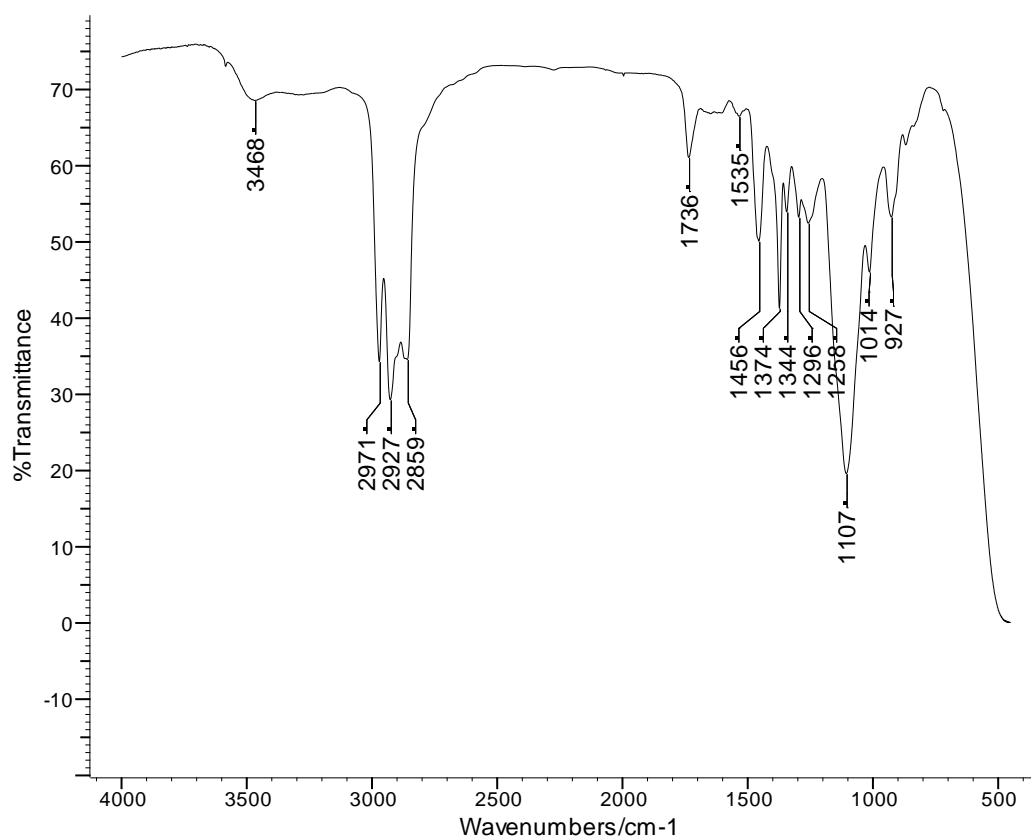


Figure 4: FTIR spectrum of the cold-ring fraction collected from the APP foam

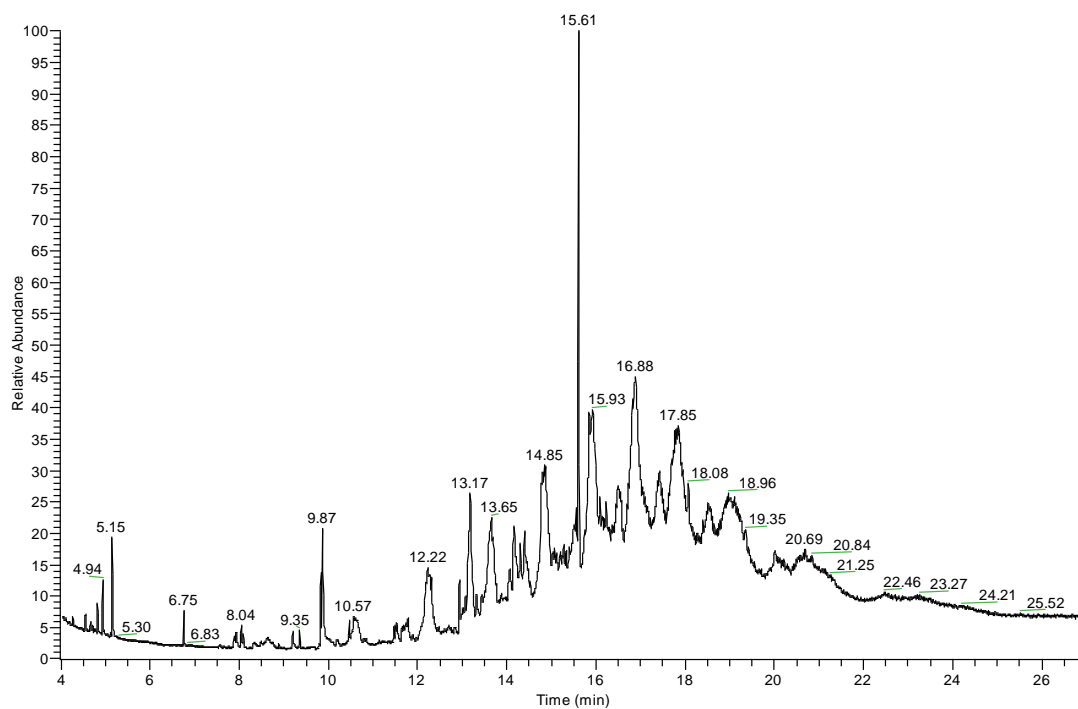


Figure 5: GC-MS total-ion chromatogram for the cold-ring fraction collected from the APP foam

2.2.3 Condensable Fraction

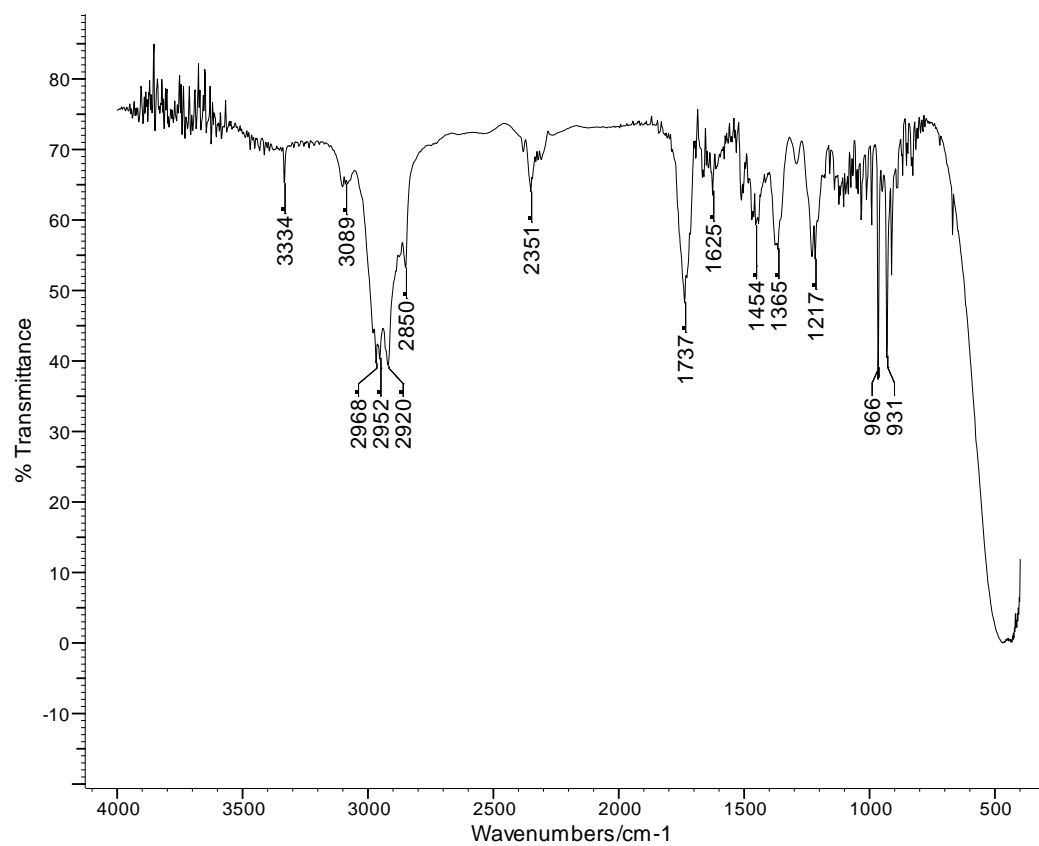


Figure 6: FTIR spectrum of fraction 1 from the APP foam

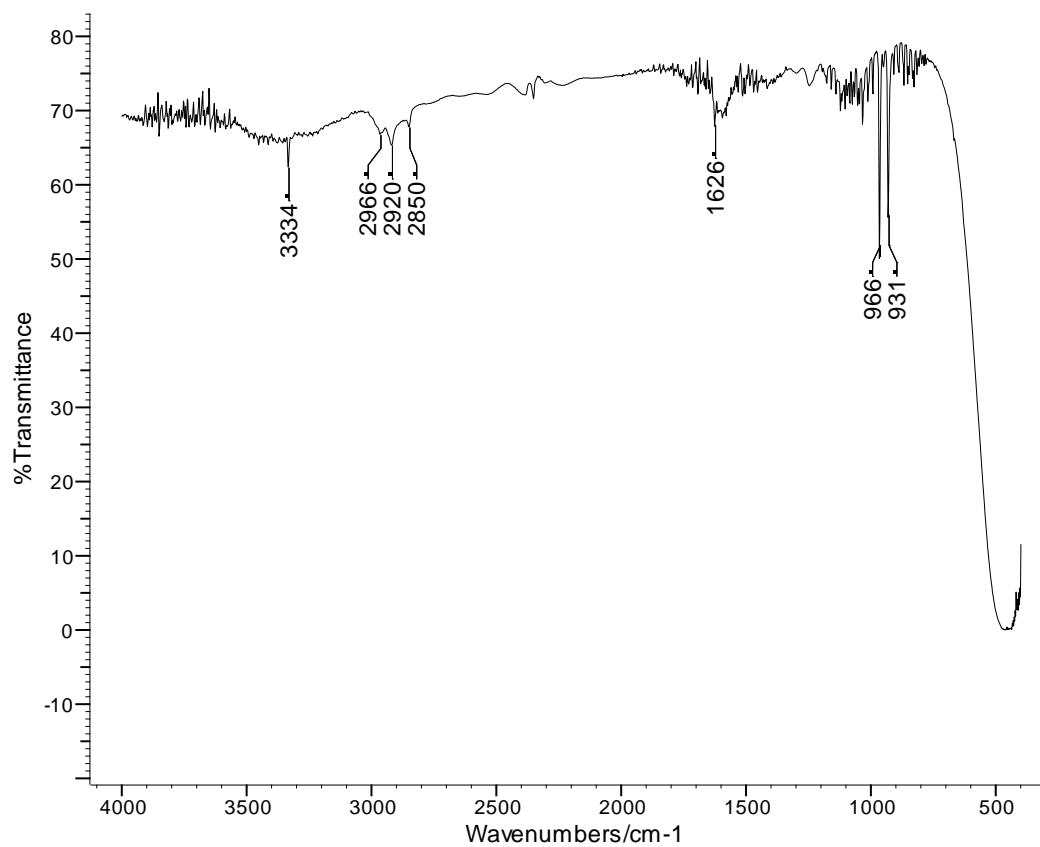


Figure 7: FTIR spectrum for fraction 2 collected from the APP foam

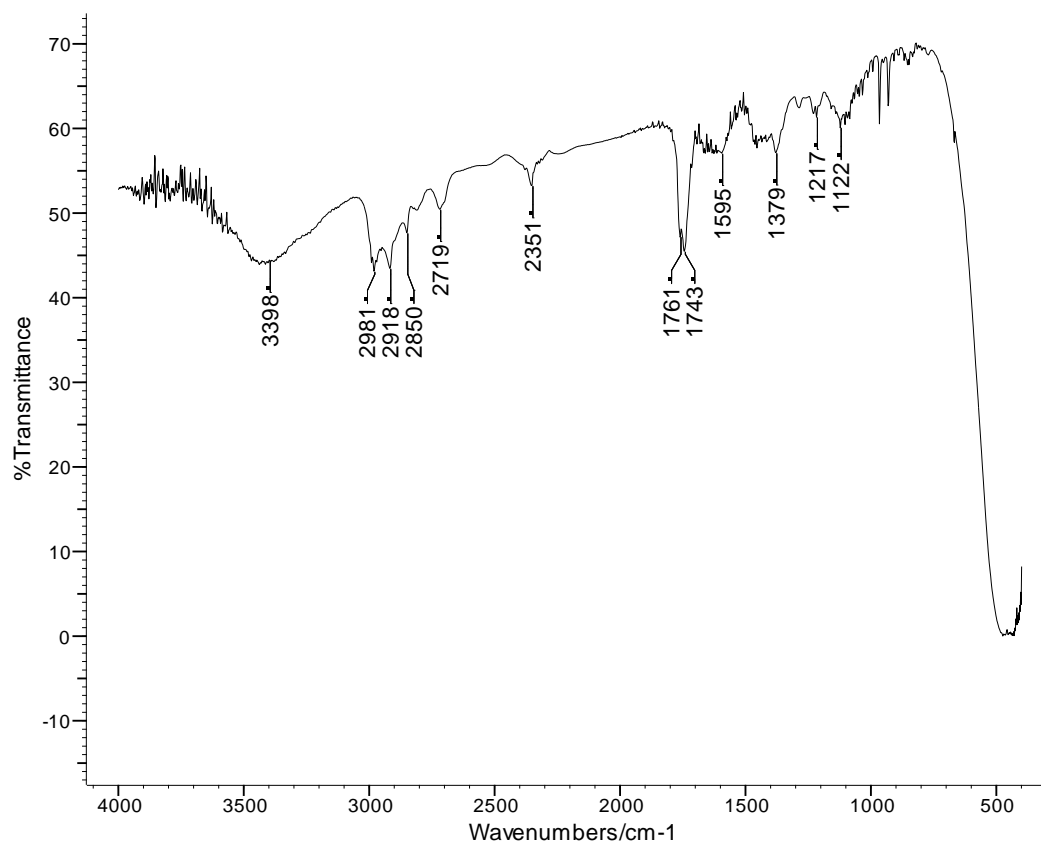


Figure 8: FTIR spectrum for fraction 3 collected from the APP foam

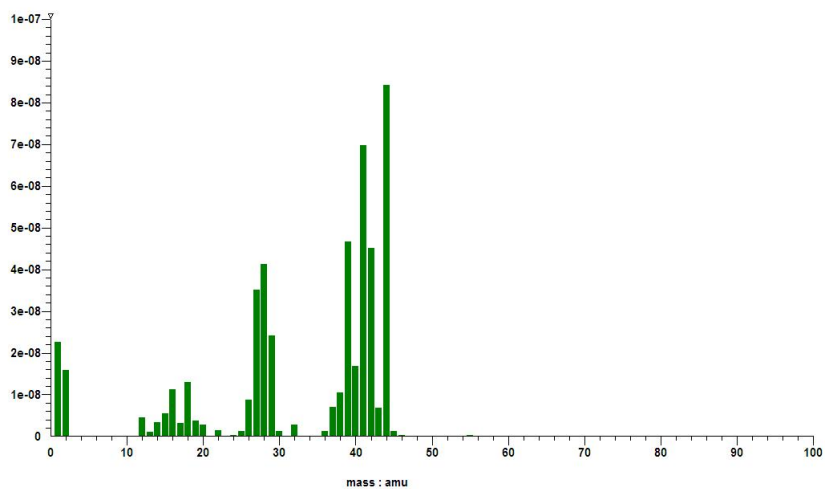


Figure 9: MS of propene and CO₂ collected from the APP foam

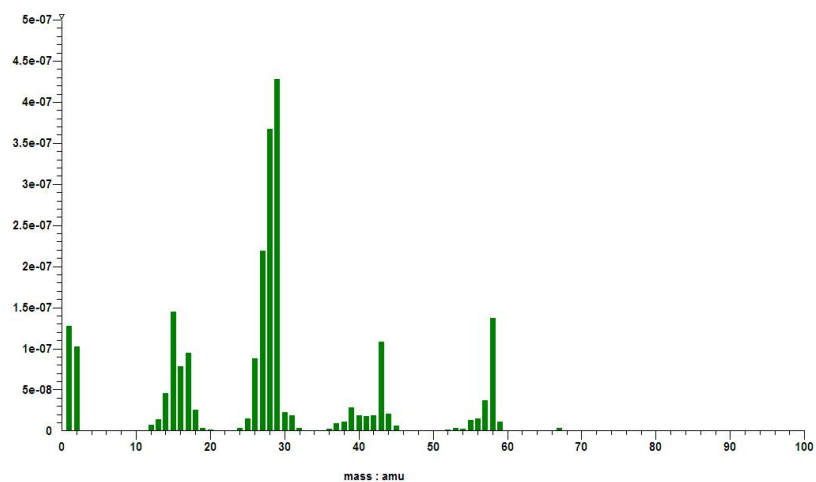


Figure 10: MS of propanal collected from the APP foam

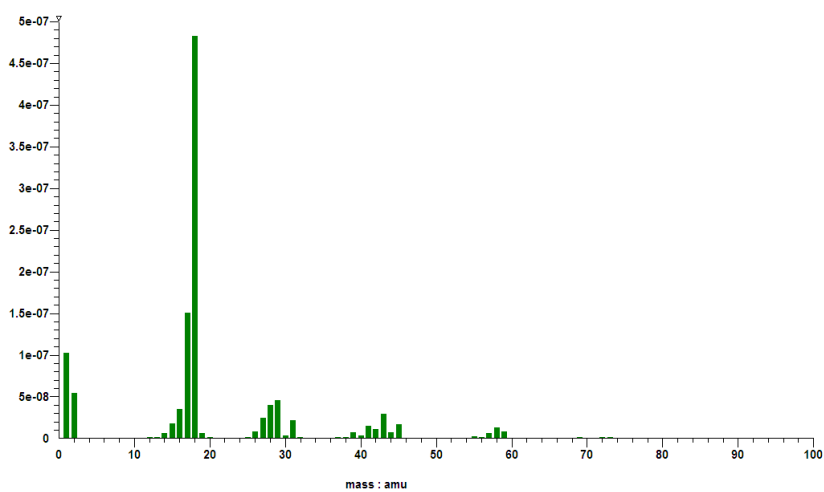


Figure 11: MS of water and high molar mass collected from the APP foam

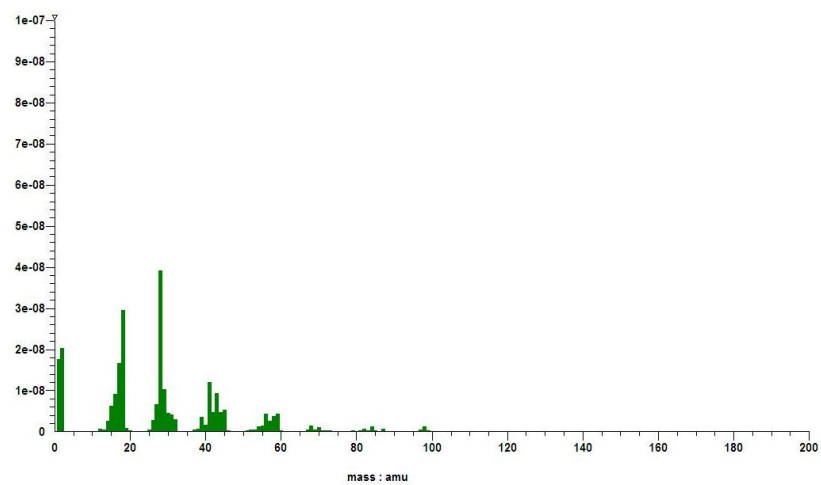


Figure 12: MS of high molar mass material collected from the APP foam

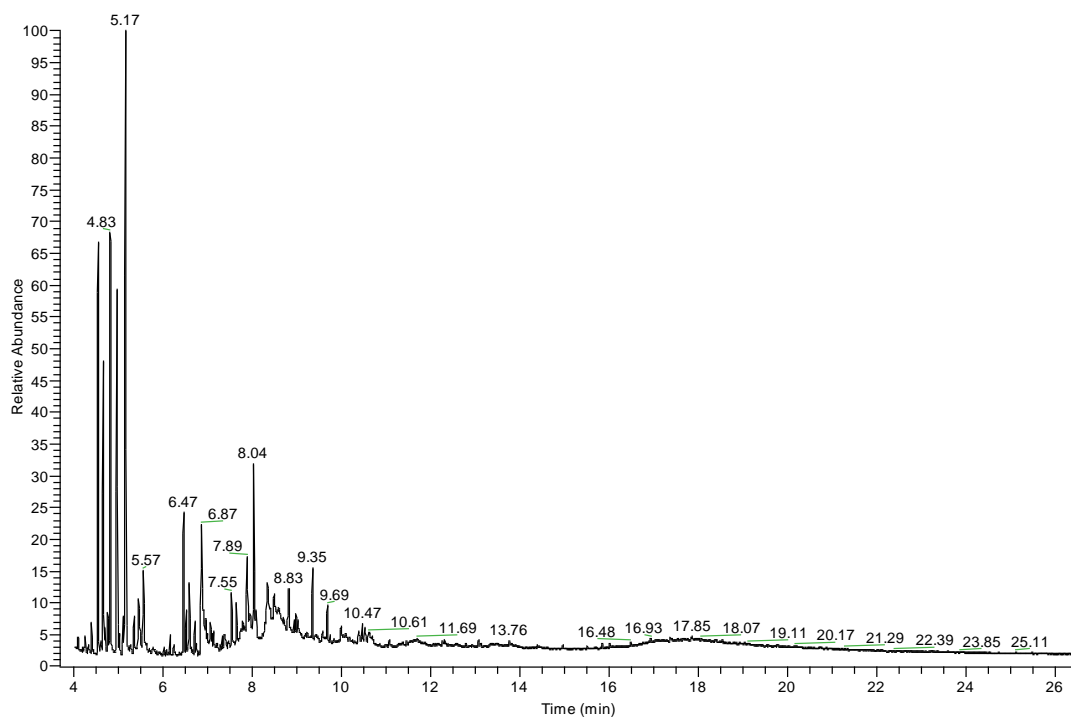


Figure 13: GC-MS chromatogram for fraction 3 from the APP foam

2.3 Isothermal TVA Study

2.3.1 Non-condensables

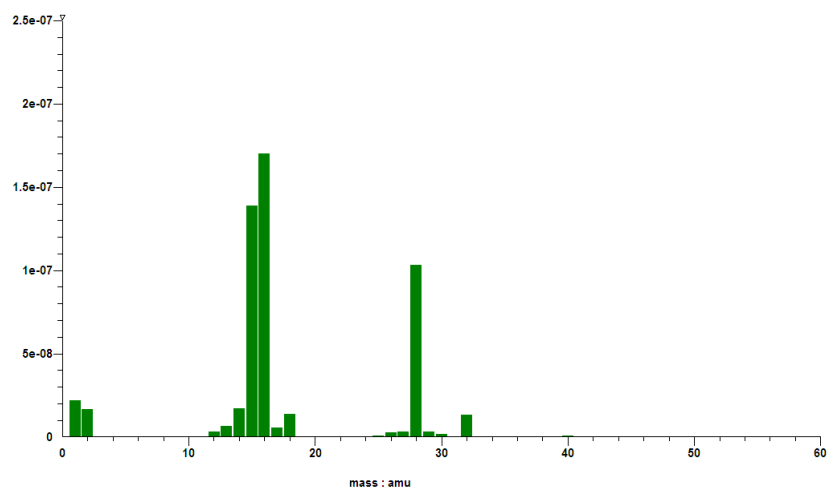


Figure 14: MS of the non-condensable volatiles from the APP foam at 350°C

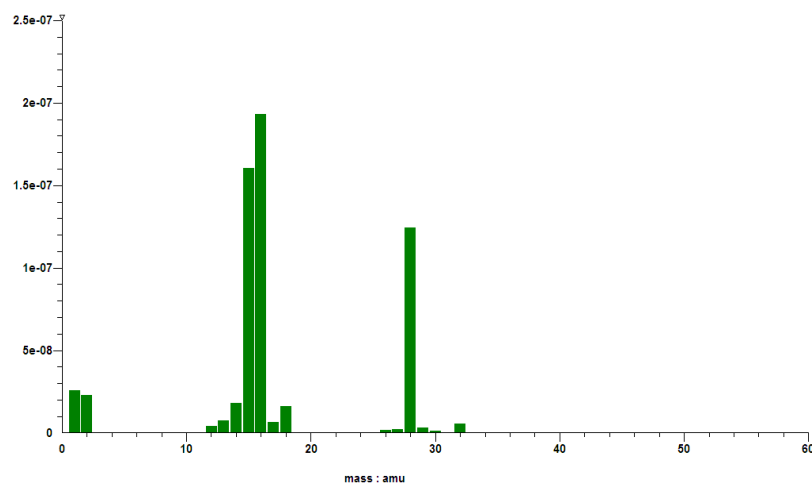


Figure 15: MS of the non-condensable volatiles from the APP foam at 400°C

2.3.2 Cold-ring Fractions

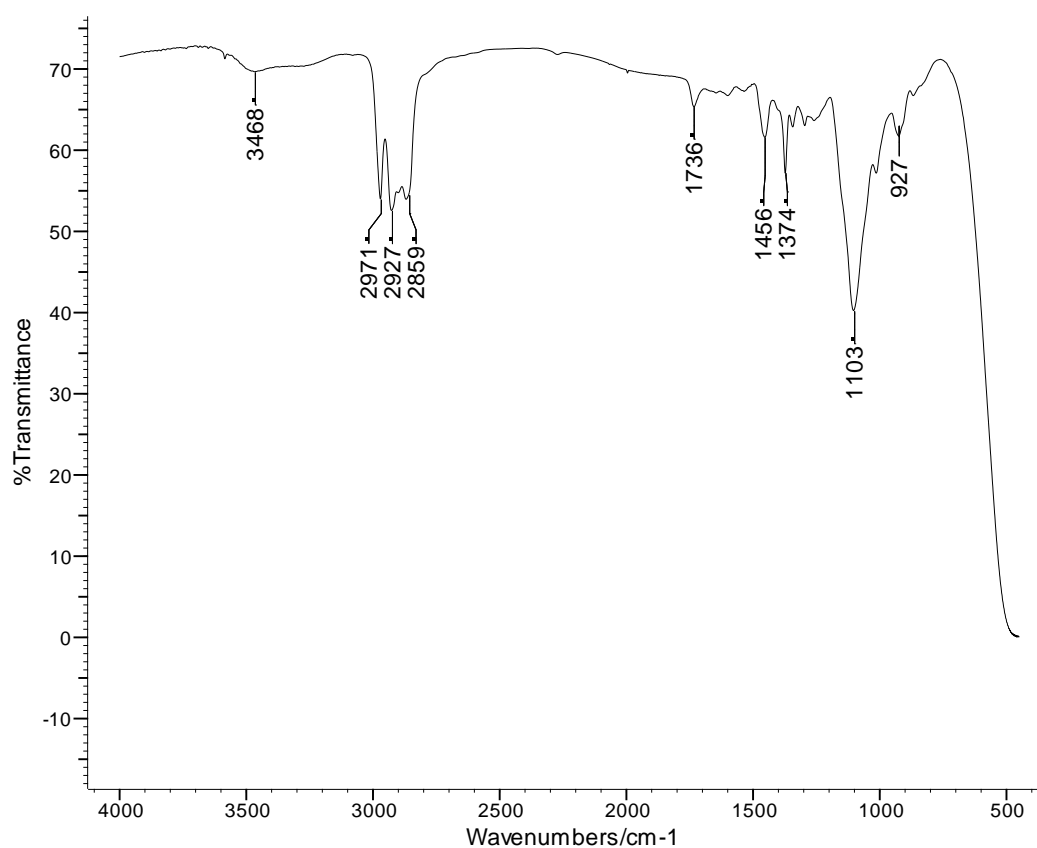


Figure 16: FTIR spectrum of the cold-ring fraction collected at 300°C

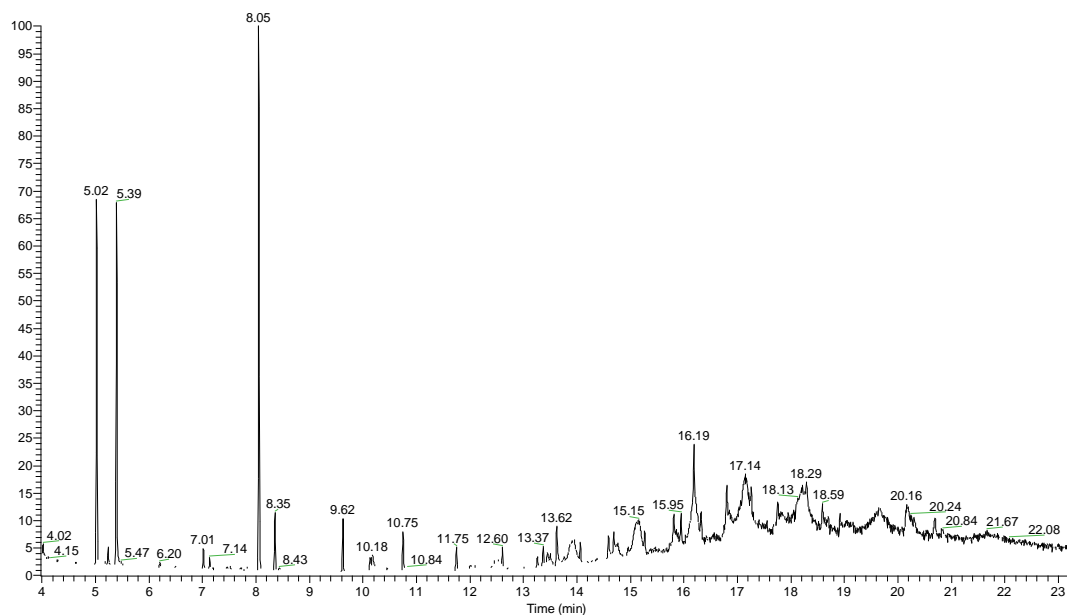


Figure 17: GC-MS chromatogram of the cold-ring fraction collected at 300°C

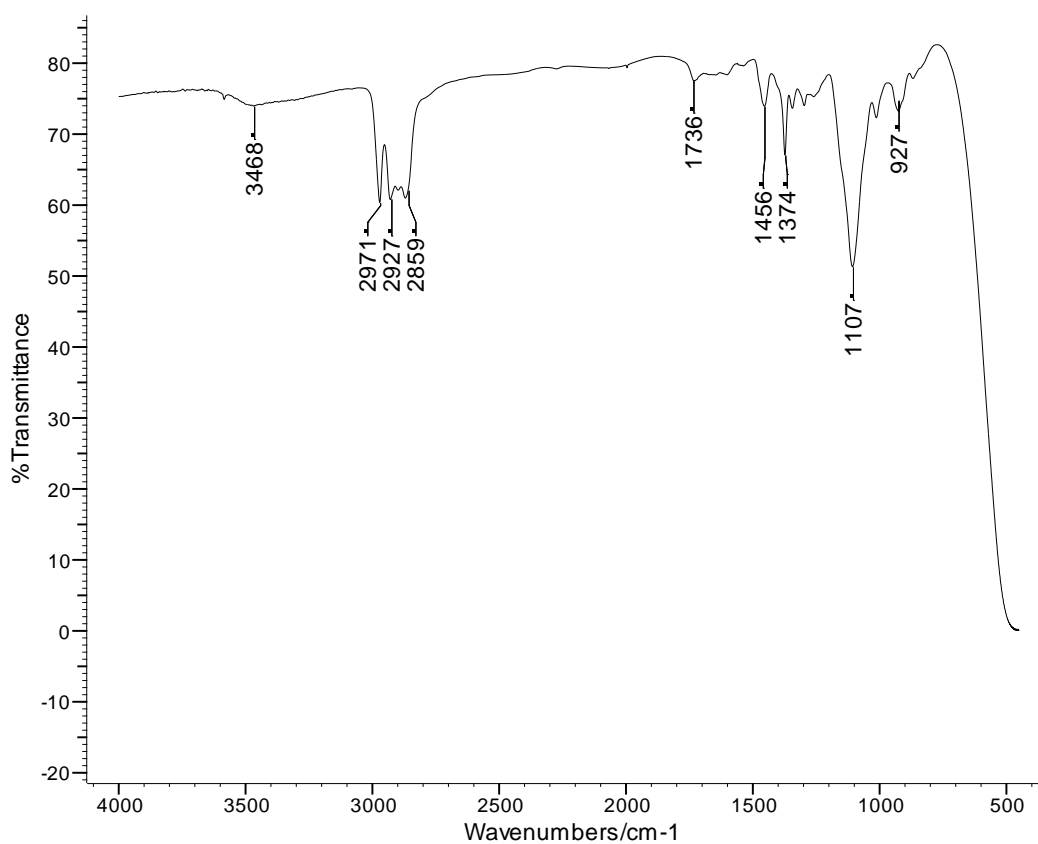


Figure 18: FTIR spectrum of the cold-ring fraction at 350°C

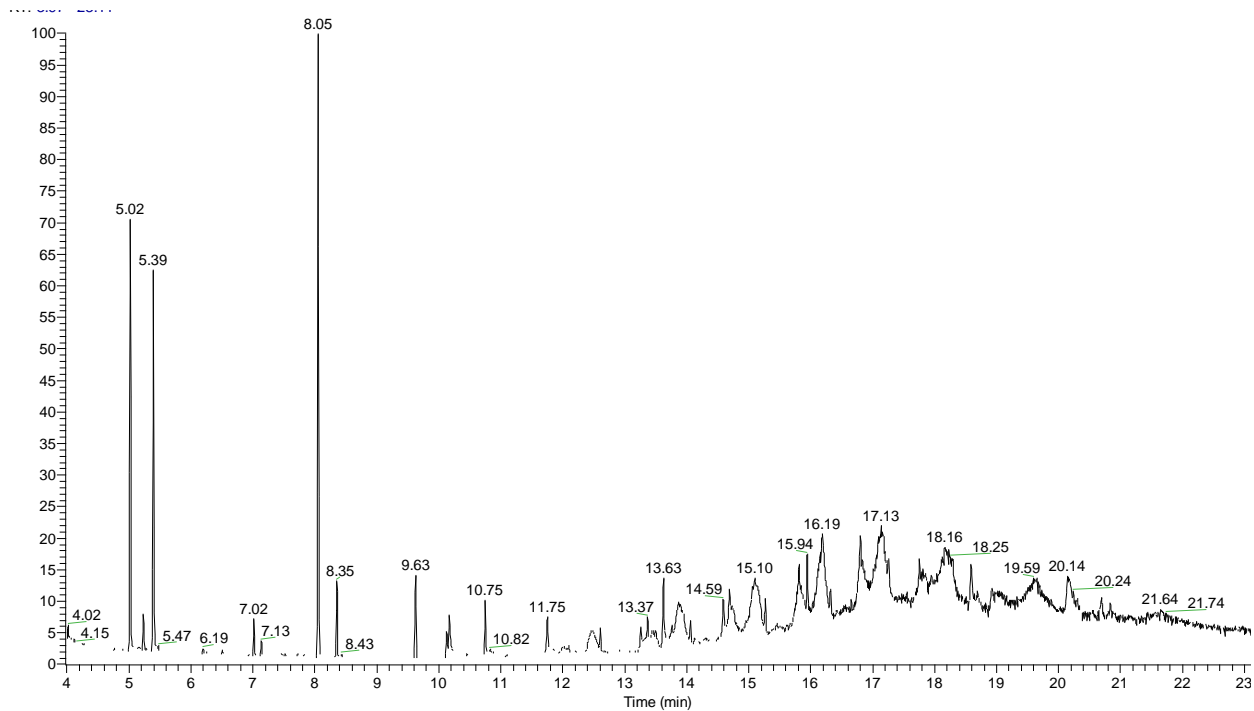


Figure 19: GC-MS chromatogram of the cold-ring fraction collected at 350°C

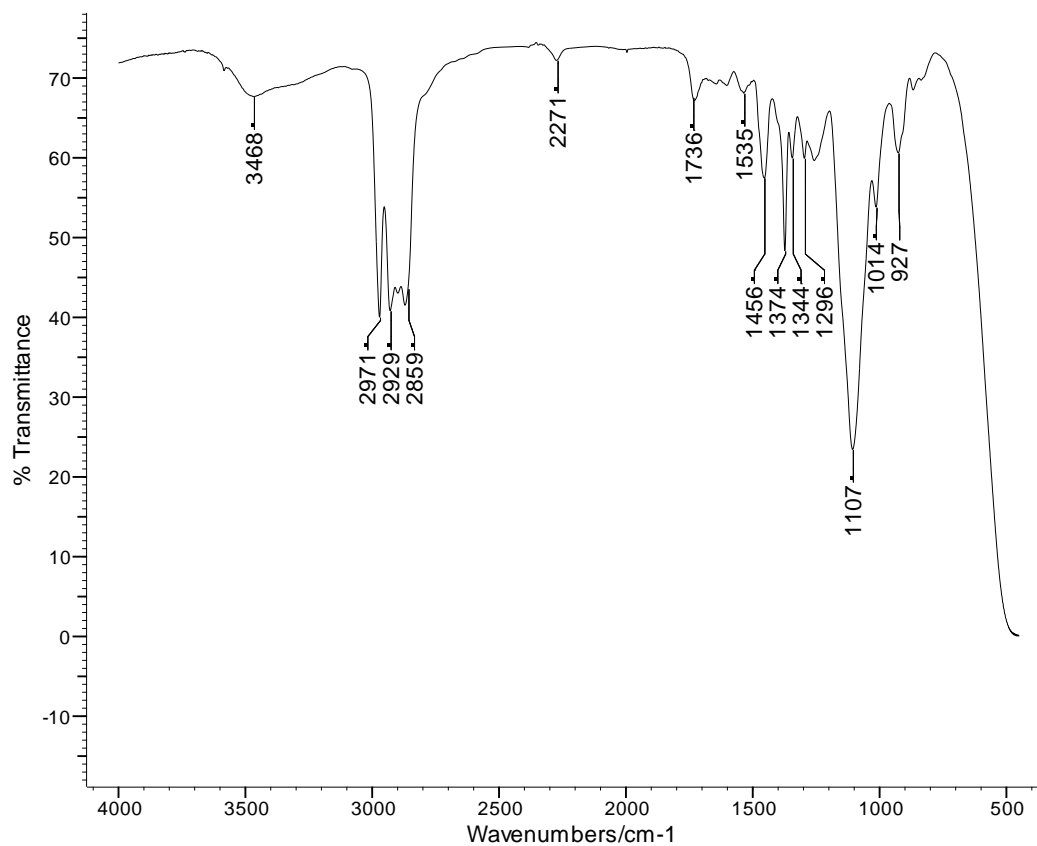


Figure 20: FTIR spectrum of the cold-ring fraction collected at 400°C

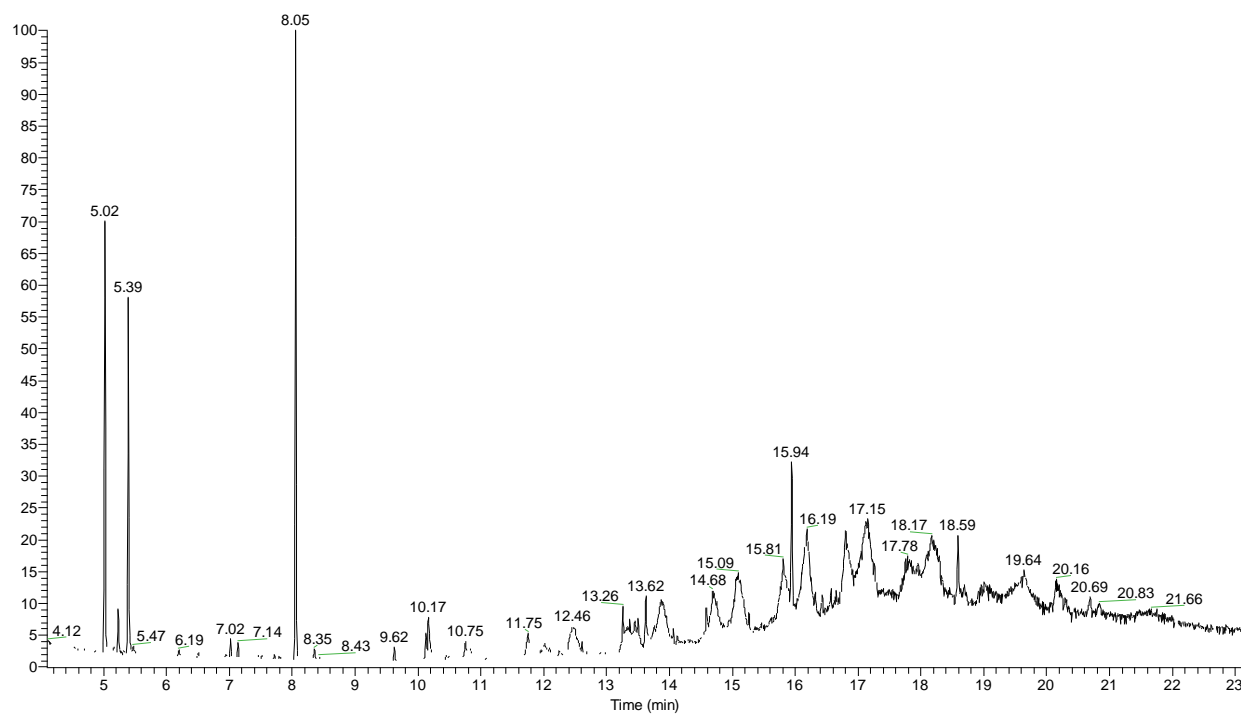


Figure 21: GC-MS chromatogram of the cold-ring fraction collected at 400°C

2.3.3 Residue

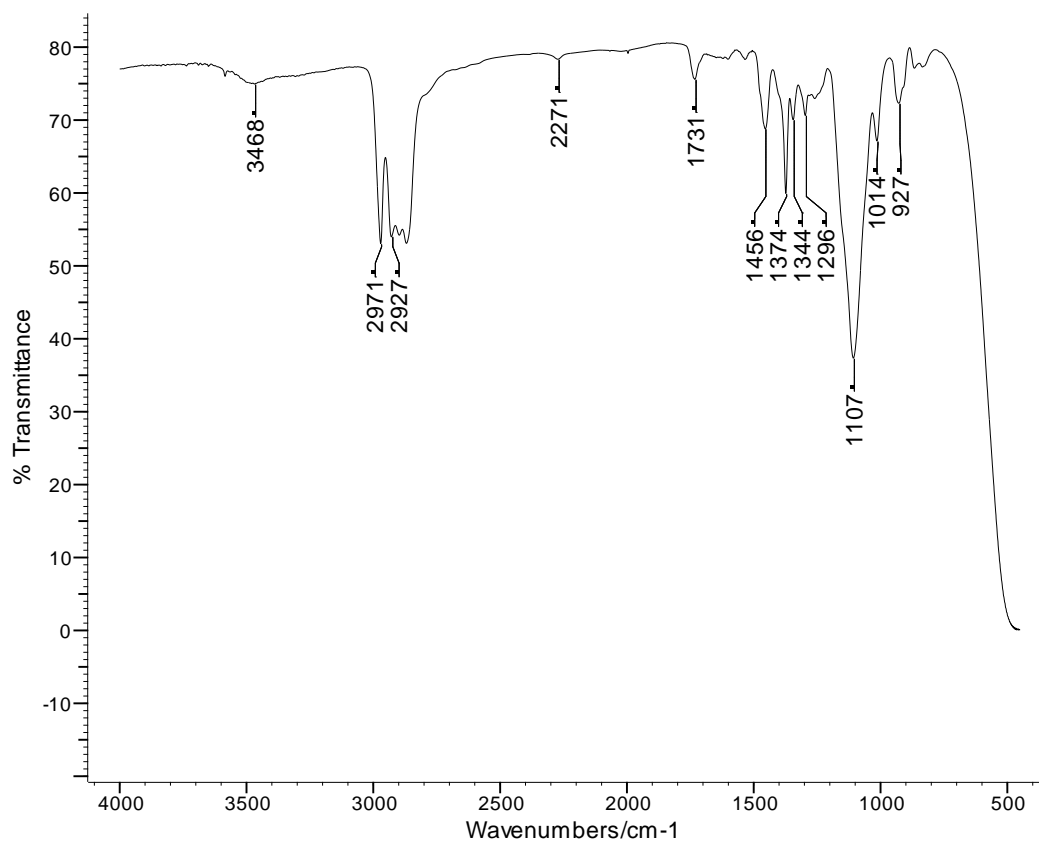


Figure 22: FTIR spectrum of the residue at 250°C

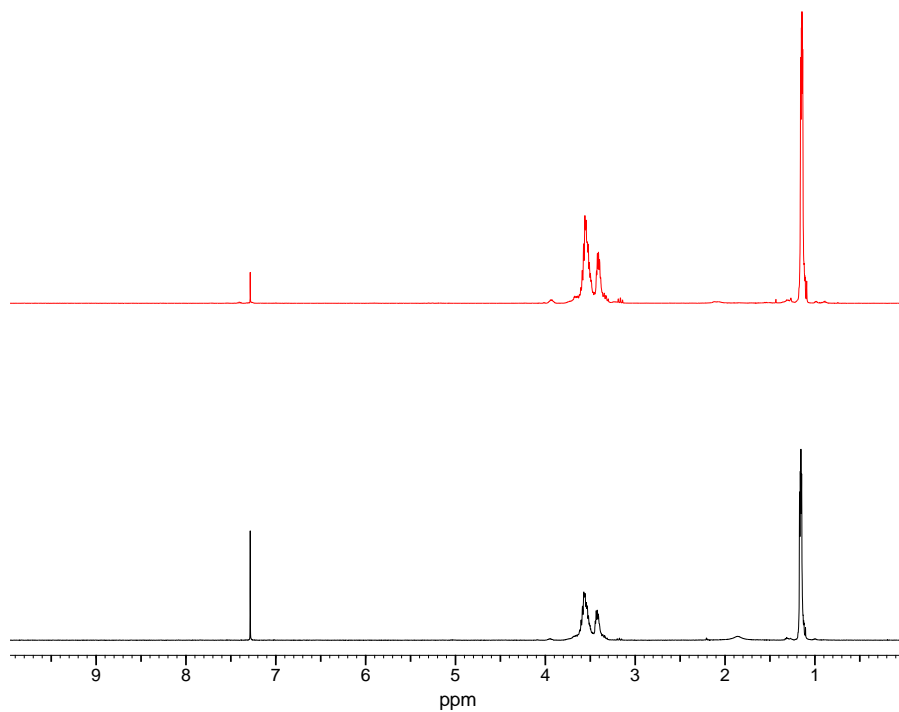


Figure 23: ¹H NMR spectrum of the residue at 250°C (black) and the polyol (red)

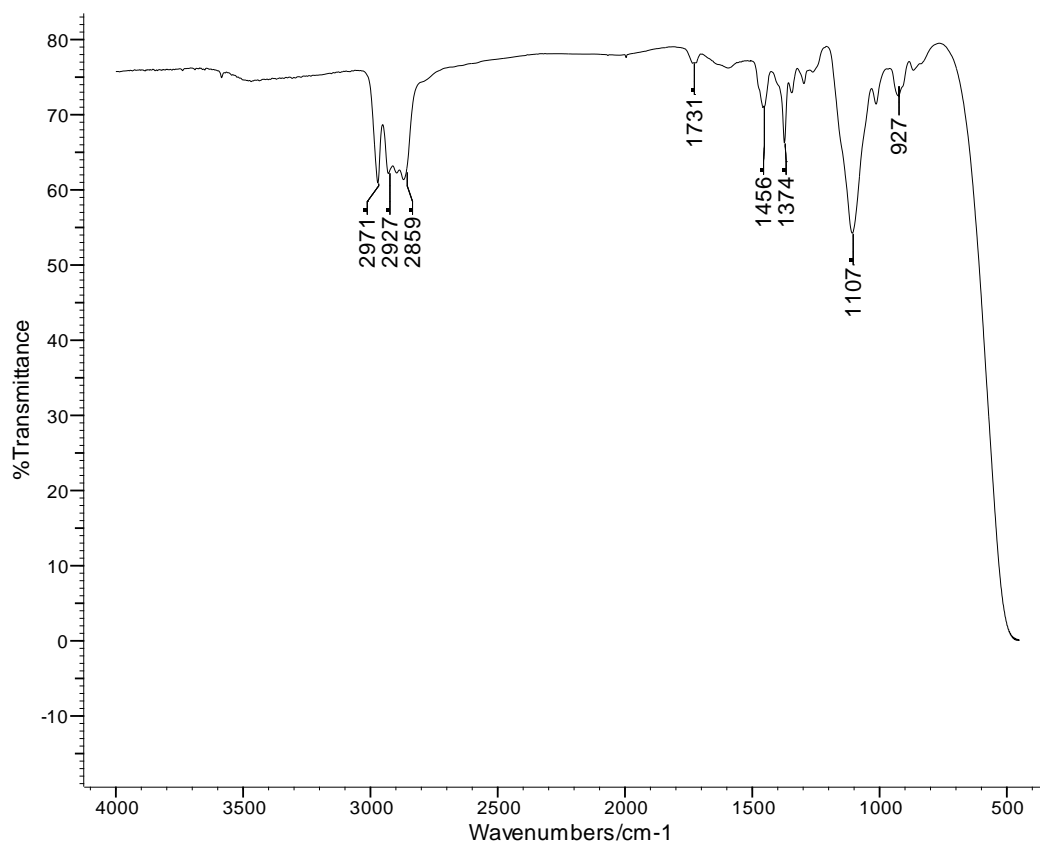


Figure 24: FTIR spectrum of the residue at 300°C

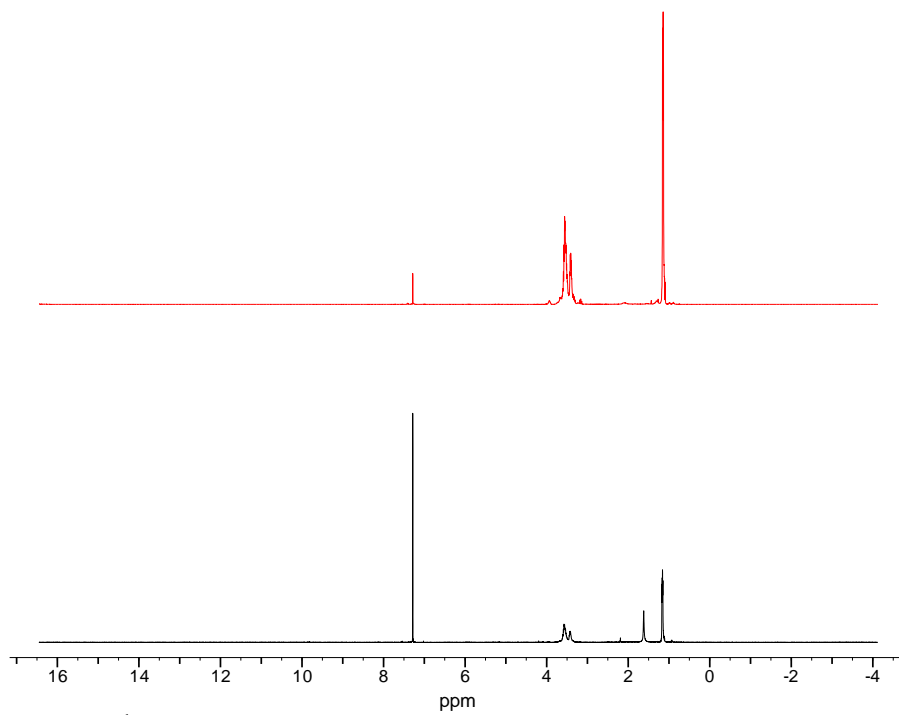


Figure 25: ¹H NMR spectrum of the residue at 300°C (black) and the polyol (red)

2.3.4 Condensable fraction

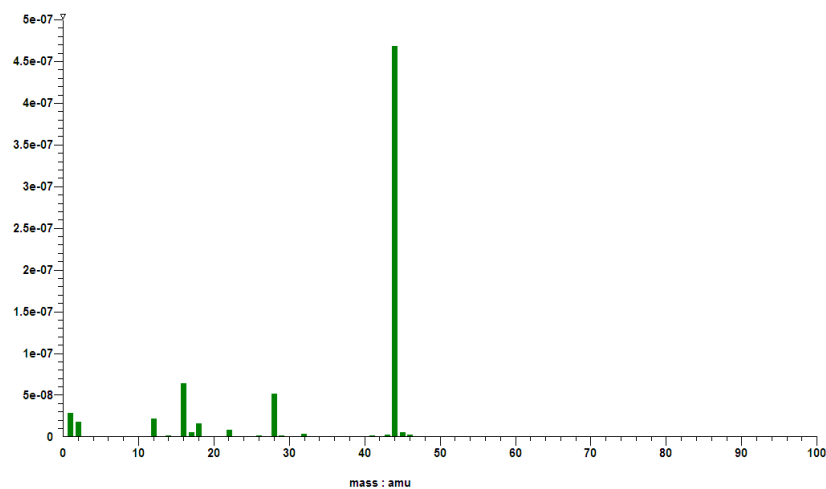


Figure 26: MS of CO₂ collected at 250°C

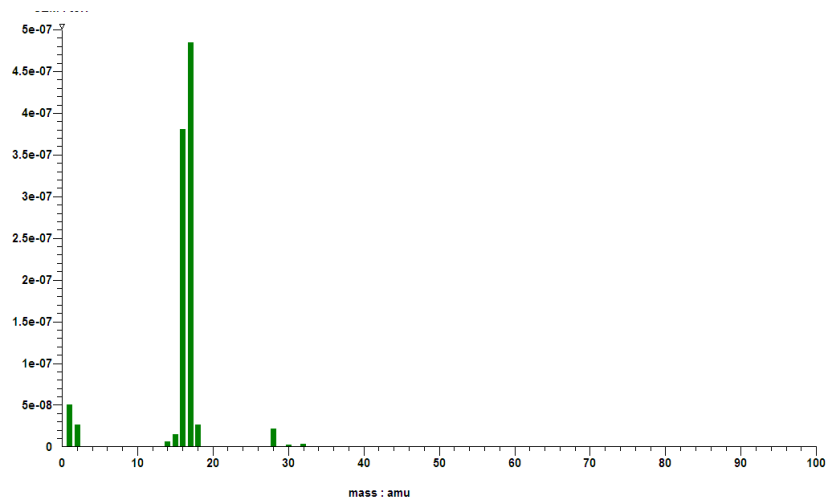


Figure 27: MS of ammonia collected at 250°C

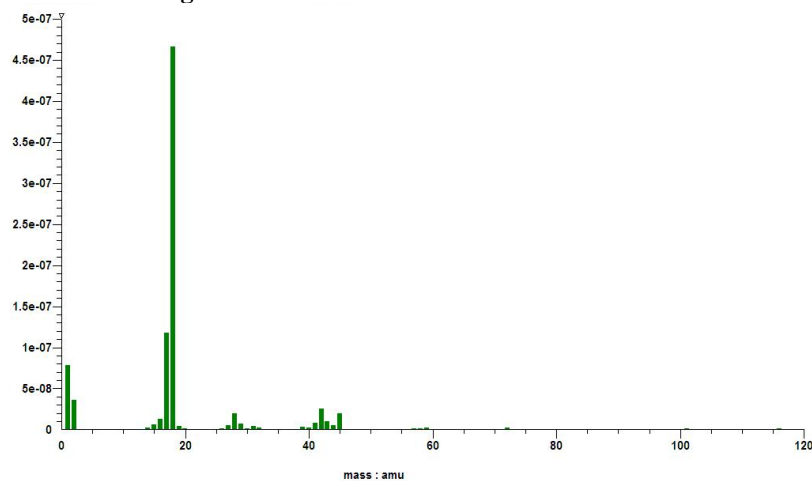
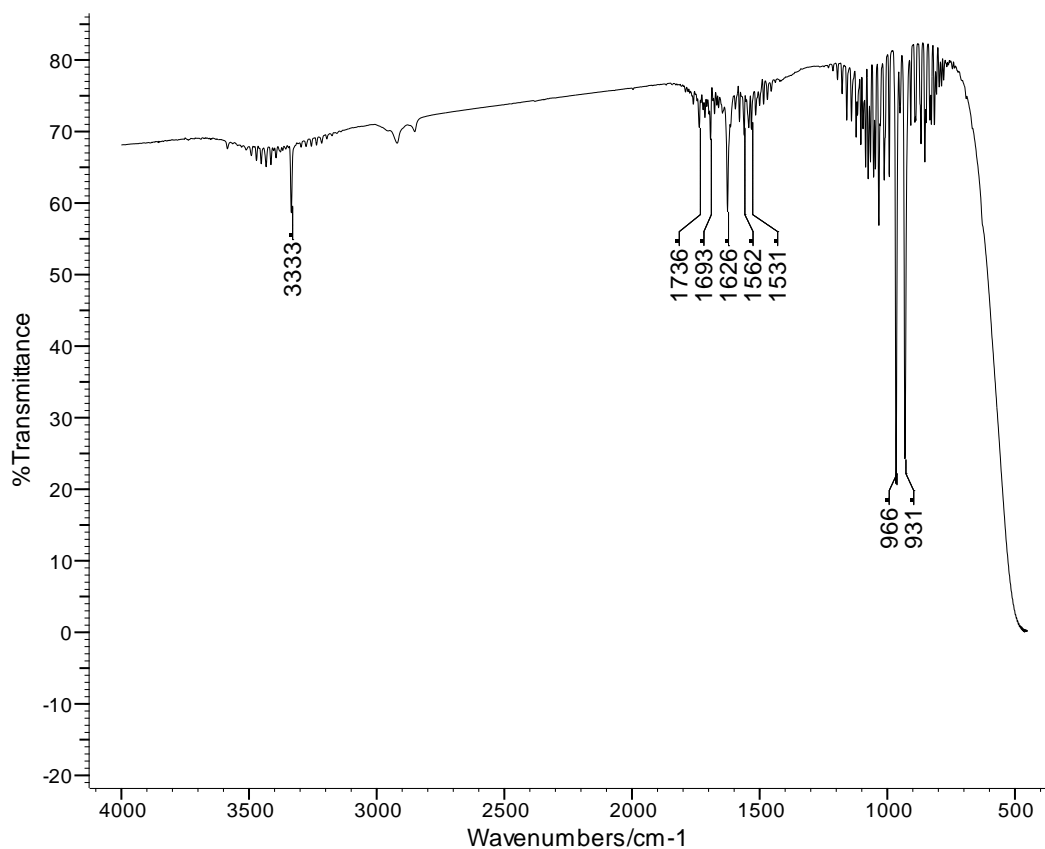
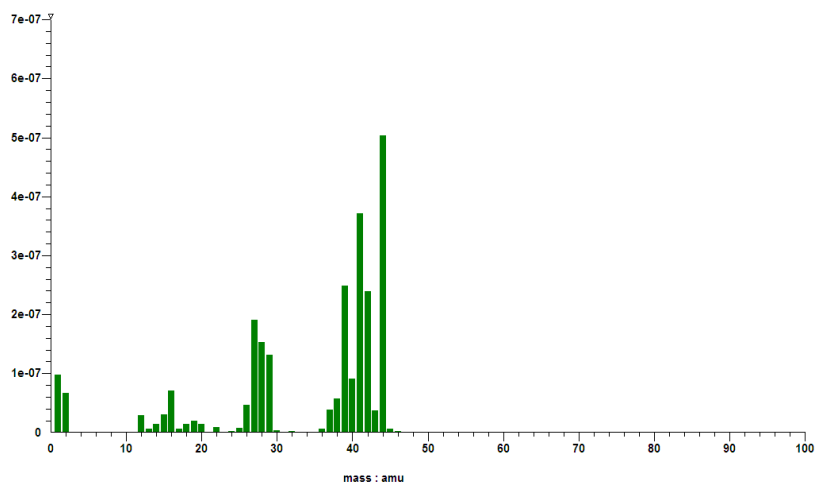
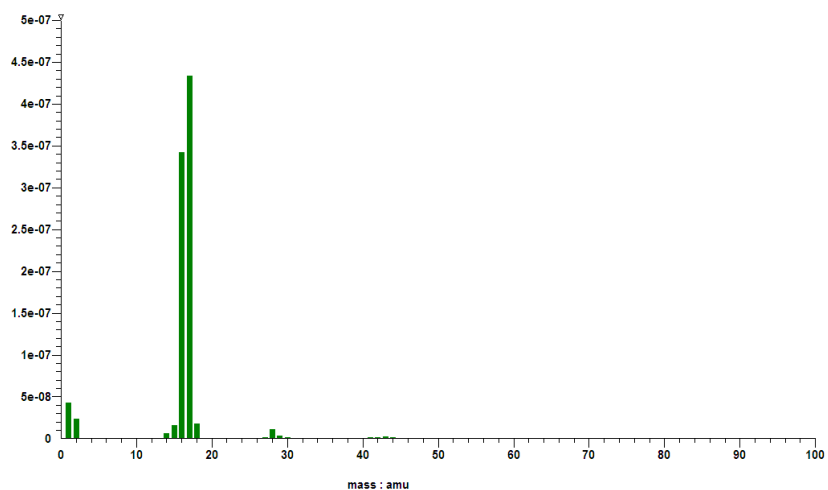
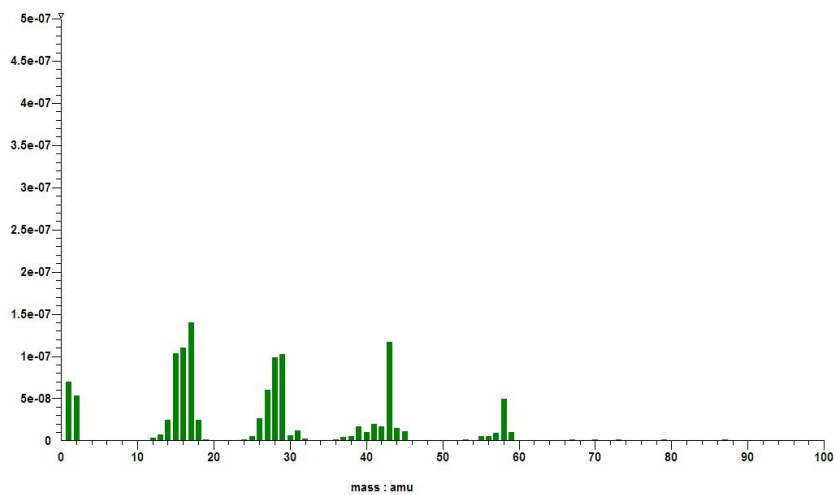
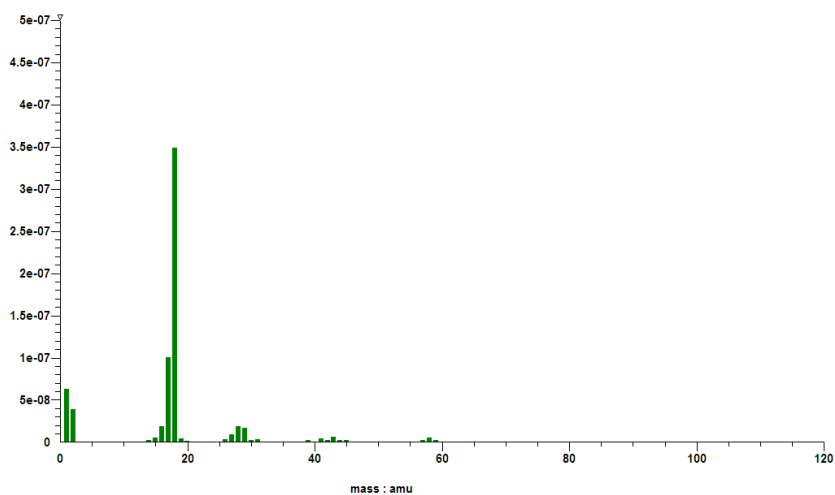


Figure 28: MS of water and higher molar mass collected at 250°C

**Figure 29: FTIR spectrum of fraction 2 at 250°C****Figure 30: MS of propene and CO₂ collected at 300°C**

**Figure 31: MS of ammonia collected at 300°C****Figure 32: MS of propanal collected at 300°C****Figure 33: MS of water and higher molar mass material collected at 300°C**

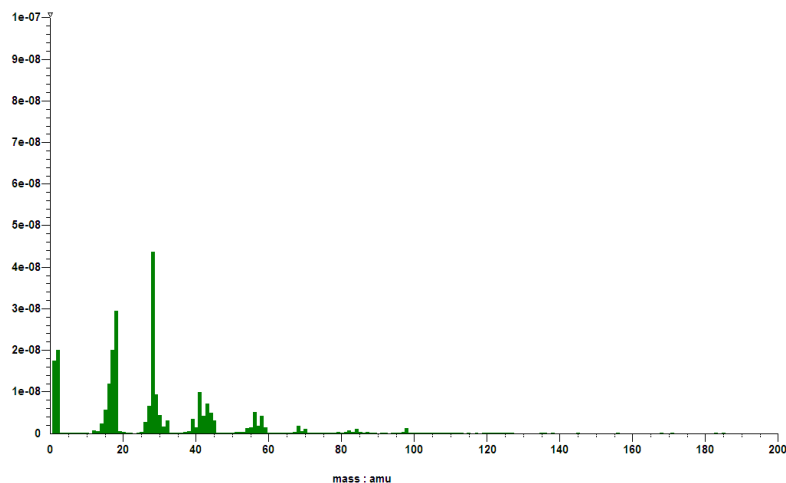


Figure 34: MS of high molar mass material collected at 300°C

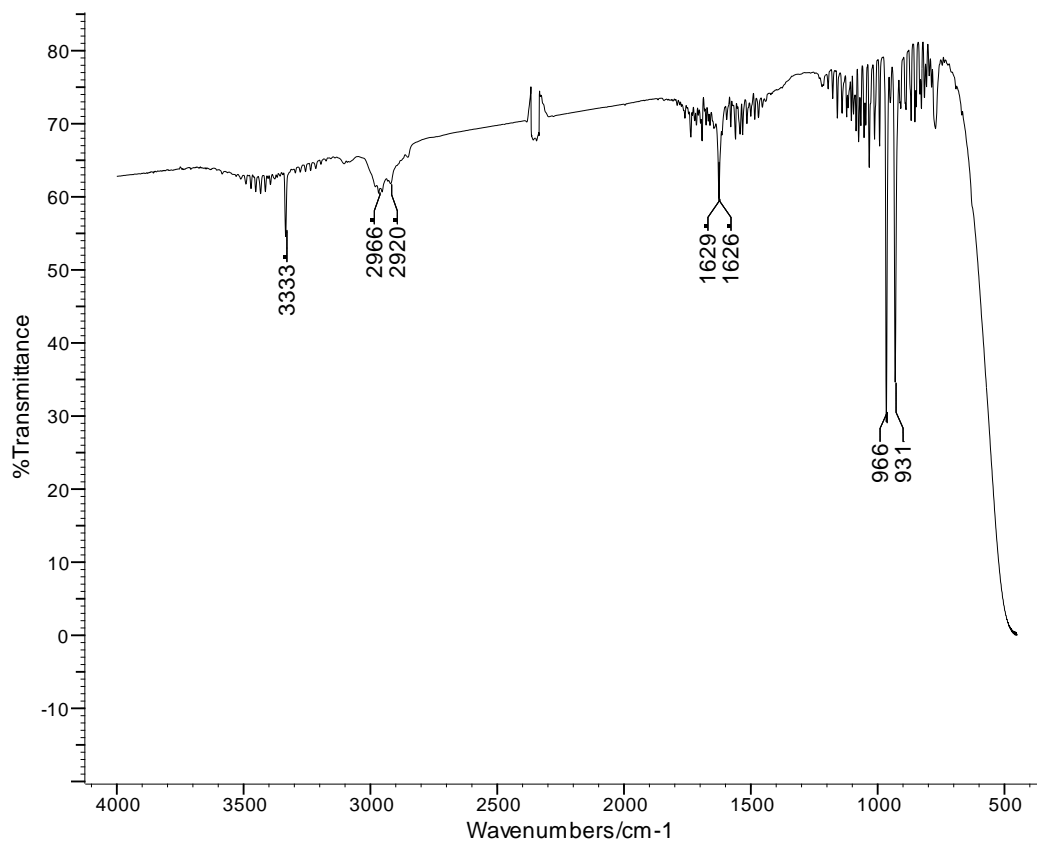


Figure 35: FTIR spectrum of fraction 1 at 300°C

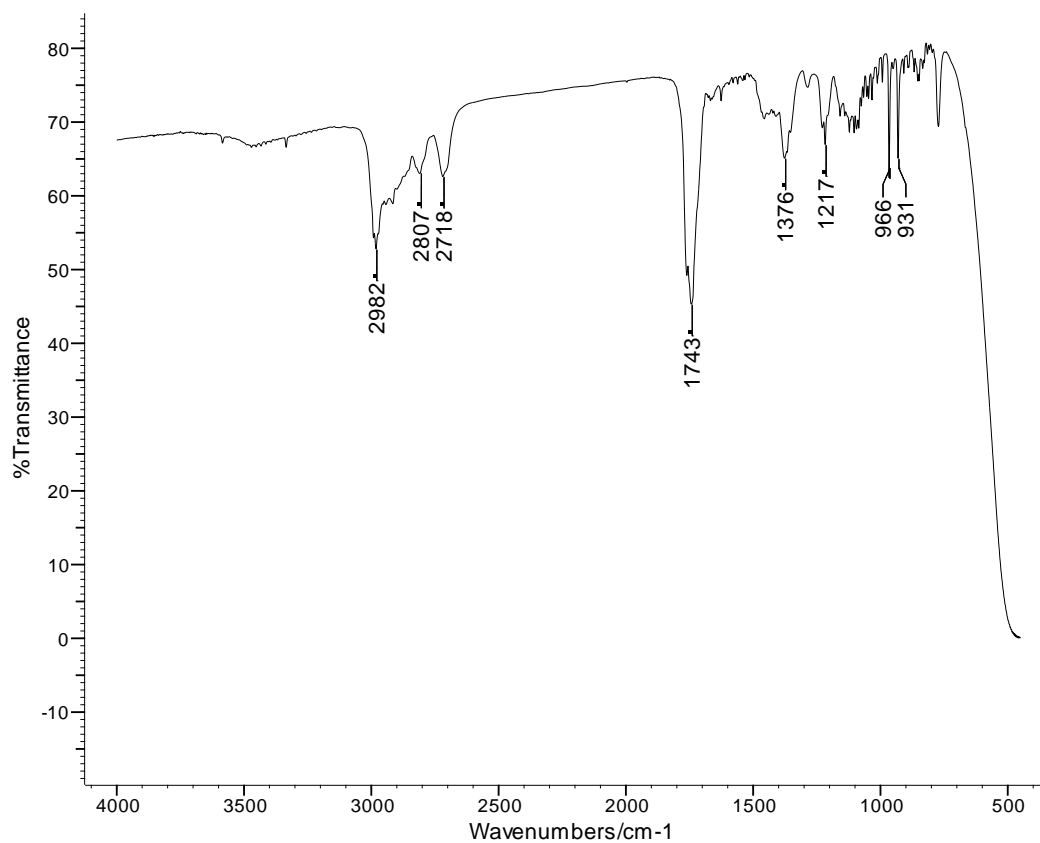


Figure 36: FTIR spectrum of fraction 2 at 300°C

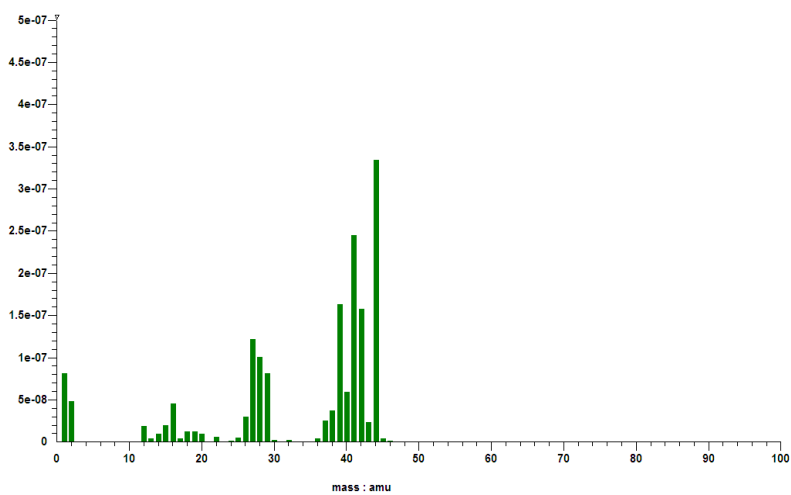


Figure 37: MS of propene and CO₂ collected at 350°C

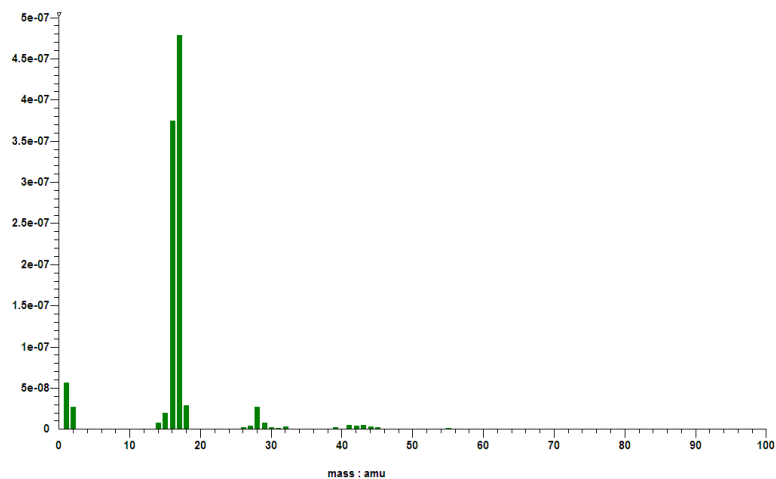


Figure 38: MS of ammonia collected at 350°C

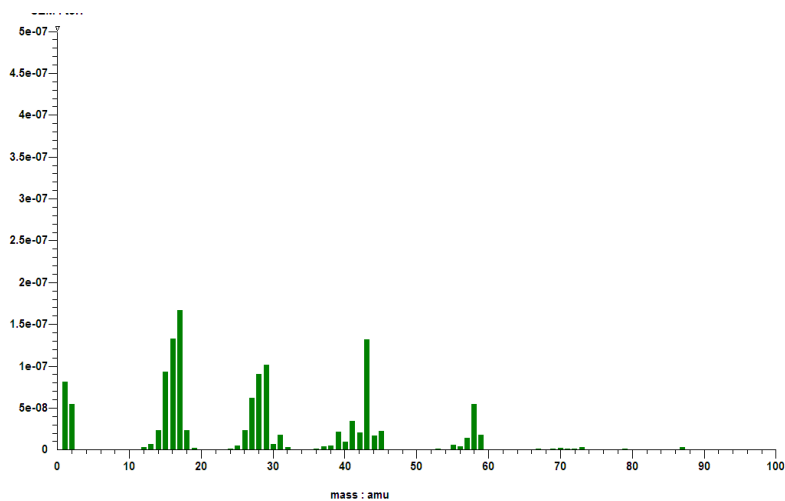


Figure 39: MS of propanal at 350°C

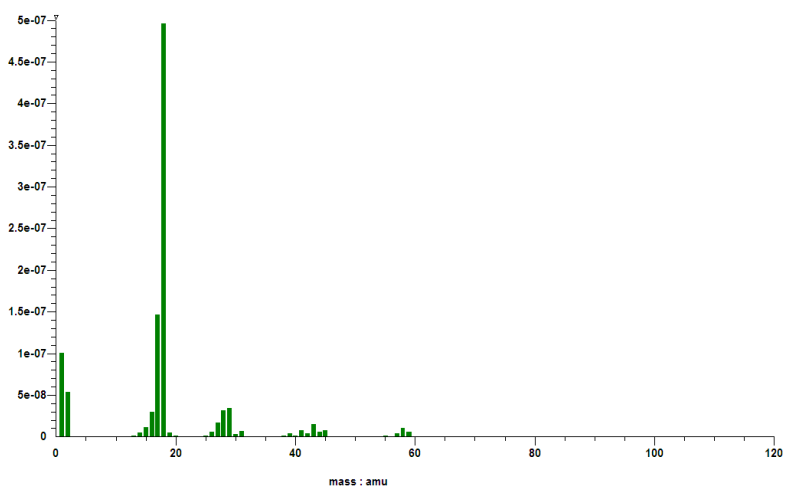


Figure 40: MS of water and higher molar mass material collected at 350°C

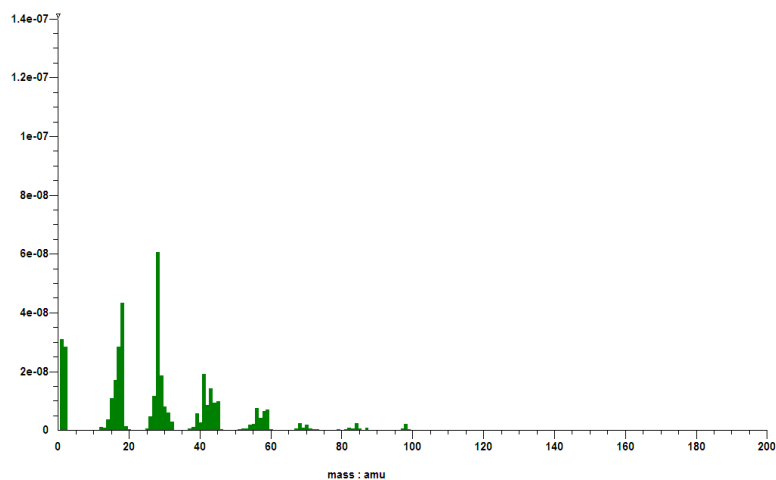


Figure 41: MS of high molar mass material collected at 350°C

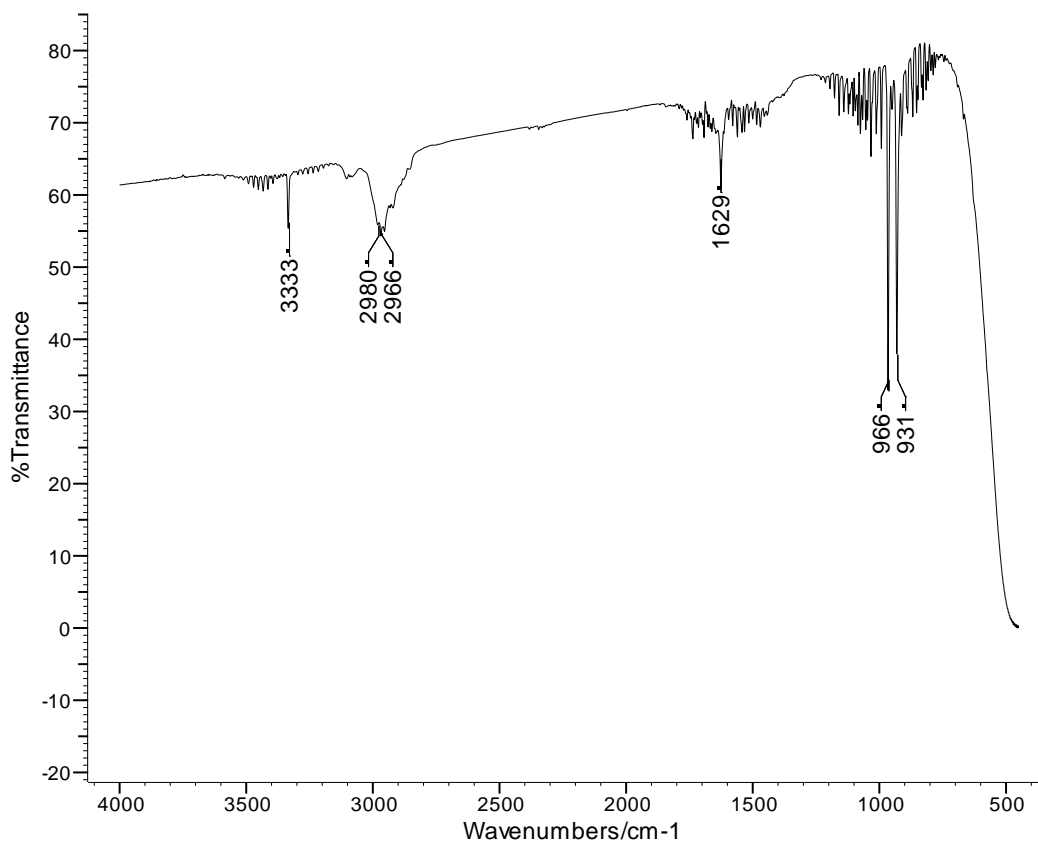


Figure 42: FTIR spectrum of fraction 1 at 350°C

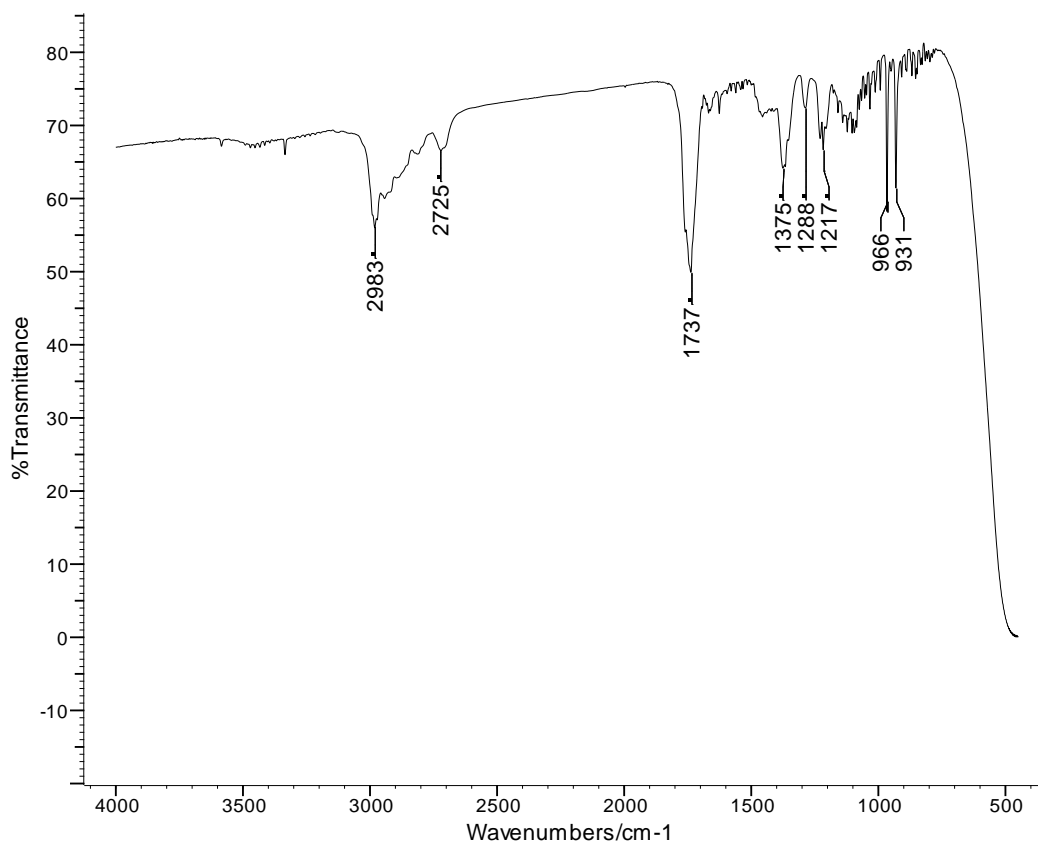
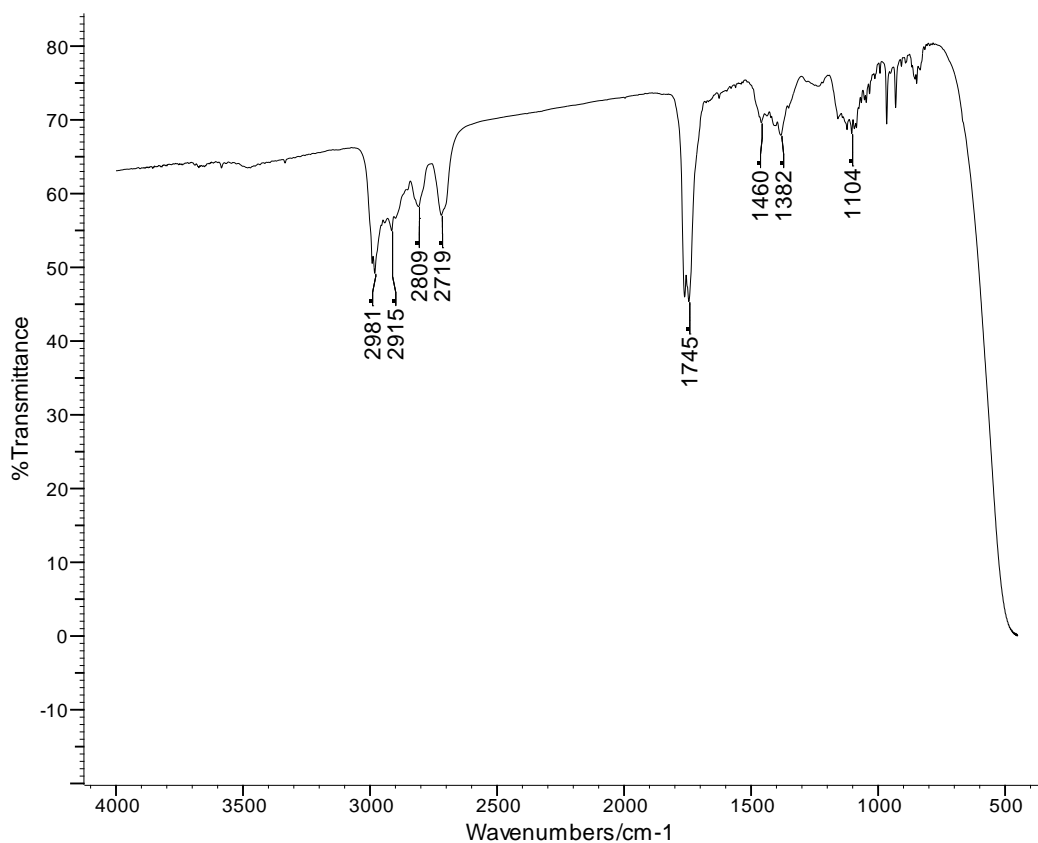
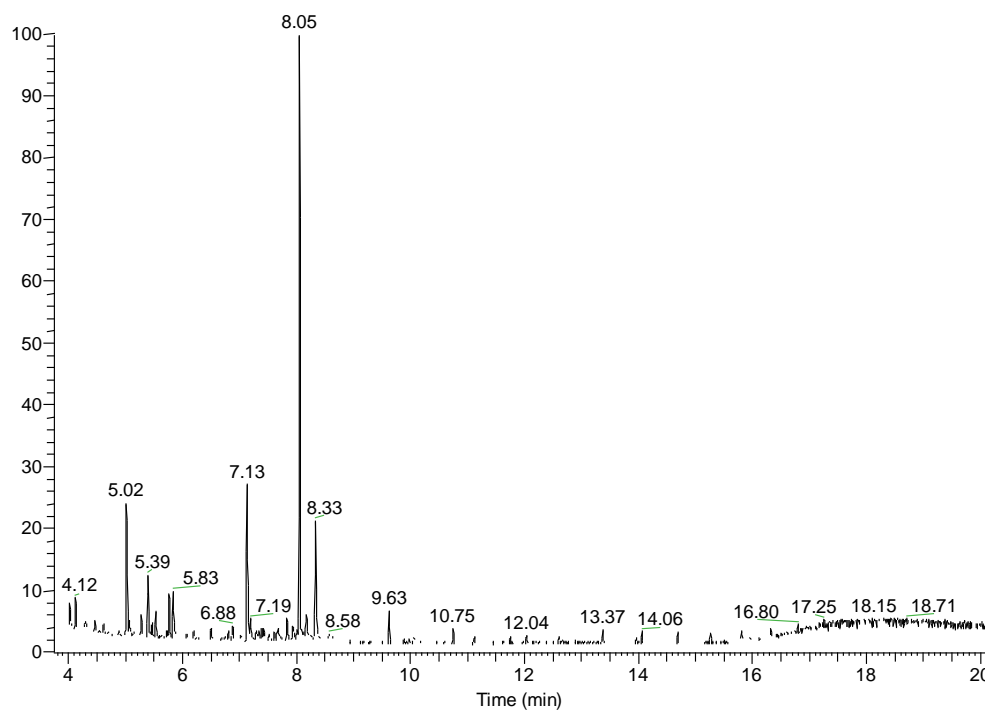


Figure 43: FTIR spectrum of fraction 2 at 350°C

**Figure 44: FTIR spectrum of fraction 3 at 350°C****Figure 45: GC-MS chromatogram of fraction 4 at 350°C**

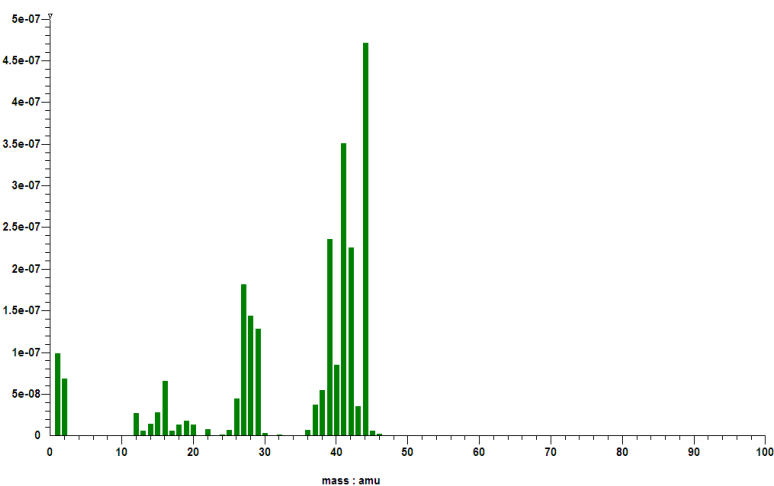


Figure 46: MS of propene and CO₂ collected at 400°C

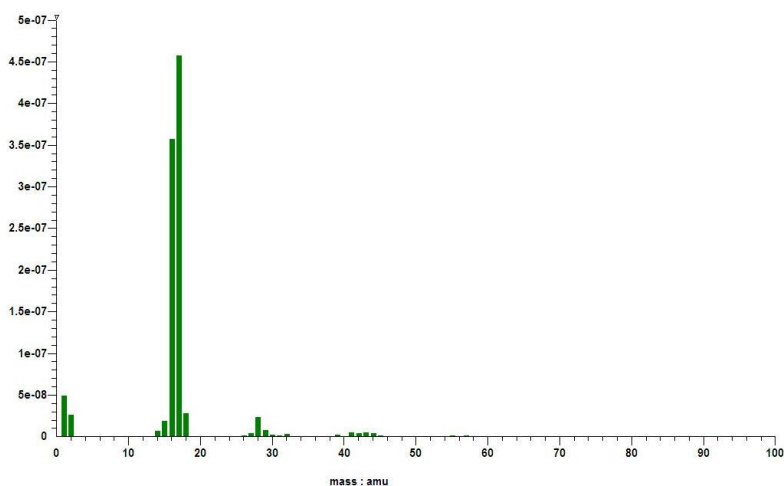


Figure 47: MS of ammonia collected at 400°C

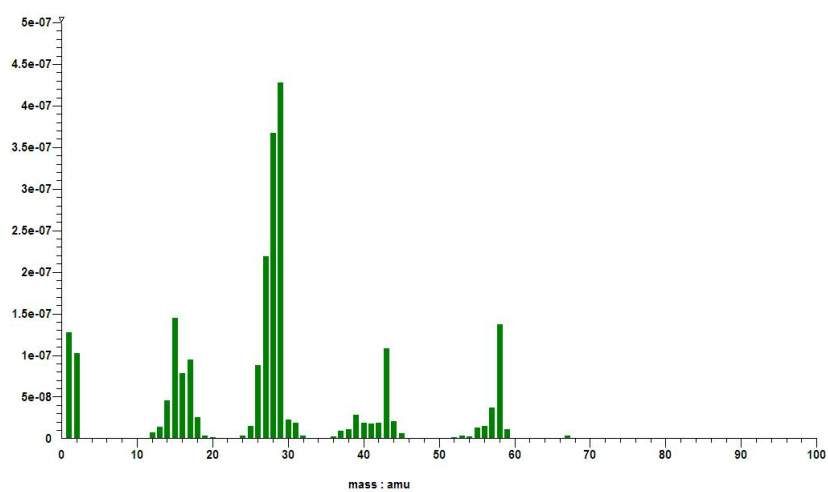


Figure 48: MS of propanal collected at 400°C

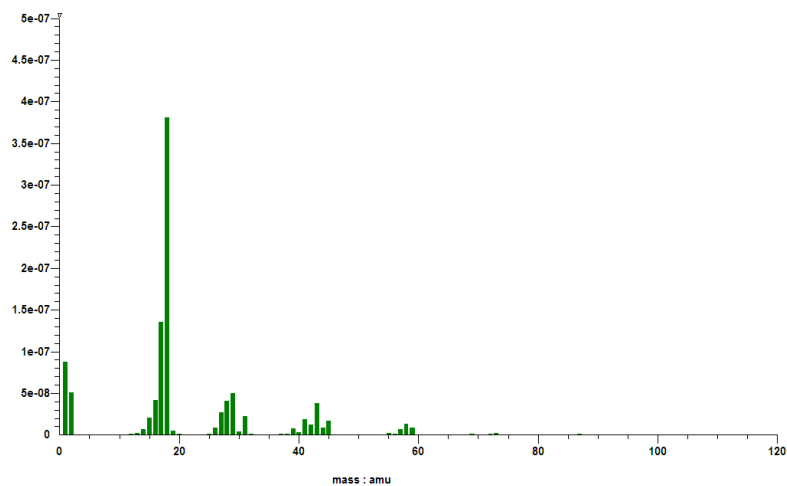


Figure 49: MS of water and higher molar mass material collected at 400°C

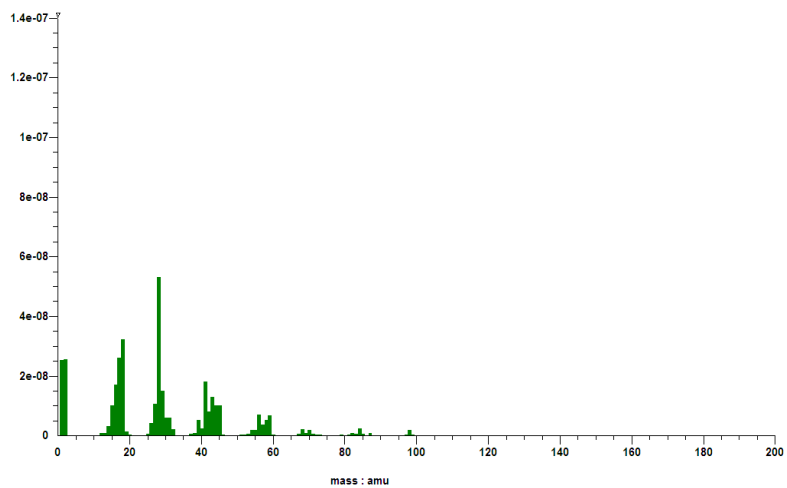


Figure 50: MS of high molar mass material at 400°C

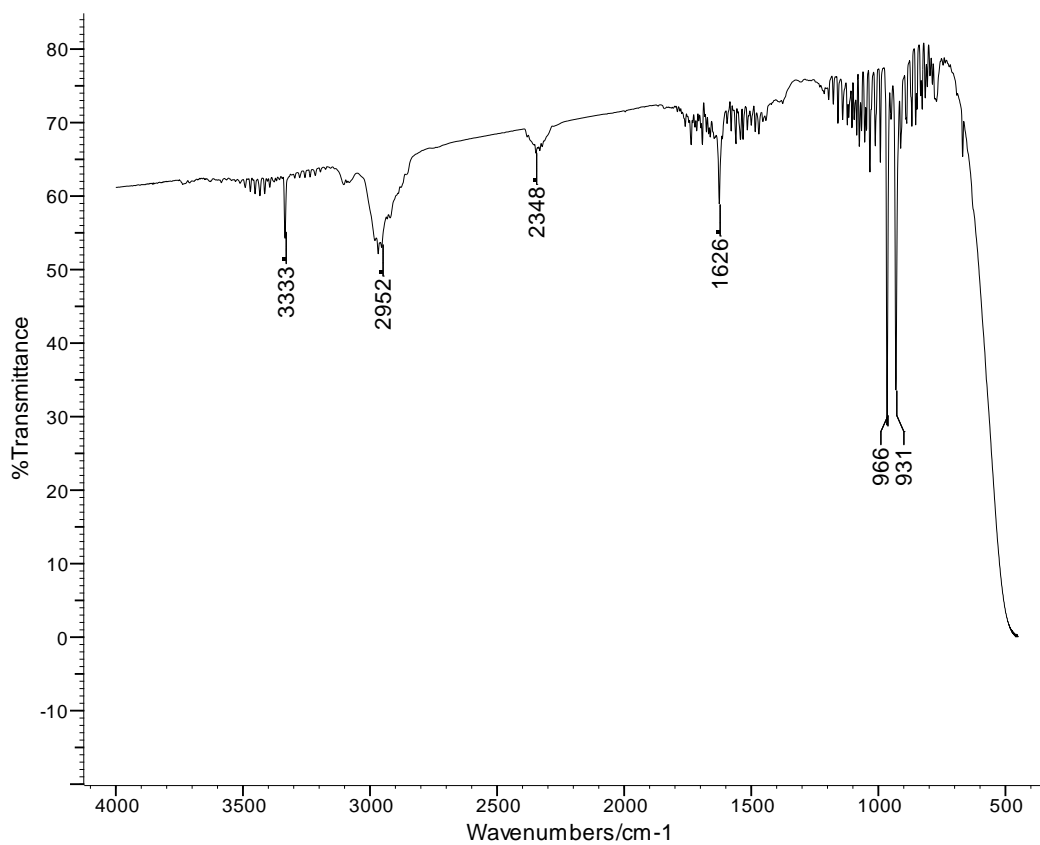


Figure 51: FTIR spectrum of fraction 1 at 400°C

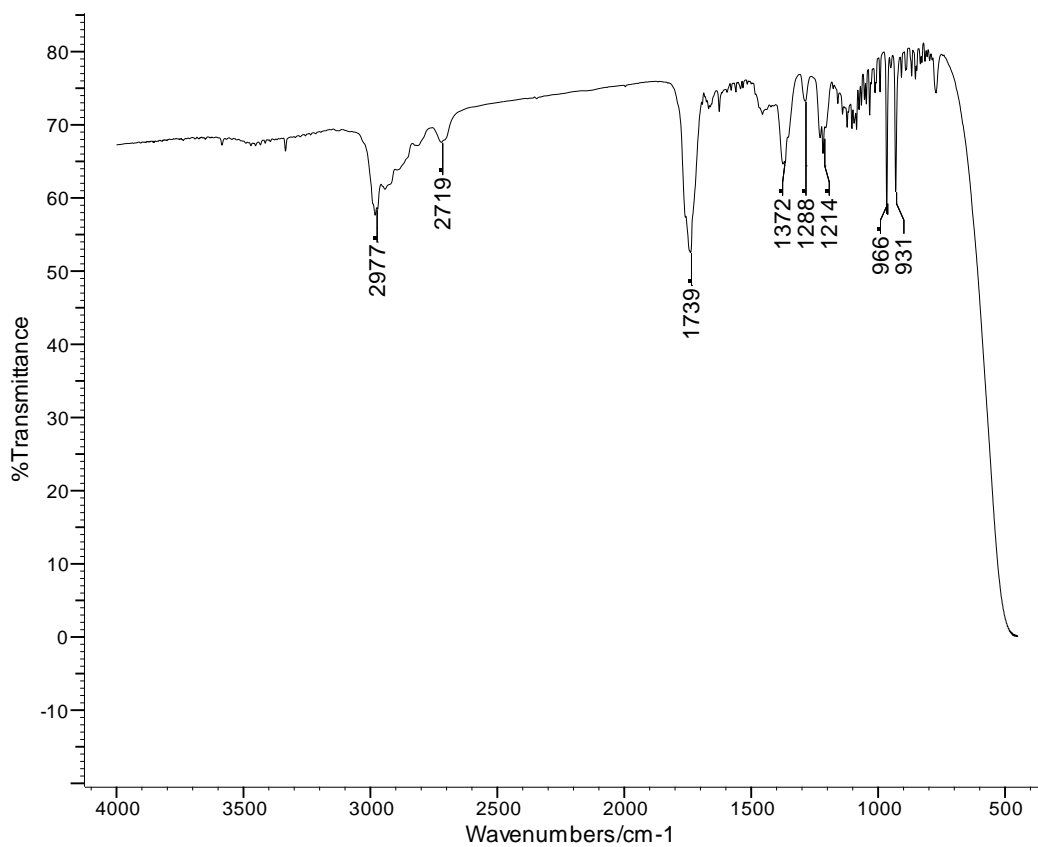


Figure 52: FTIR spectrum of fraction 2 at 400°C

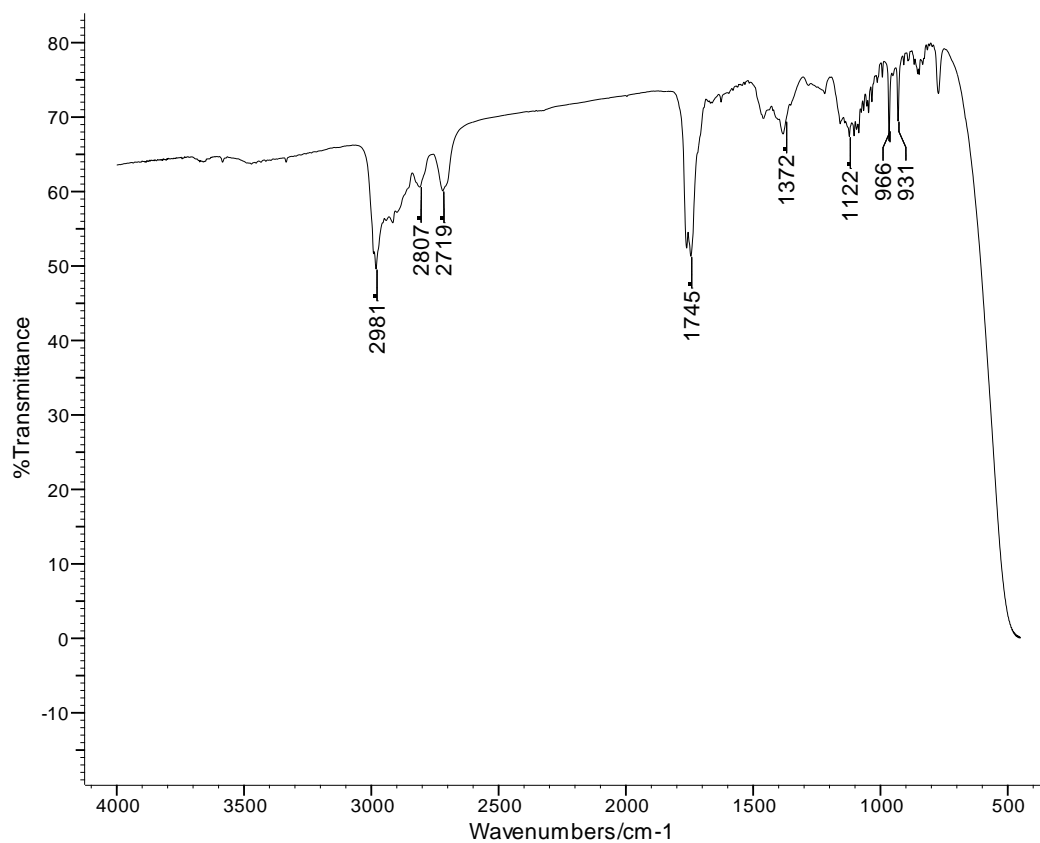


Figure 53: FTIR spectrum of fraction 3 at 400°C

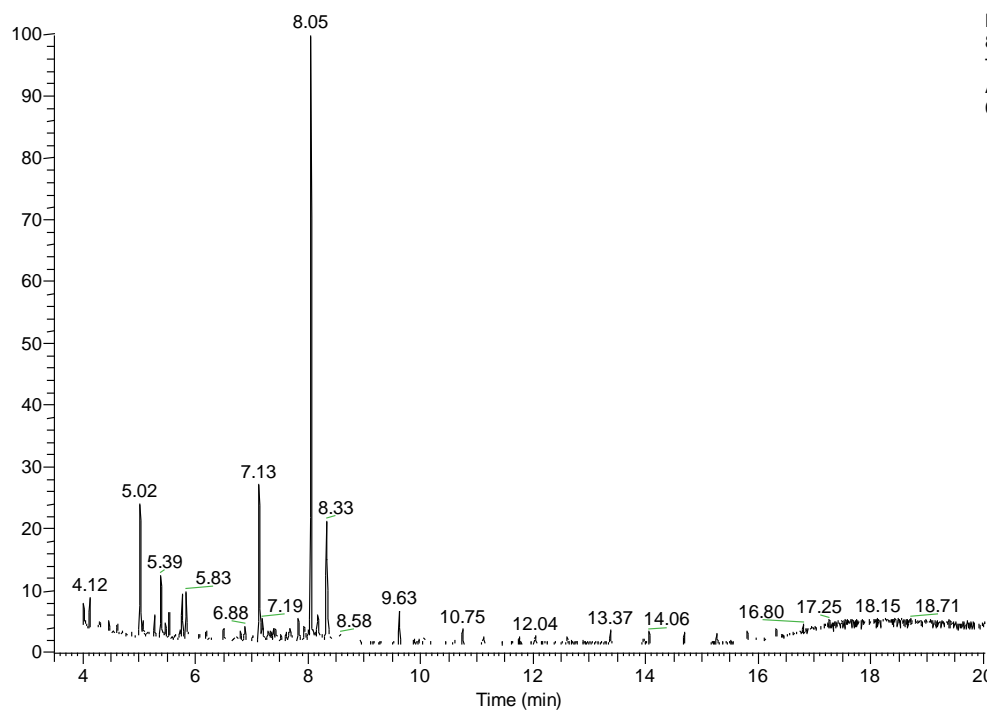


Figure 54: GC-MS chromatogram of fraction 4 at 400°C

2.4 Pyrolysis under Nitrogen

2.4.1 Cold-Ring Fractions

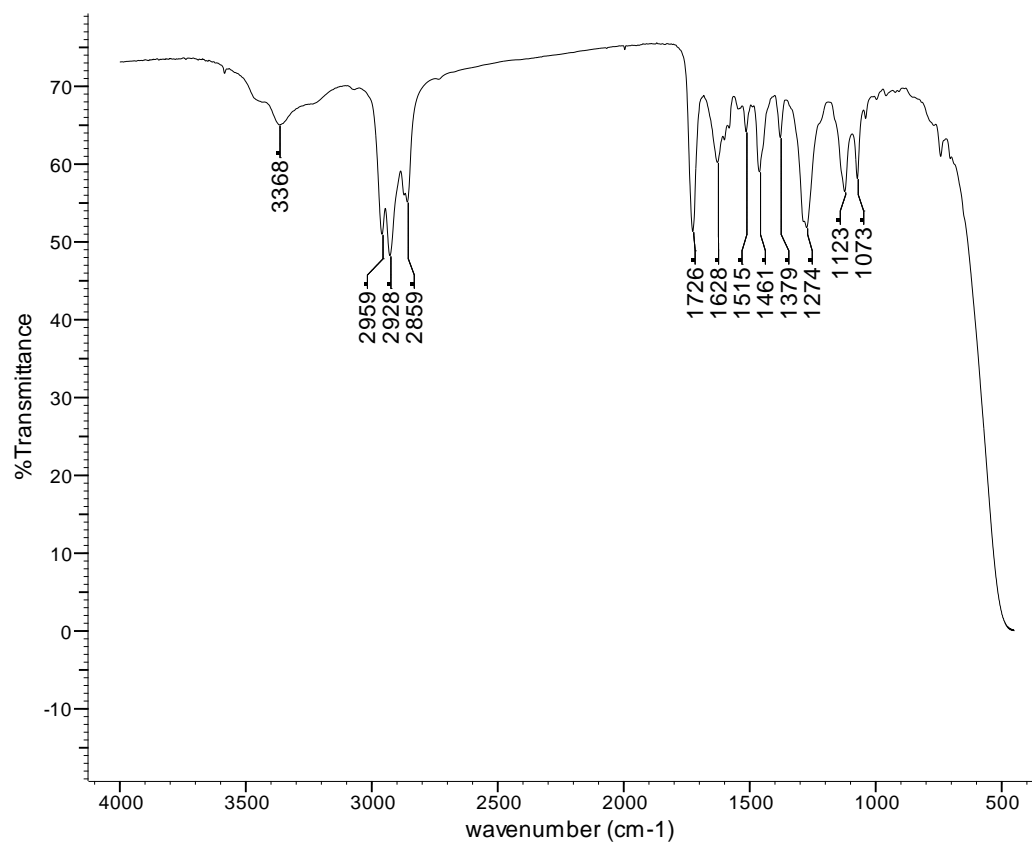


Figure 55: FTIR spectrum of the cold-ring obtained at 300°C under nitrogen

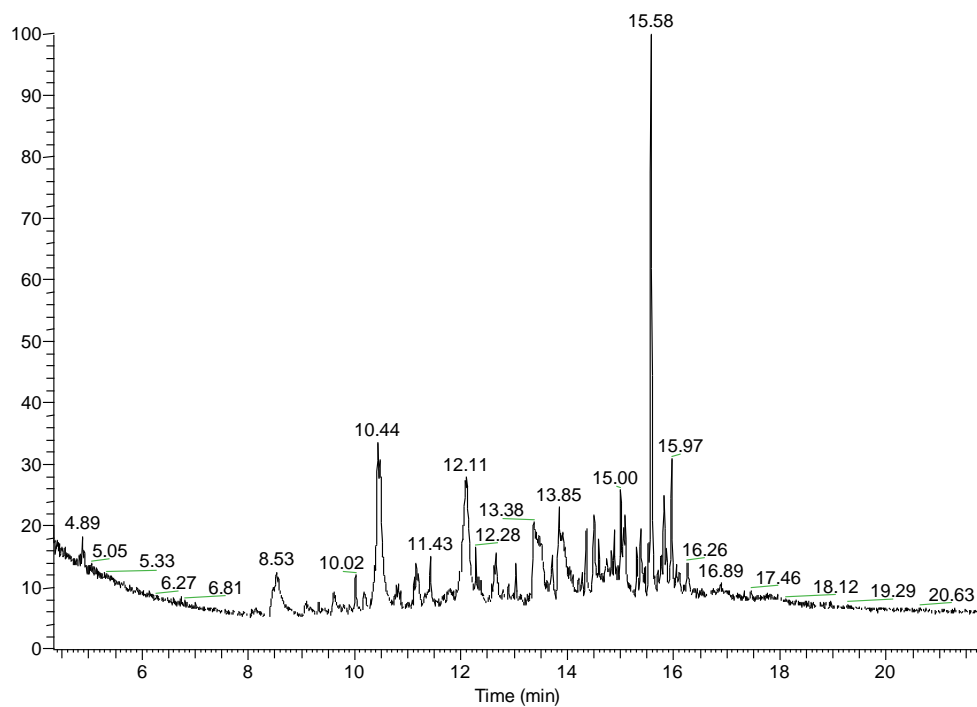


Figure 56: GC-MS chromatogram of the cold-ring fraction obtained at 300°C under nitrogen

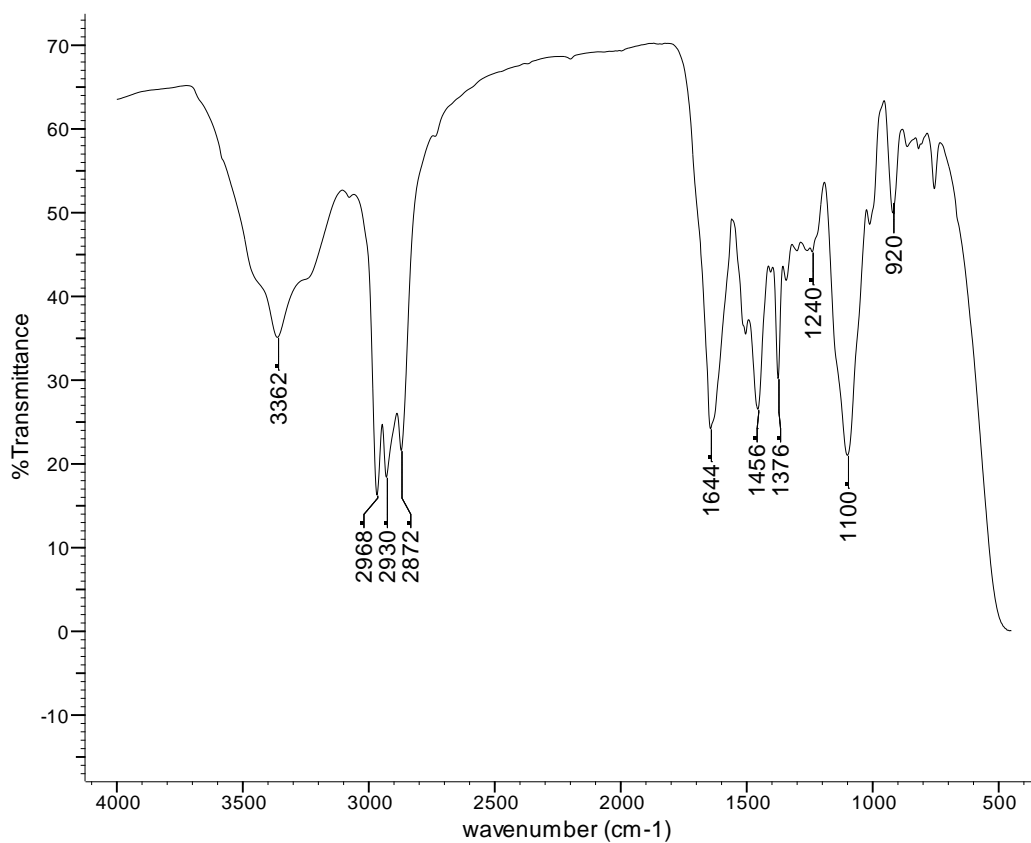


Figure 57: FTIR spectrum of the cold-ring fraction obtained at 350°C under nitrogen

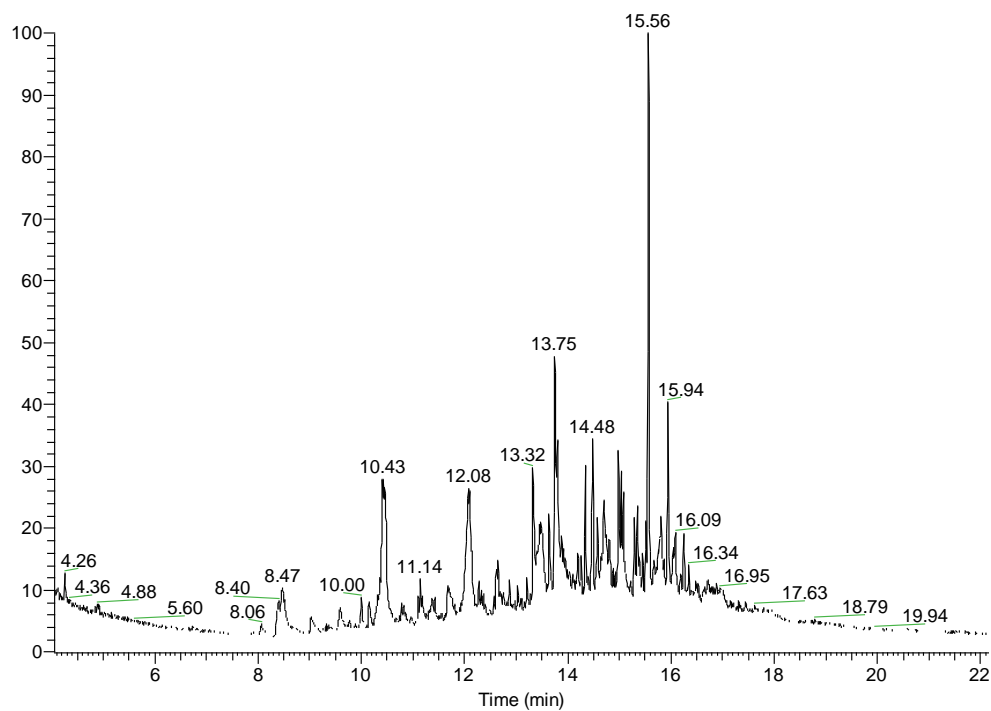


Figure 58: GC-MS chromatogram of the cold-ring fraction obtained at 350°C under nitrogen

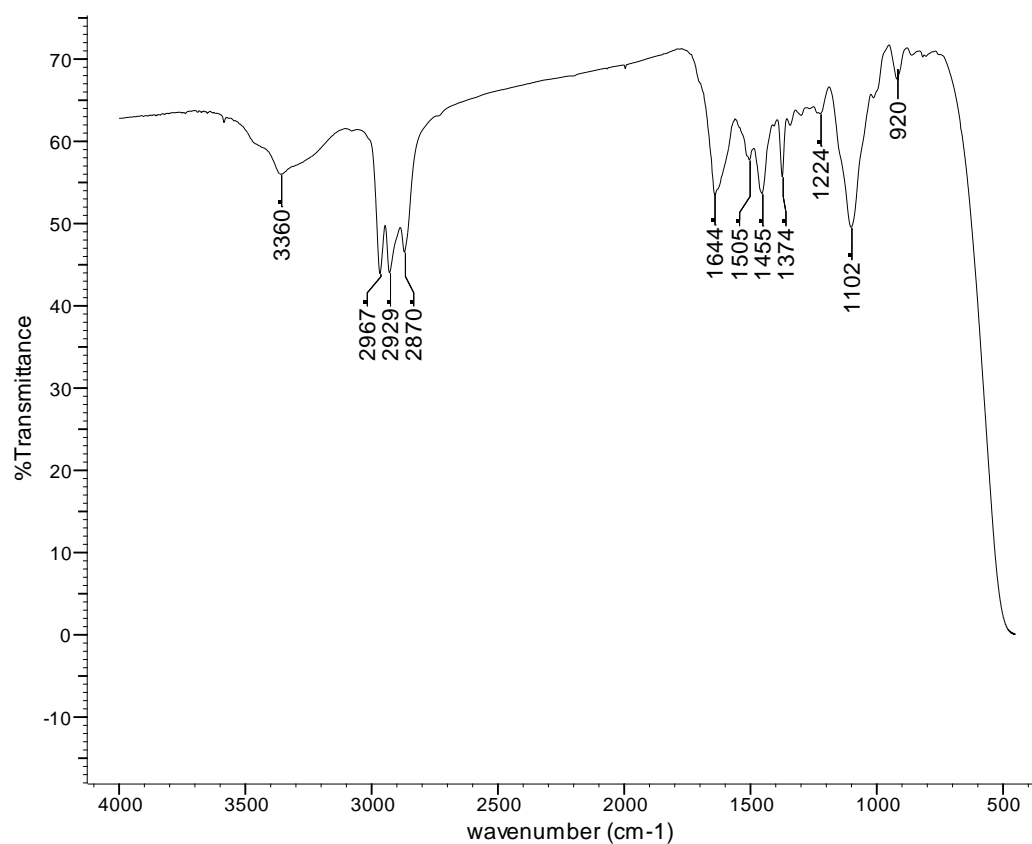


Figure 59: FTIR spectrum of the cold-ring fraction obtained at 400°C under nitrogen

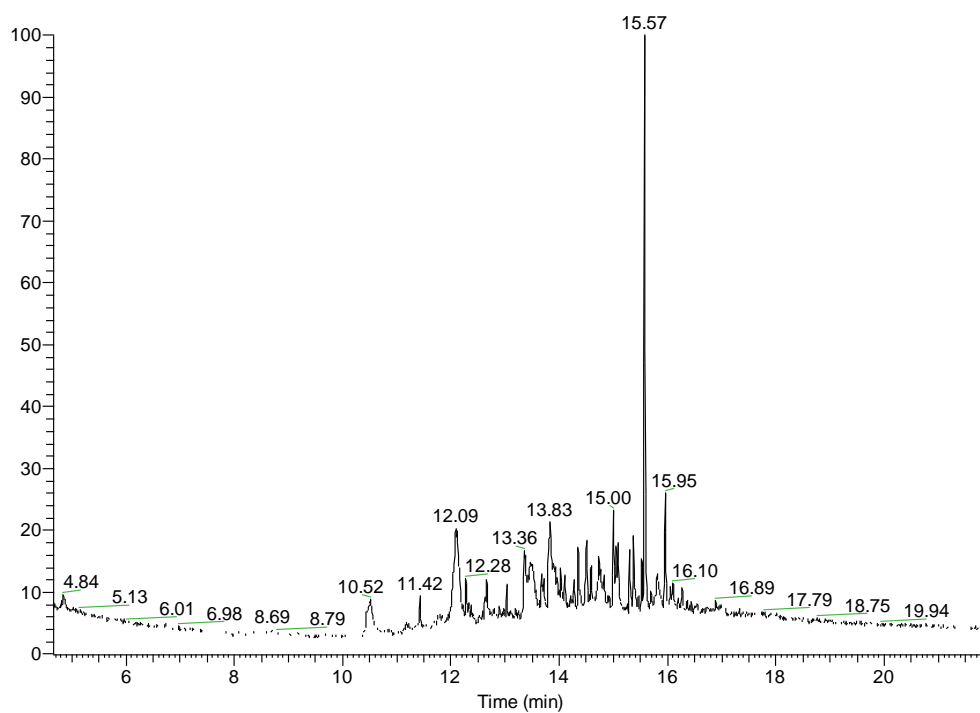


Figure 60: GC-MS chromatogram of the cold-ring fraction obtained at 400°C under nitrogen

2.4.2 Tars

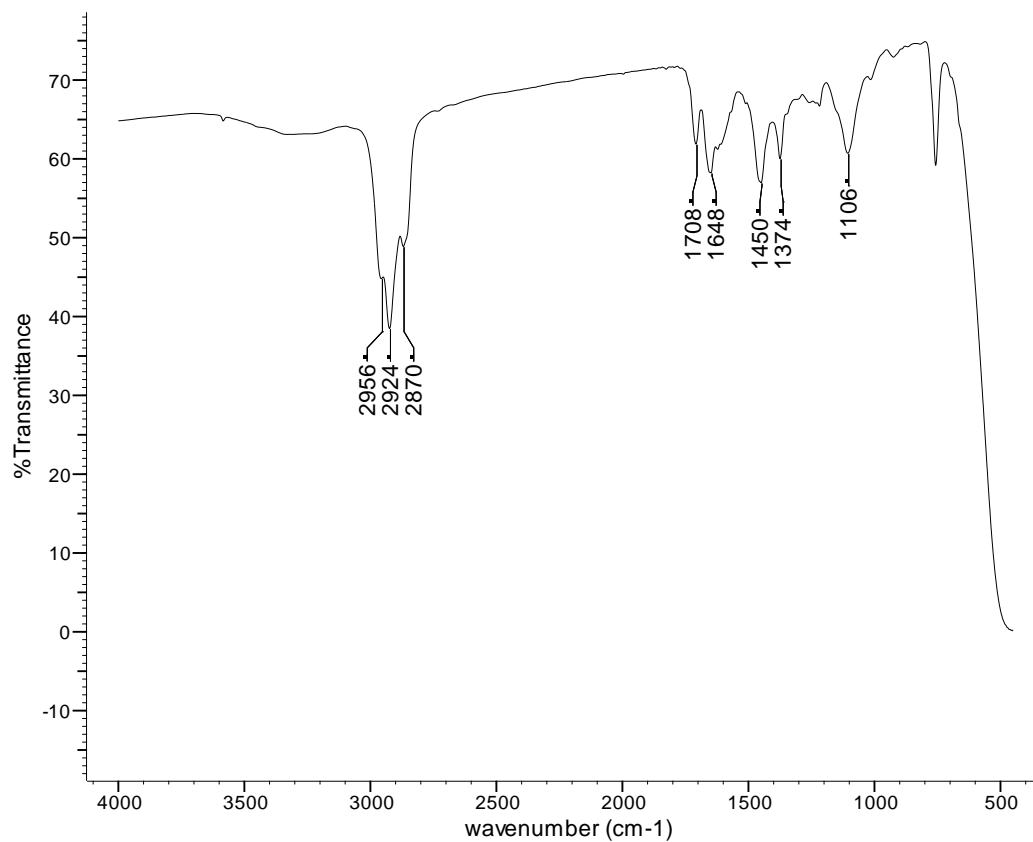


Figure 61: FTIR spectrum of the tar extracted at 350°C under nitrogen

2.5 Pyrolysis under Air

2.5.1 Cold-Ring Fractions

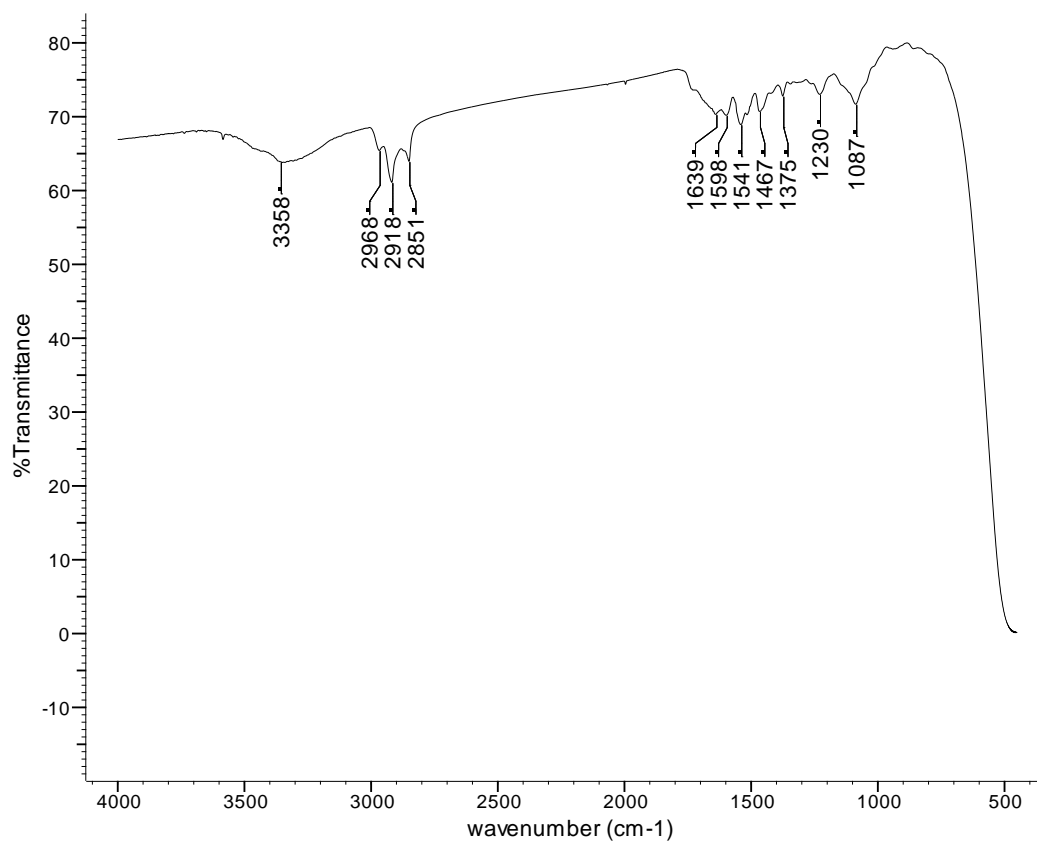


Figure 62: FTIR spectrum of the cold-ring fraction obtained at 250°C under air

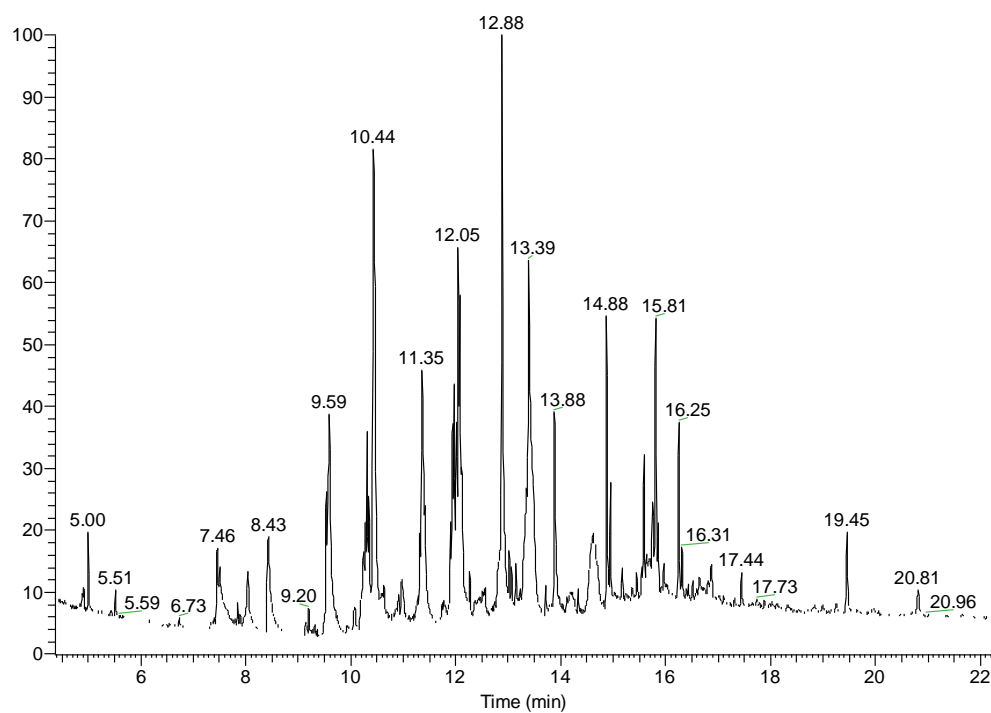


Figure 63: GC-MS chromatogram of the cold-ring fraction obtained at 250°C under air

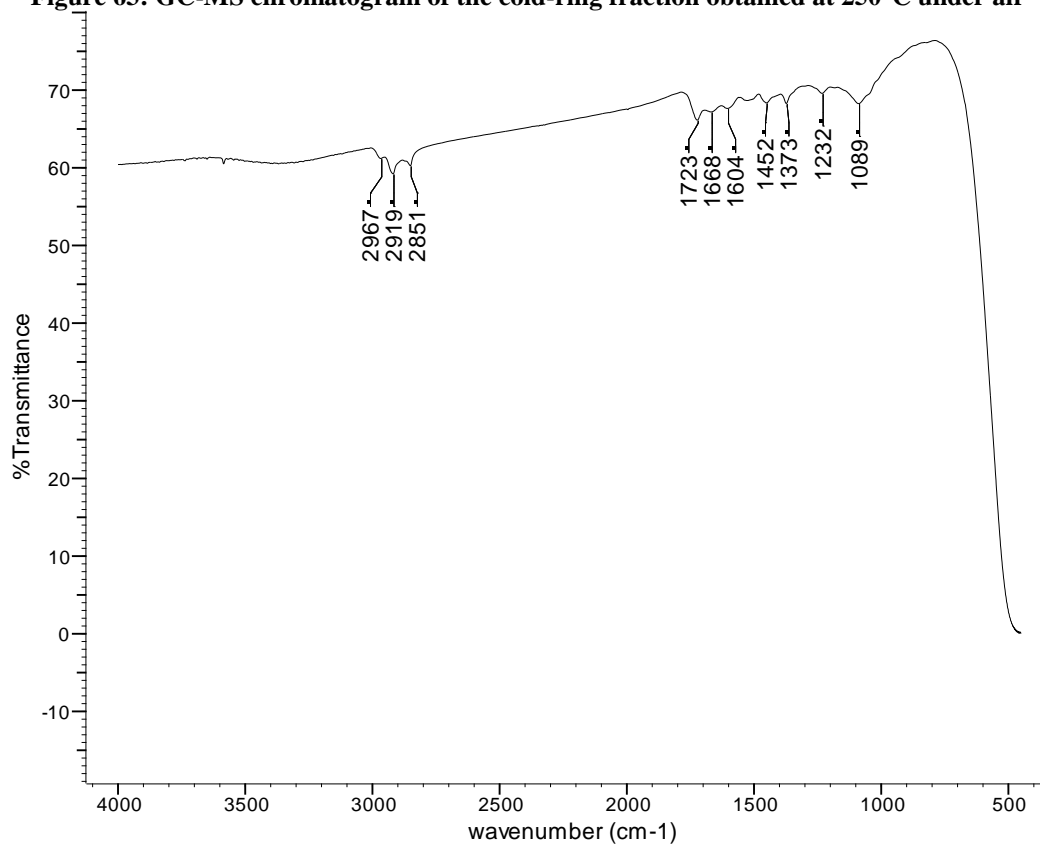


Figure 64: FTIR spectrum of the cold-ring fraction obtained at 300°C under air

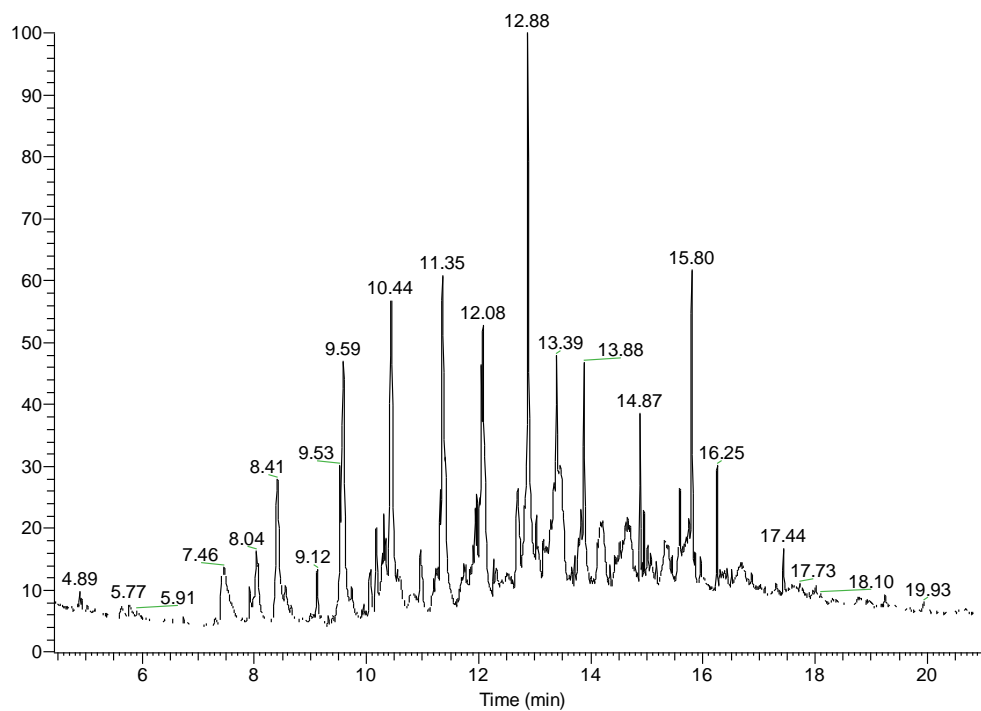


Figure 65:GC-MS chromatogram of the cold-ring fraction obtained at 300°C under air

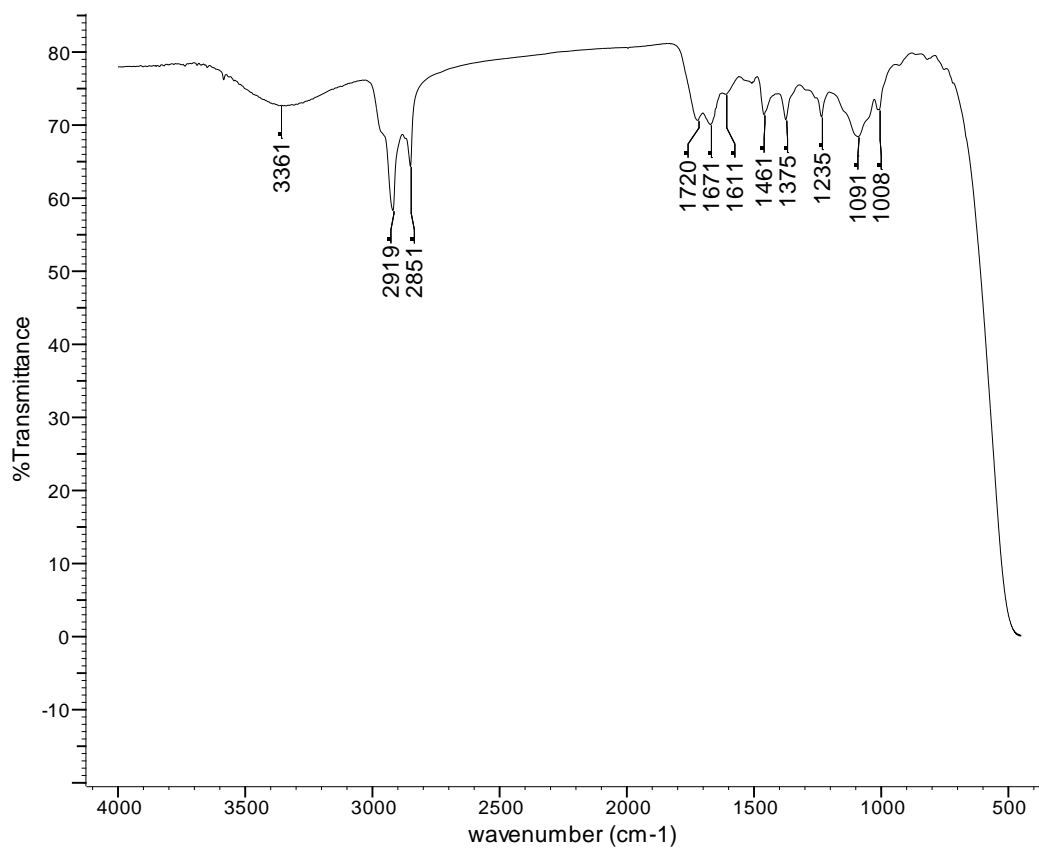


Figure 66: FTIR spectrum of the cold-ring fraction obtained at 350°C under air

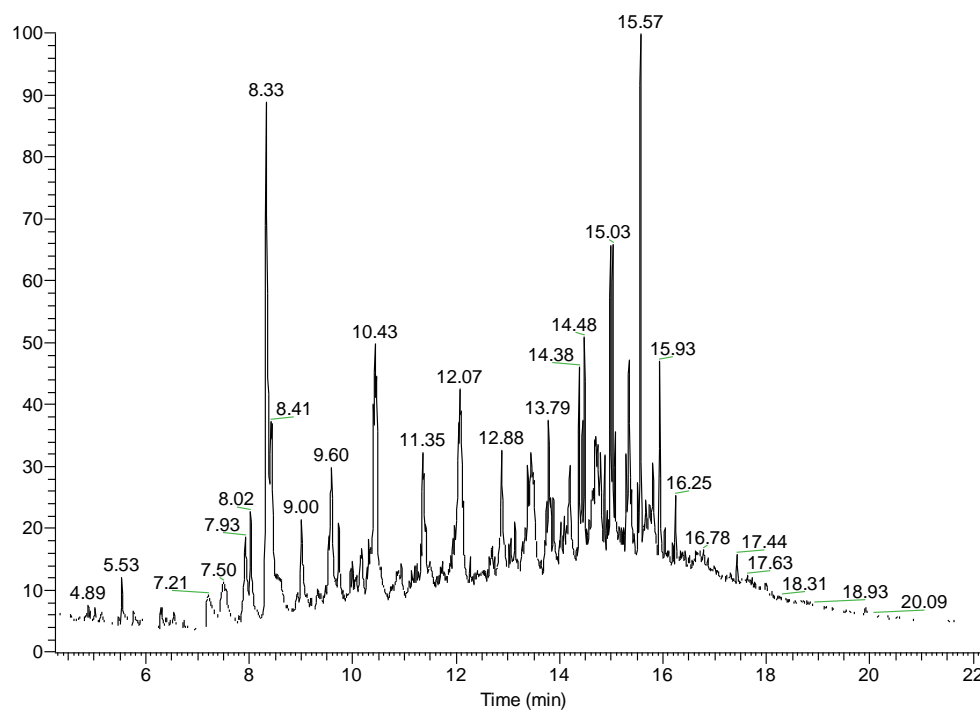


Figure 67:GC-MS chromatogram of the cold-ring fraction obtained at 350°C under air

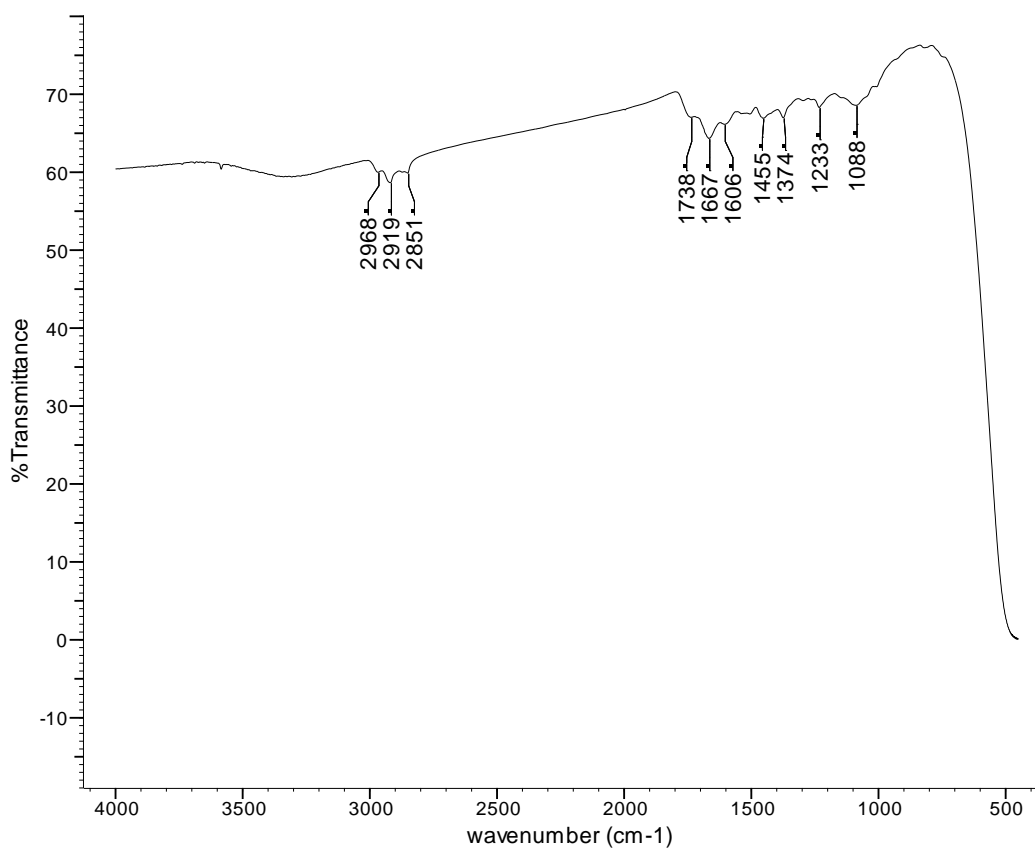


Figure 68:FTIR spectrum of the cold-ring fraction obtained at 400°C under air

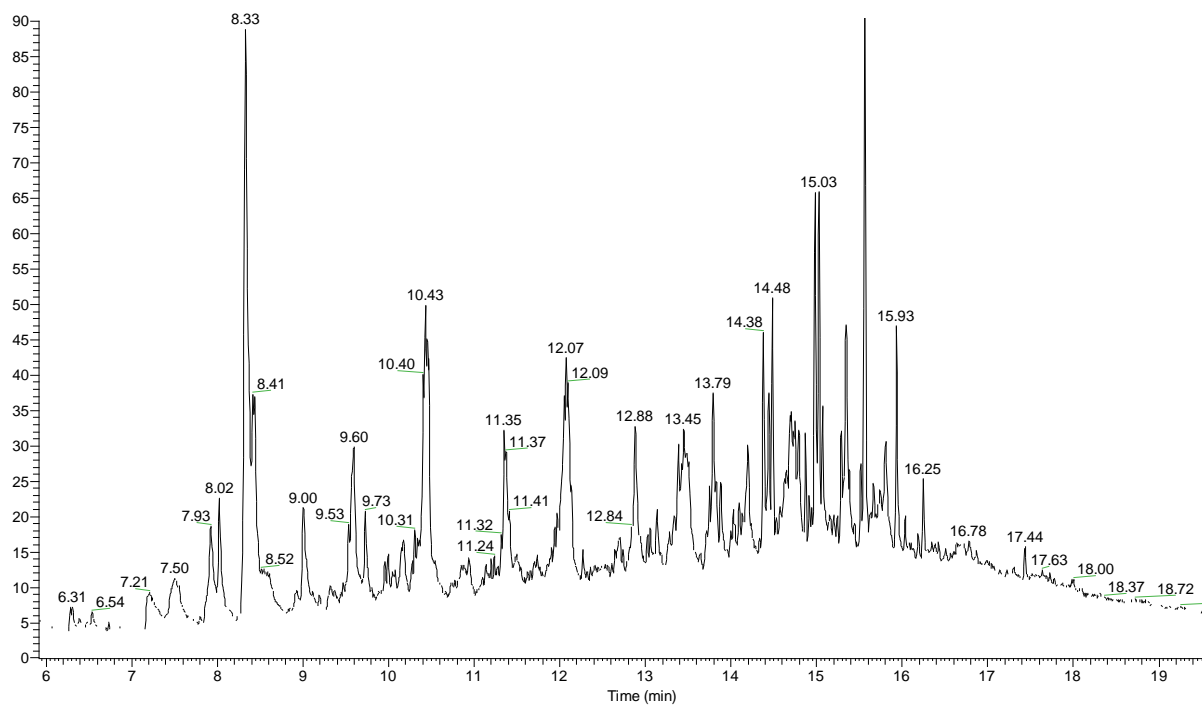


Figure 69:GC-MS chromatogram of the cold-ring fraction obtained at 400°C under air

2.5.2 Tars

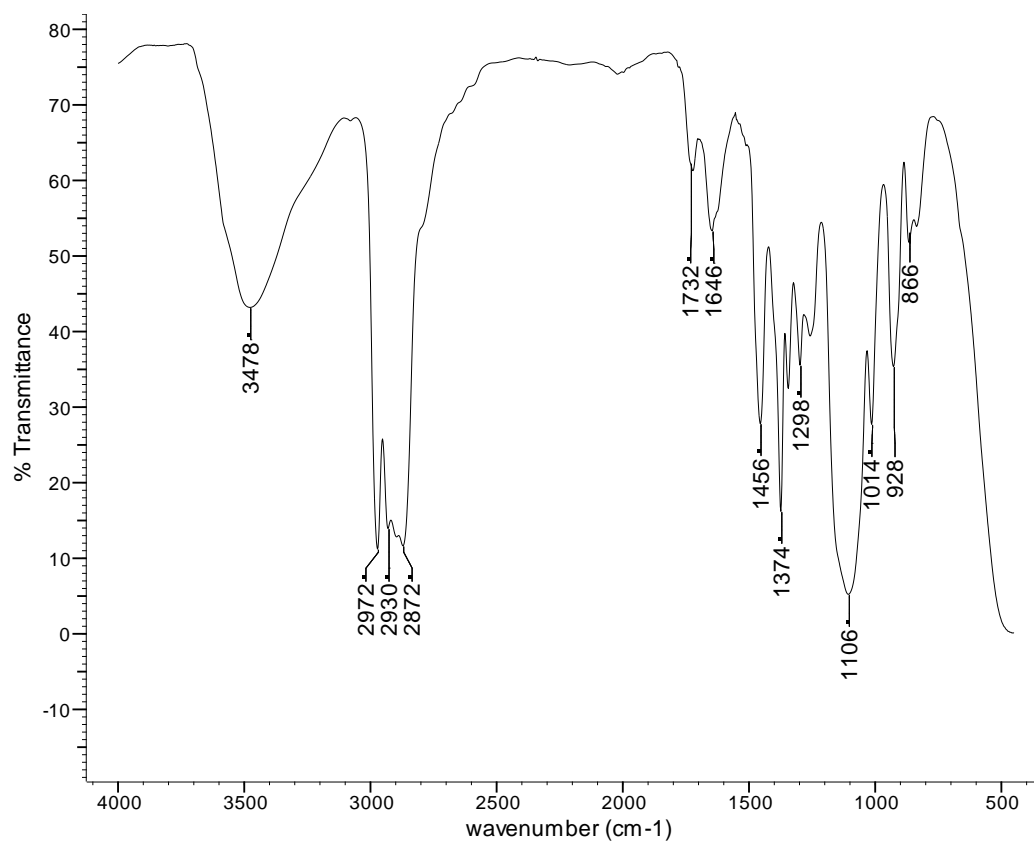


Figure 70: FTIR spectrum of the tar extracted at 300°C under air

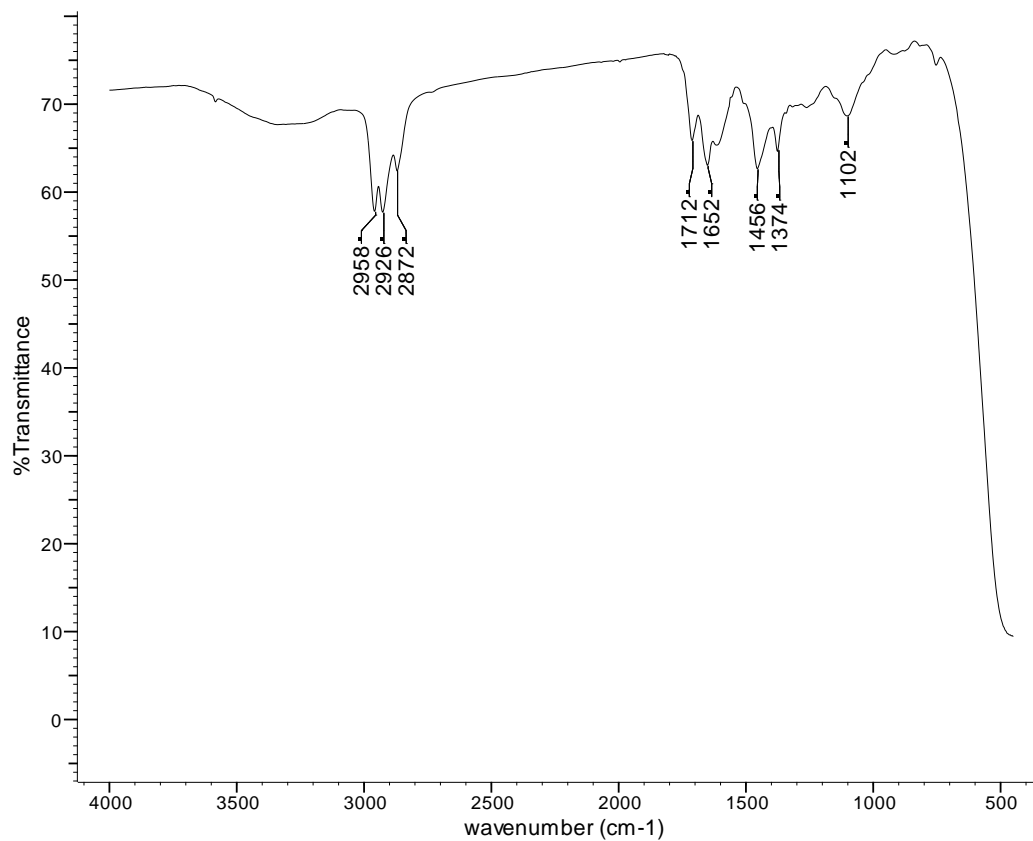


Figure 71: FTIR spectrum of the tar extracted at 350°C under air

2.6 Pyrolysis under 3% oxygen in nitrogen

2.6.1 Cold-Ring Fractions

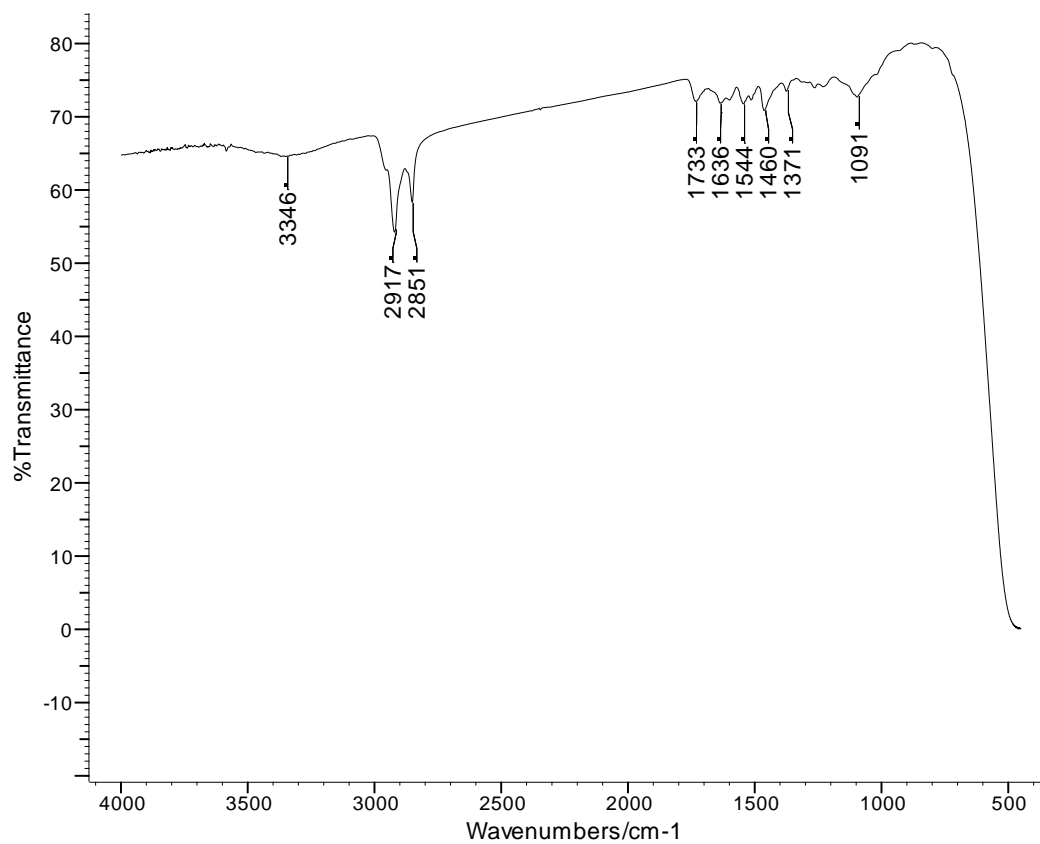


Figure 72: FTIR spectrum of the cold-ring fraction obtained at 250°C under 3% O₂ in nitrogen

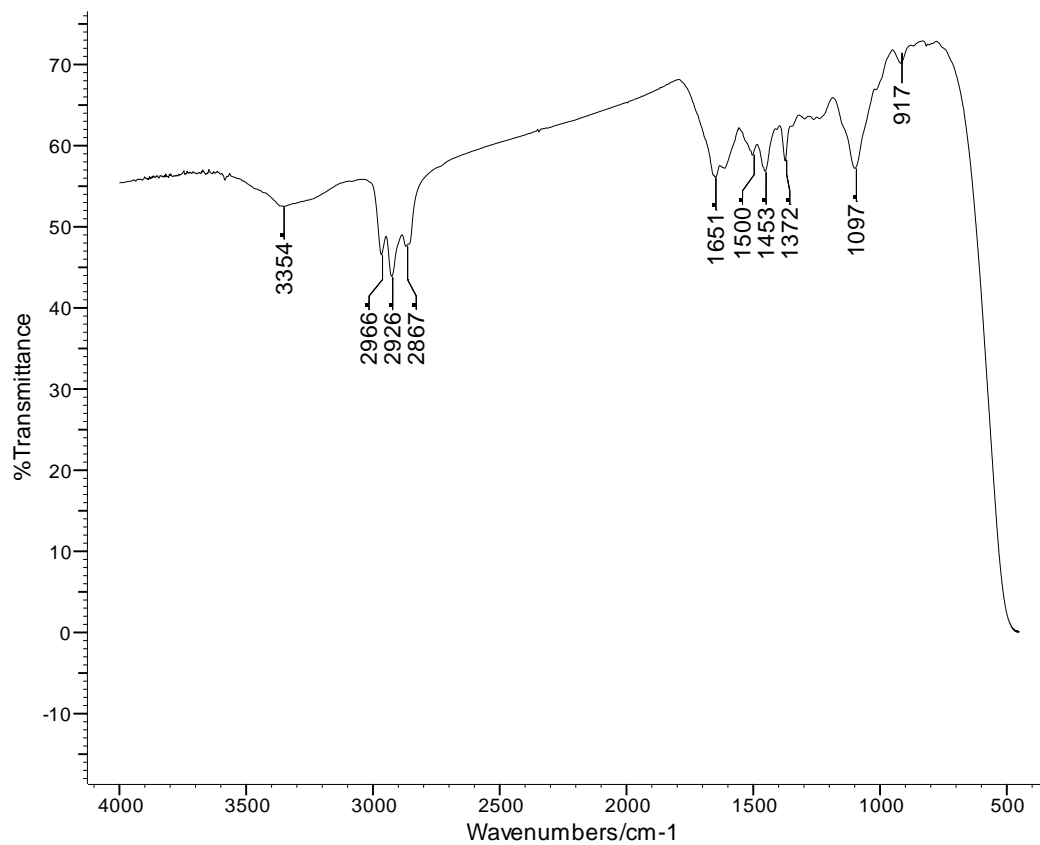


Figure 73: FTIR spectrum of the cold-ring fraction obtained at 300°C under 3% O₂ in nitrogen

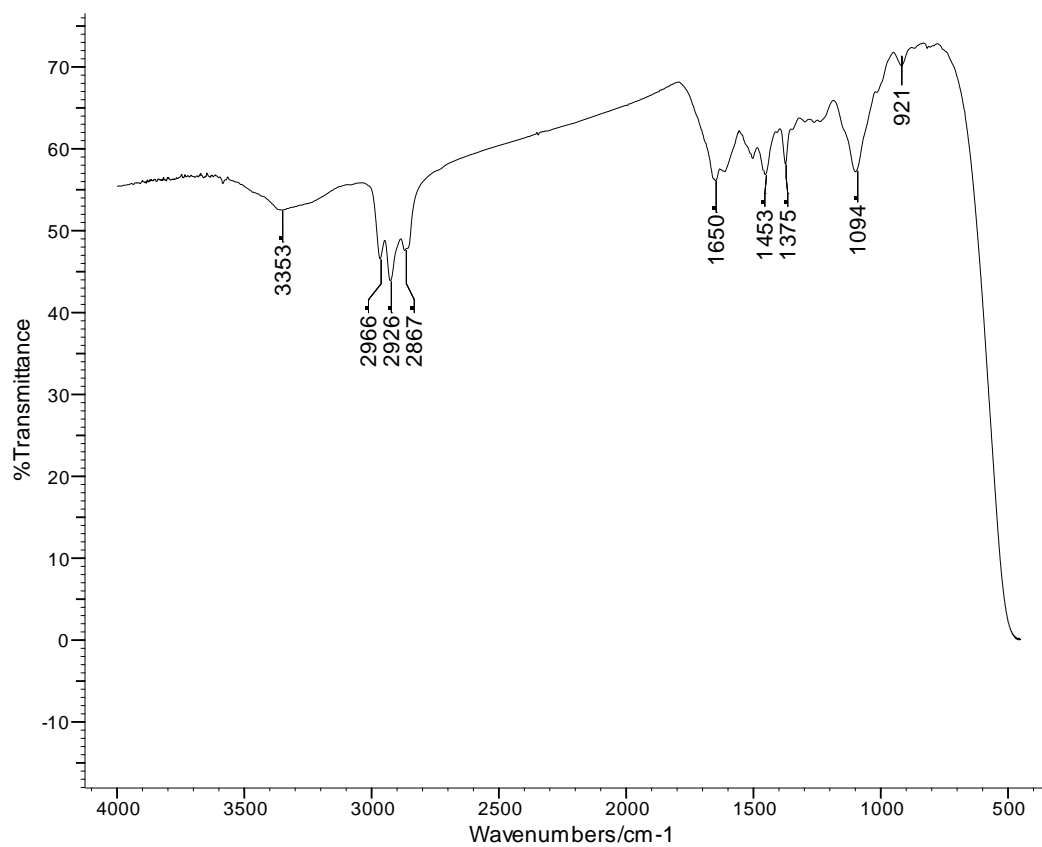


Figure 74: FTIR spectrum of the cold-ring fraction obtained at 350°C under 3% O₂ in nitrogen

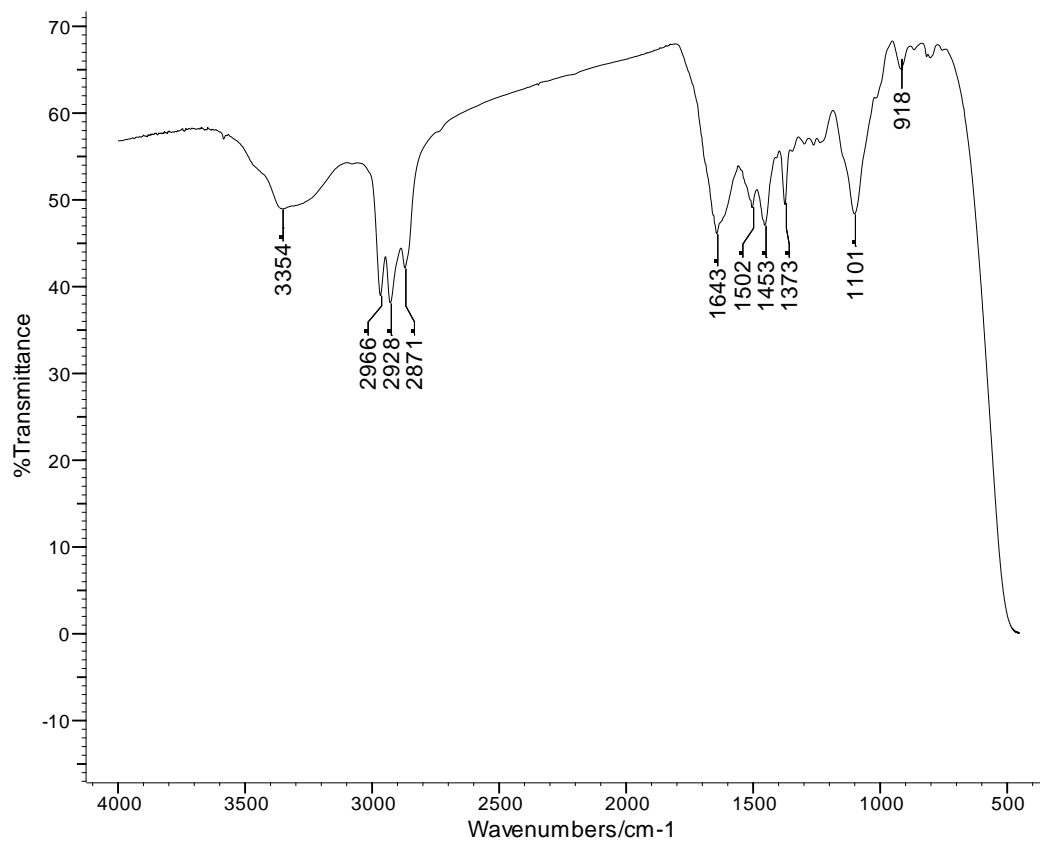


Figure 75: FTIR spectrum of the cold-ring fraction obtained at 400°C under 3% O₂ in nitrogen

2.6.2 Tars

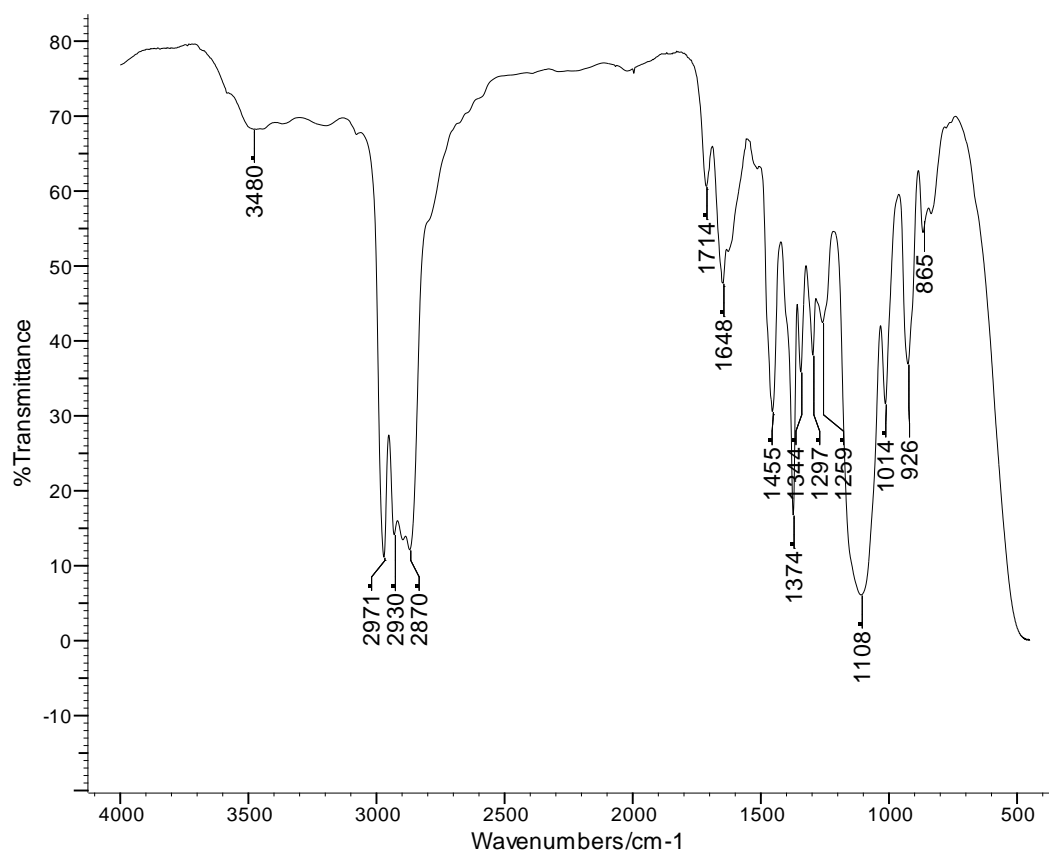


Figure 76: FTIR spectrum of the tar extracted at 300°C under 3% O₂ in nitrogen

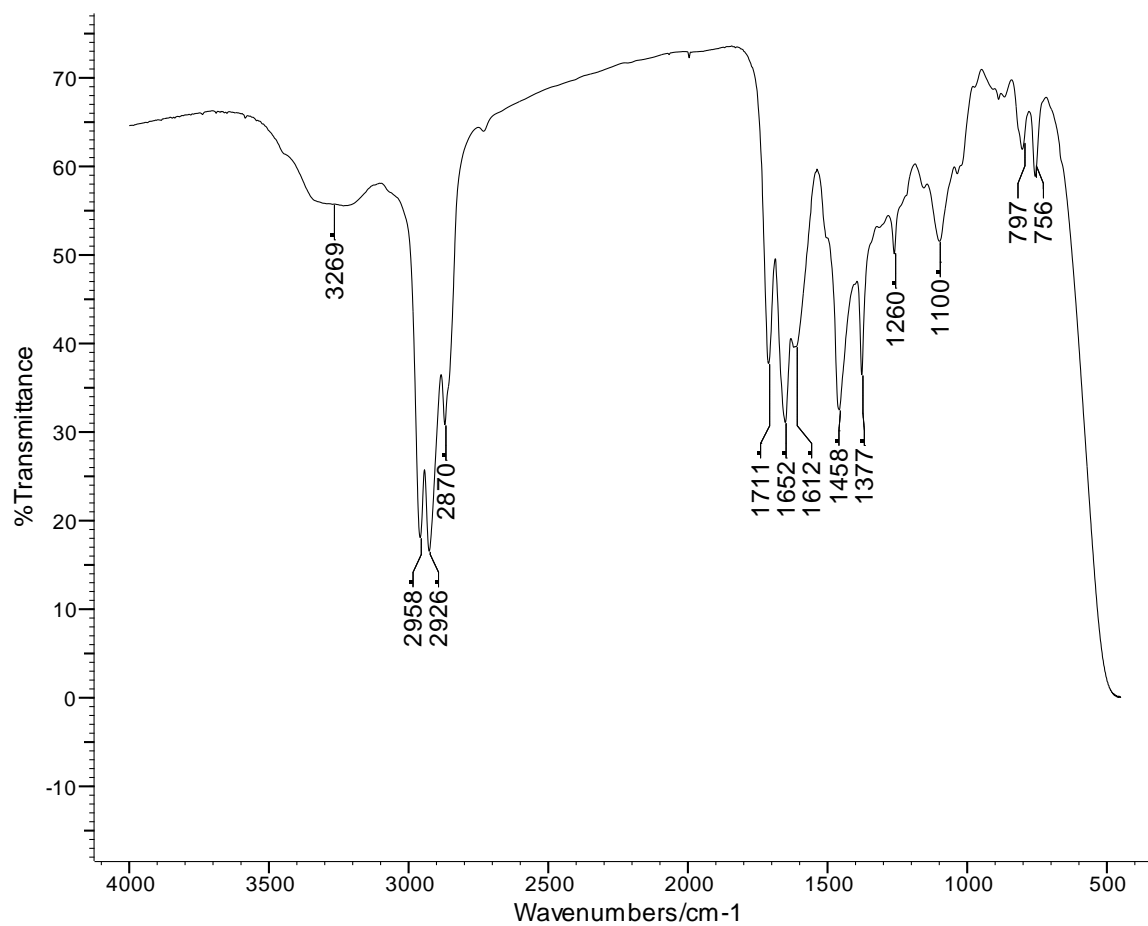


Figure 77: FTIR spectrum of the tar extracted at 350°C under 3% O₂ in nitrogen

2.6.3 Solid state NMR

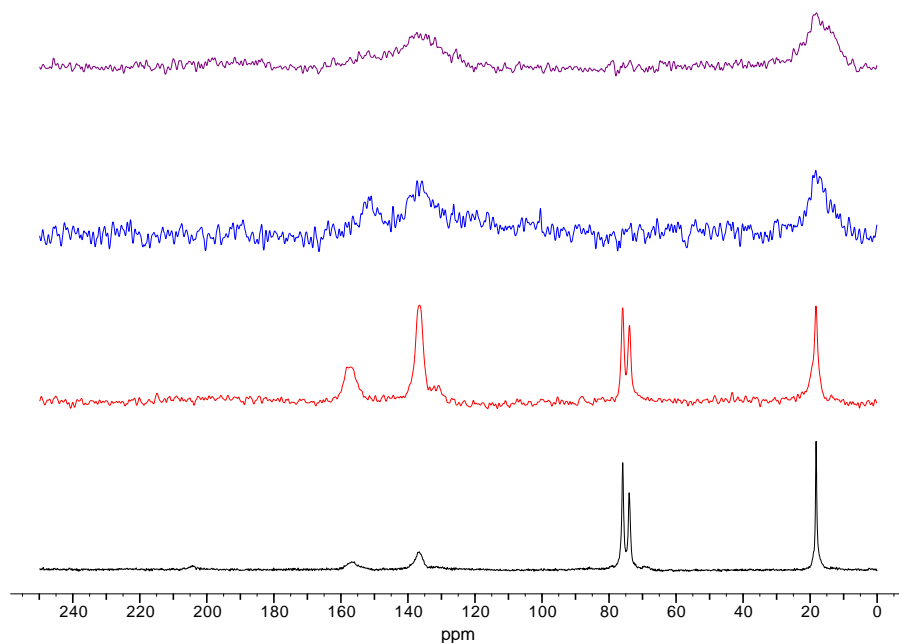
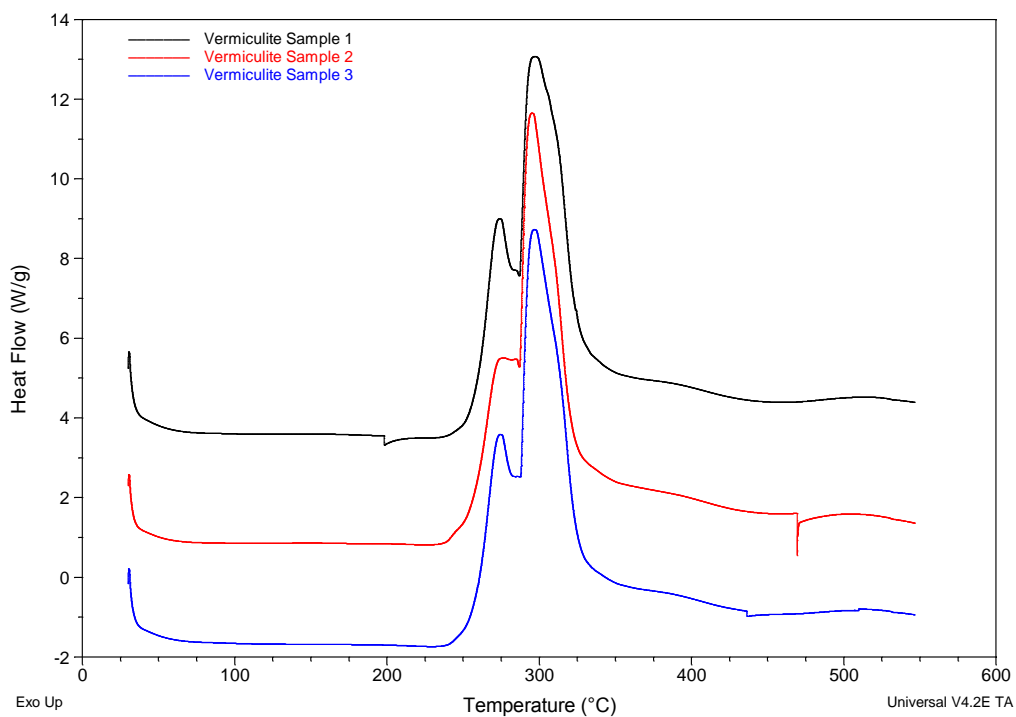
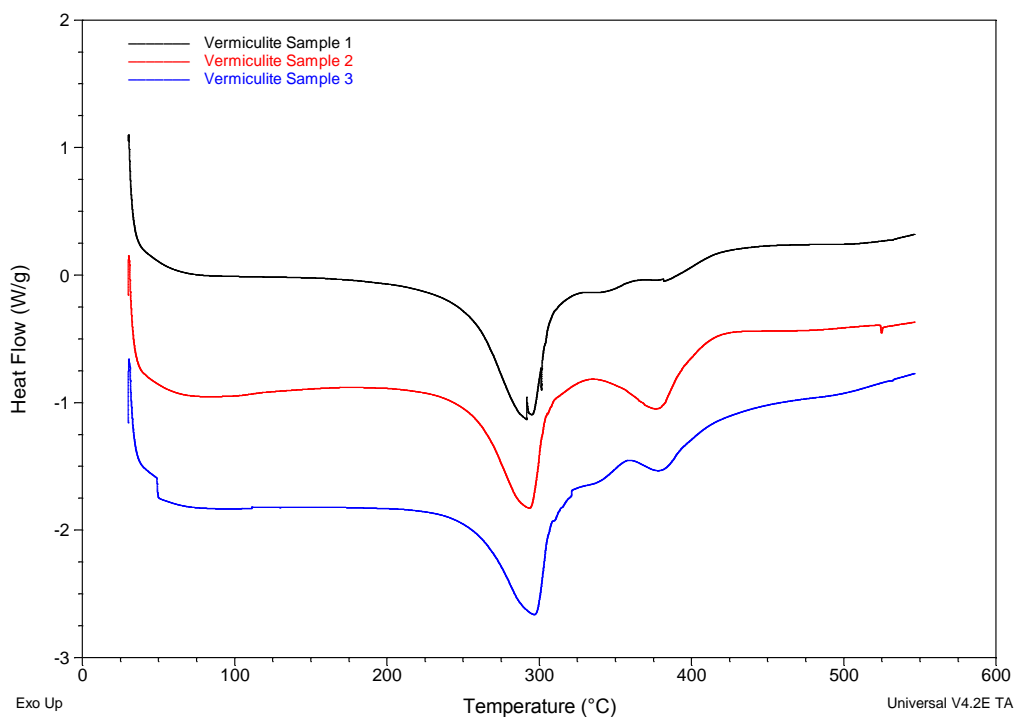
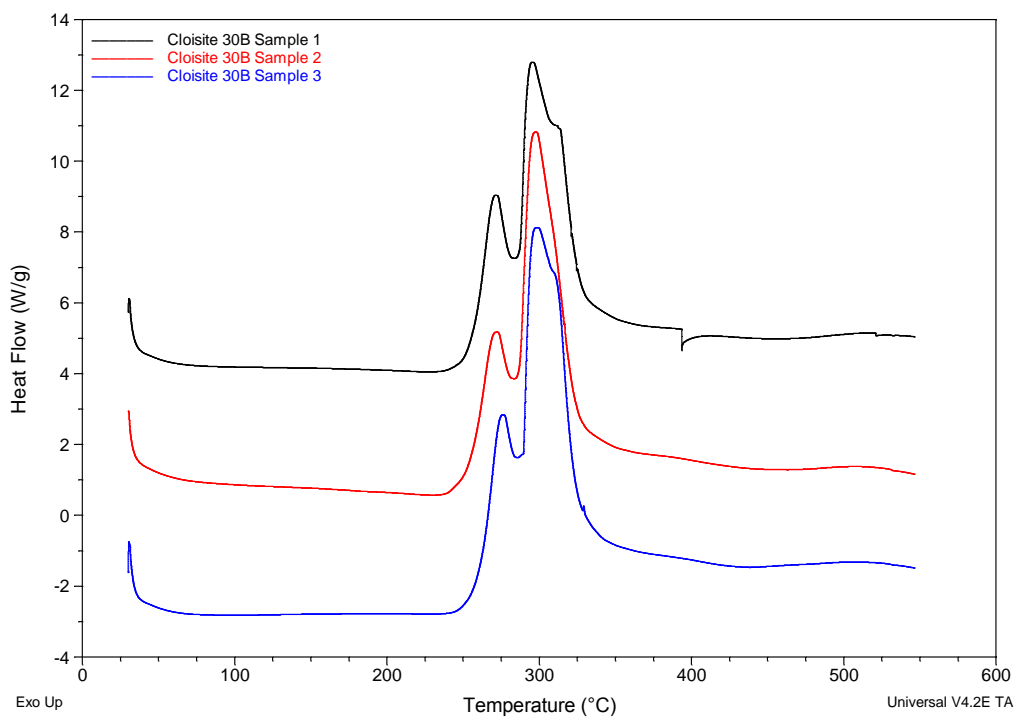
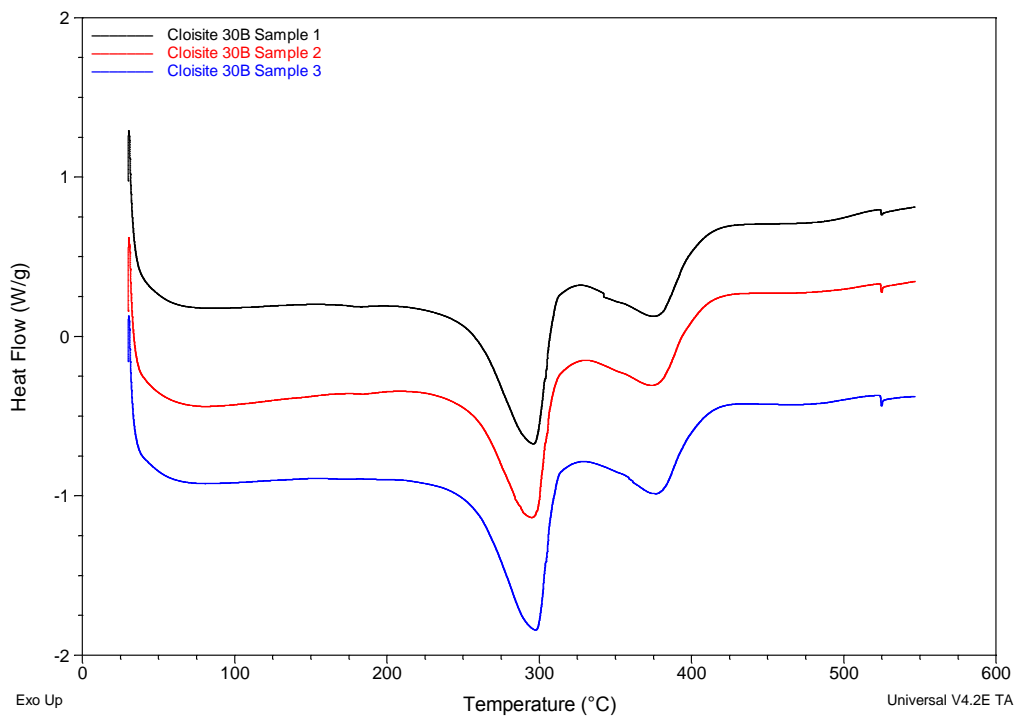


Figure 78: Comparison of the ^{13}C CPMAS dipolar dephased spectra of the virgin foam (black) with the chars obtained after pyrolysis under 3% oxygen in nitrogen at 250°C (red), 300°C (blue), 350°C (purple) and 400°C (pink)

Appendix 3: Nanocomposite Foams

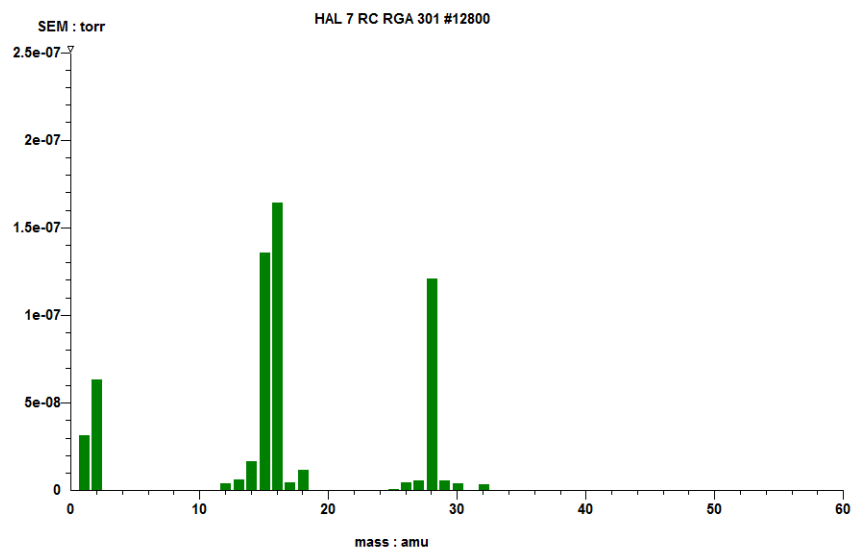
2.7 DSC Repeat Analyses

**Figure 79: Vermiculite foam in air****Figure 80: Vermiculite foam in N₂**

**Figure 81: Cloisite 30B foam in air****Figure 82: Cloisite 30B foam in N₂**

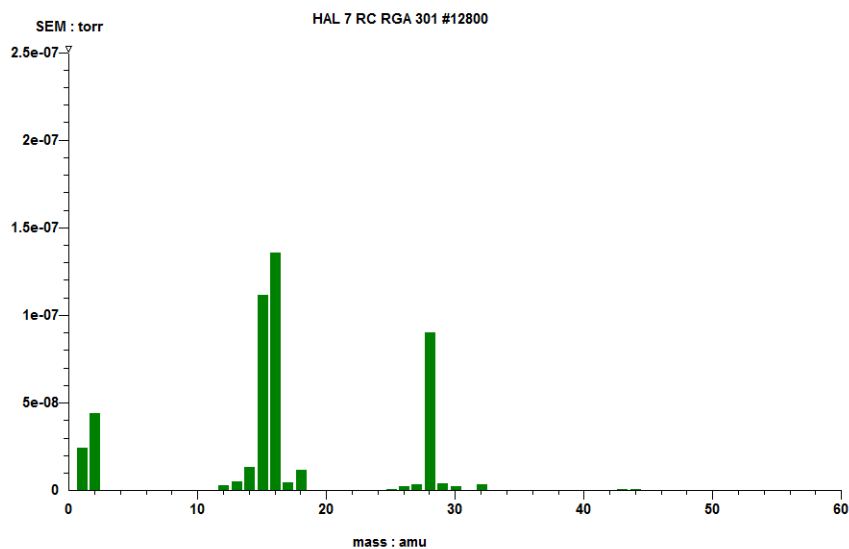
2.8 TVA Studies

2.8.1 Non-condensables



Time 09:29:16 Date 15/08/2011

83: vermiculite



Time 09:51:04 Date 16/08/2011

84: Clositie

2.9 TVA- cold ring fractions

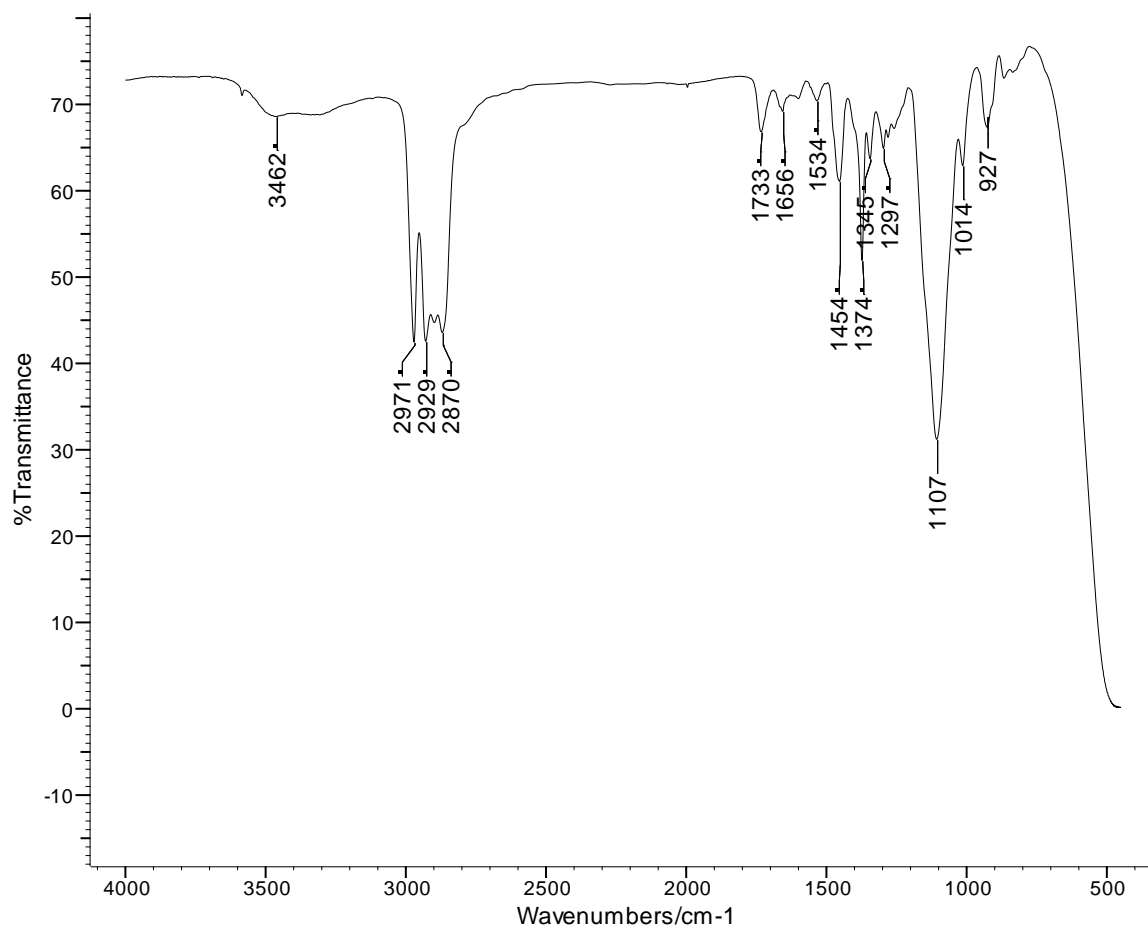


Figure 85: FTIR spectrum of the cold-ring fraction collected from the vermiculite foam

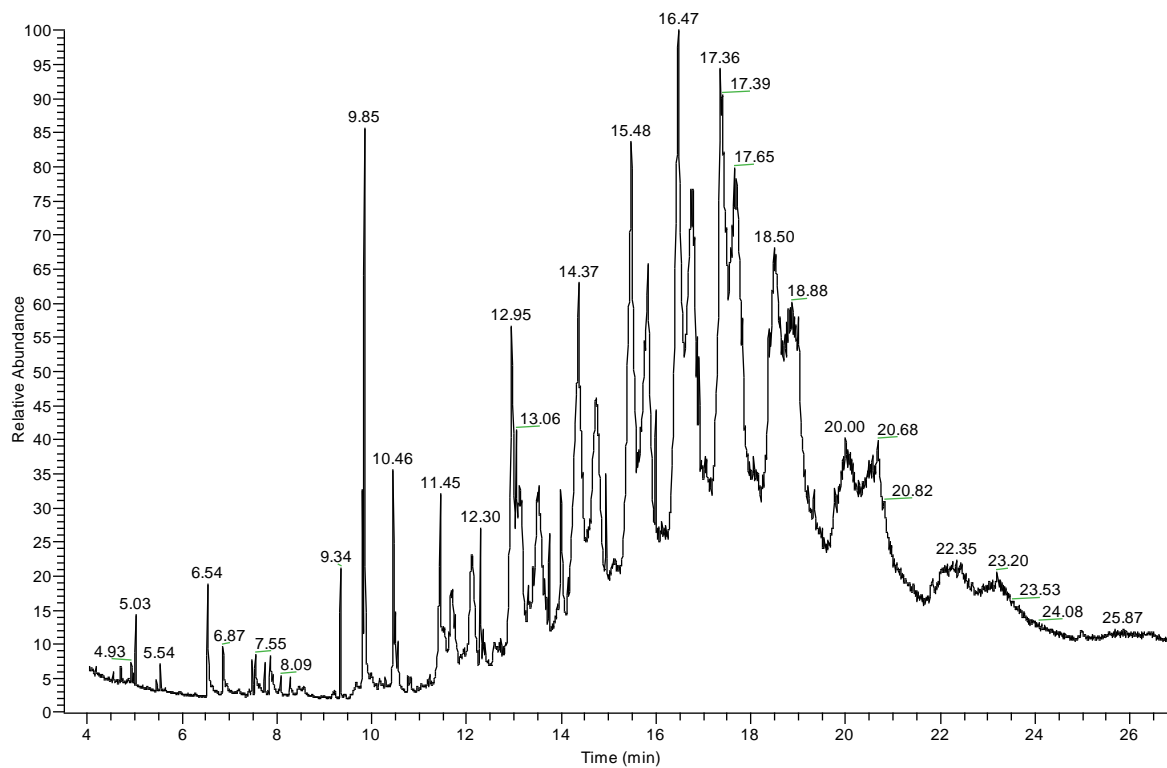


Figure 86: GC-MS total-ion chromatogram for the cold-ring fraction collected from the vermiculite foam

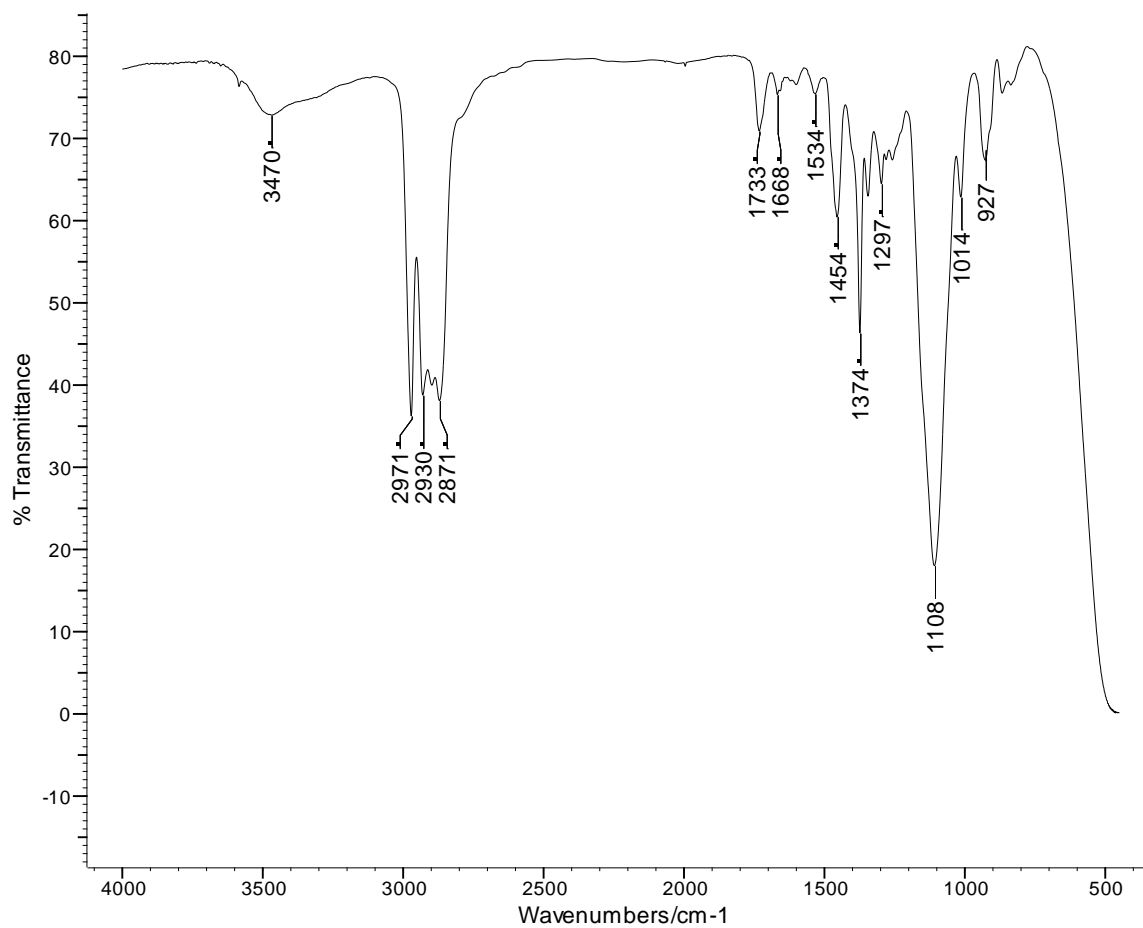


Figure 87: FTIR spectrum of the cold-ring fraction collected from the Cloisite® 30B foam

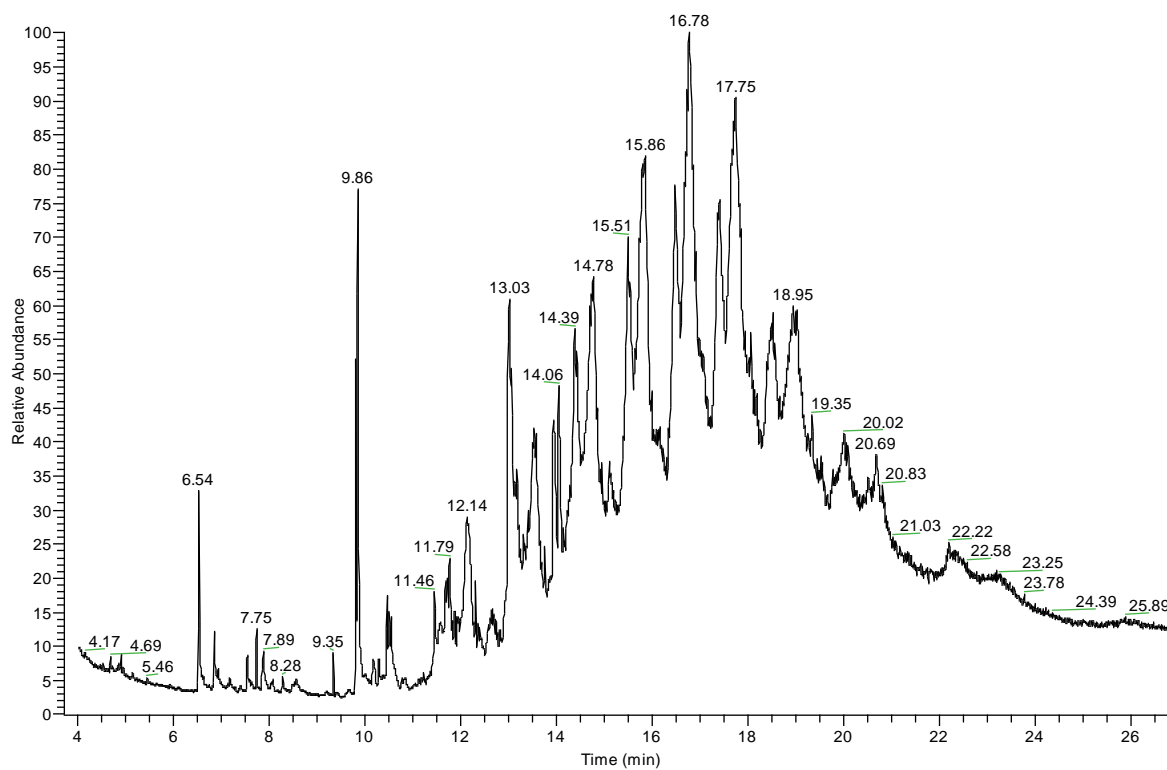
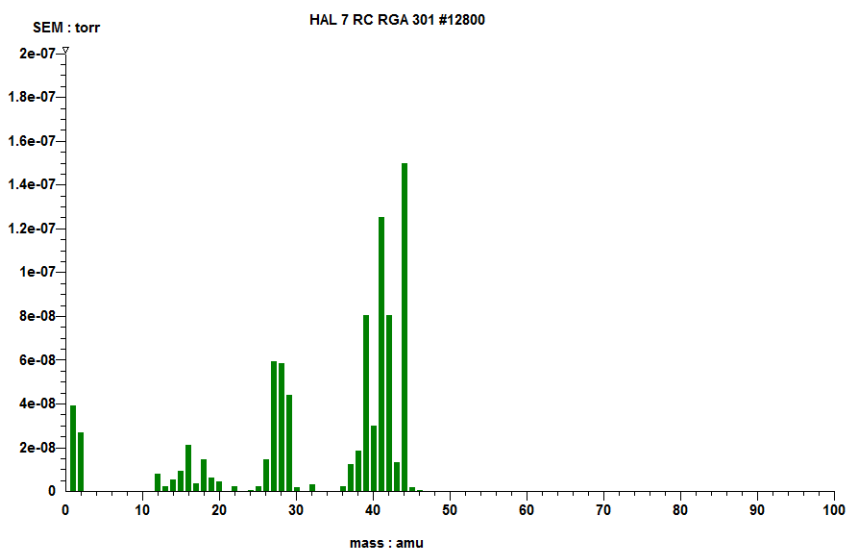


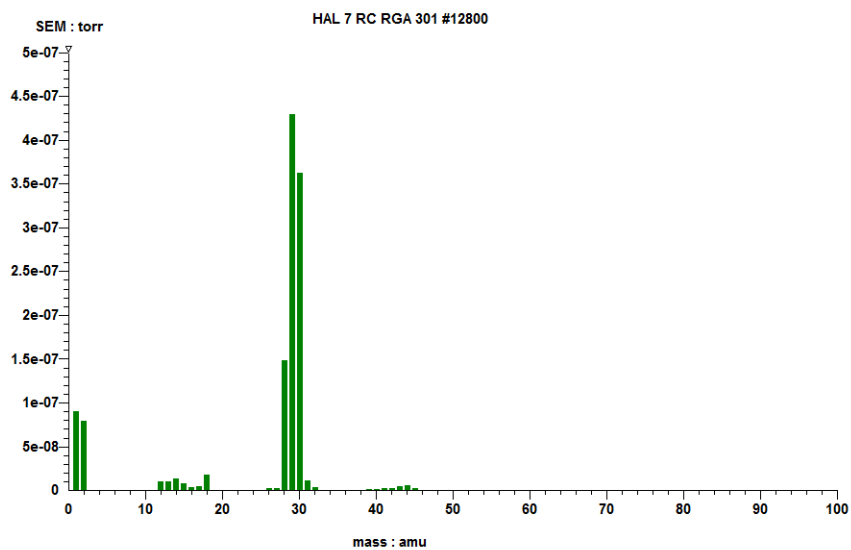
Figure 88: GC-MS total-ion chromatogram for the cold-ring fraction collected from the Cloisite 30B foam

2.10 TVA- condensables

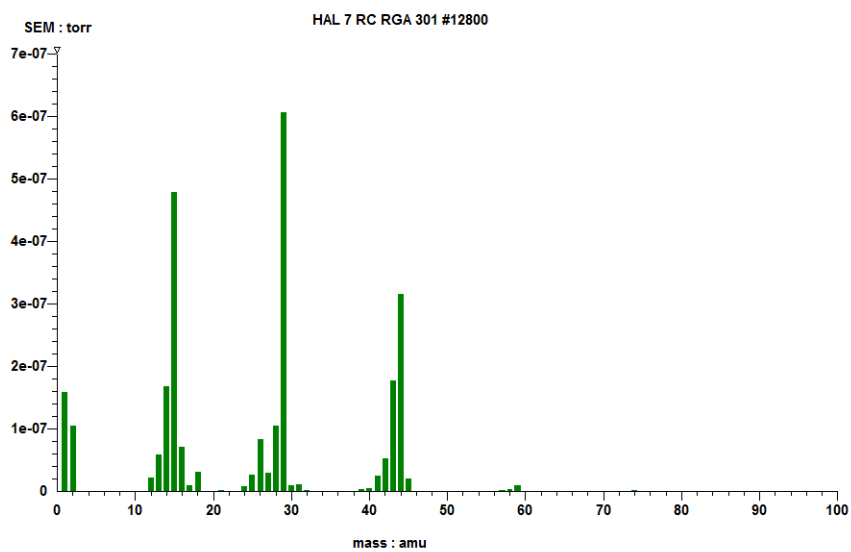


Time 13:51:24 Date 15/08/2011

89: verm propene co2

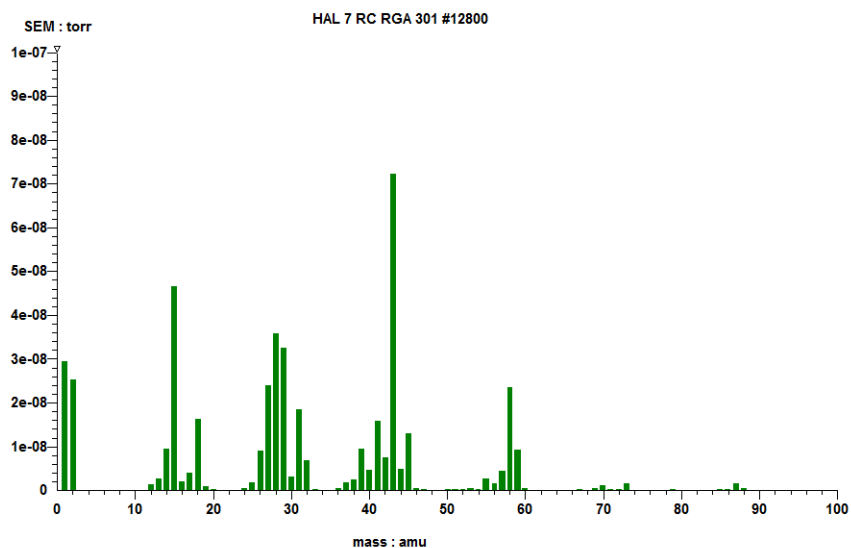


Time 13:58:29 Date 15/08/2011

90: verm form

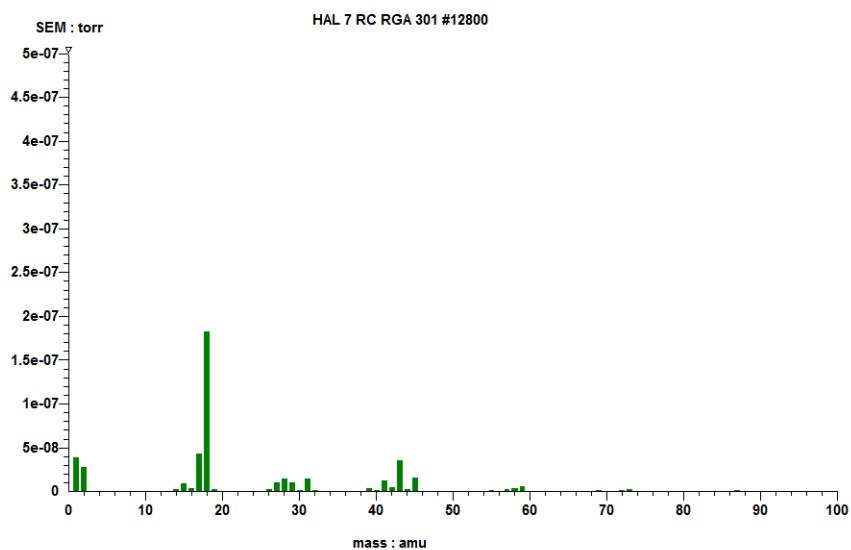
Time 14:05:03 Date 15/08/2011

91: verm acetaldehyde



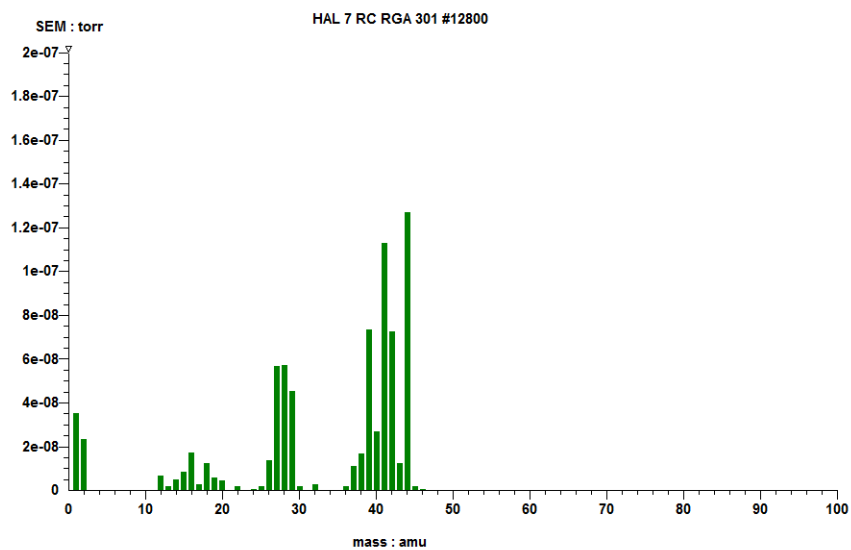
Time 14:10:58 Date 15/08/2011

92: verm isomers

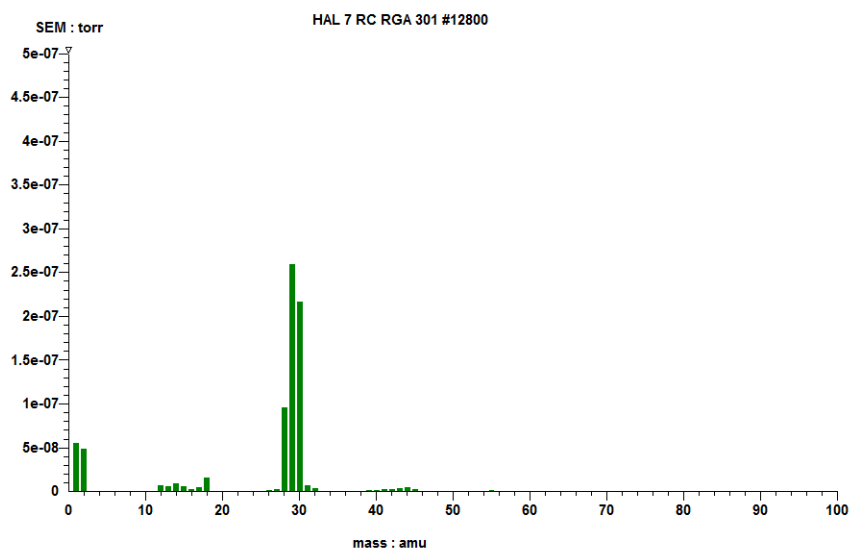


Time 14:27:26 Date 15/08/2011

93: verm higher molar mass and water

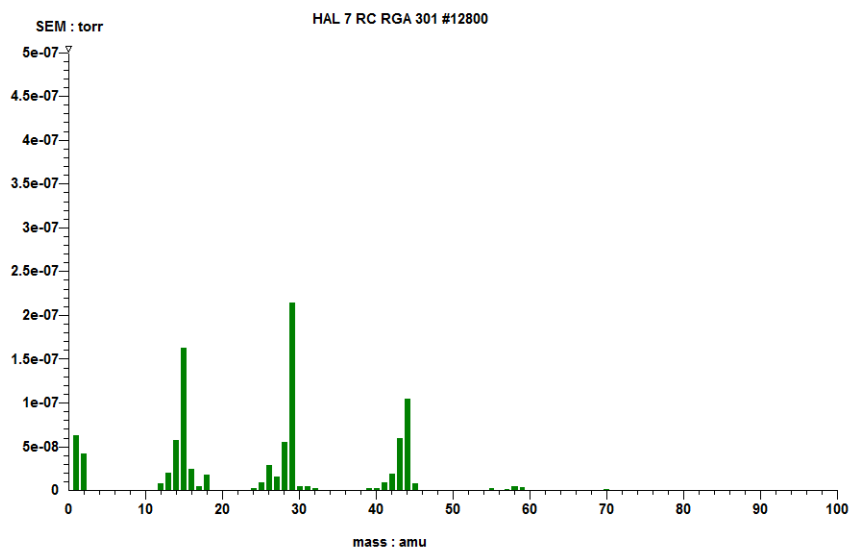


Time 11:02:42 Date 16/08/2011

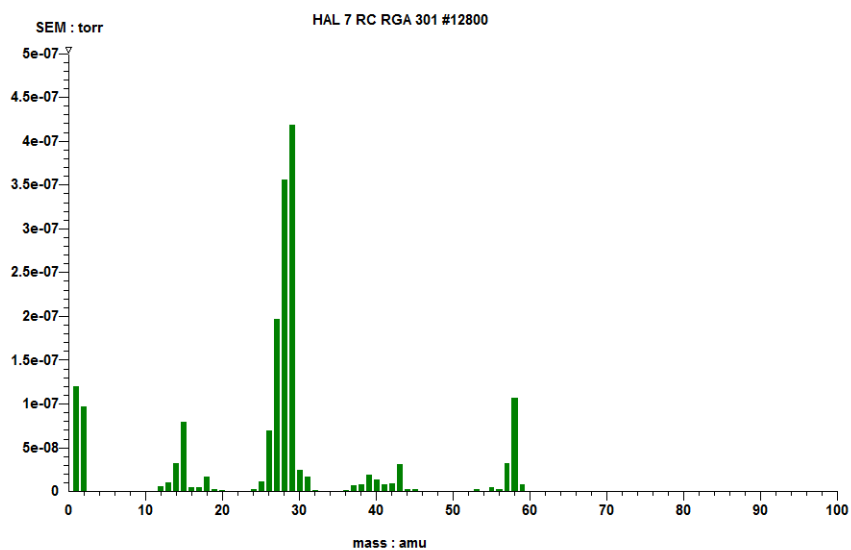
94: cloisite propene co2

Time 11:09:08 Date 16/08/2011

95: cloisite formaldehyde



Time 11:15:04 Date 16/08/2011

96: clositie acetaldehyde

Time 11:22:01 Date 16/08/2011

97: clositie propanal

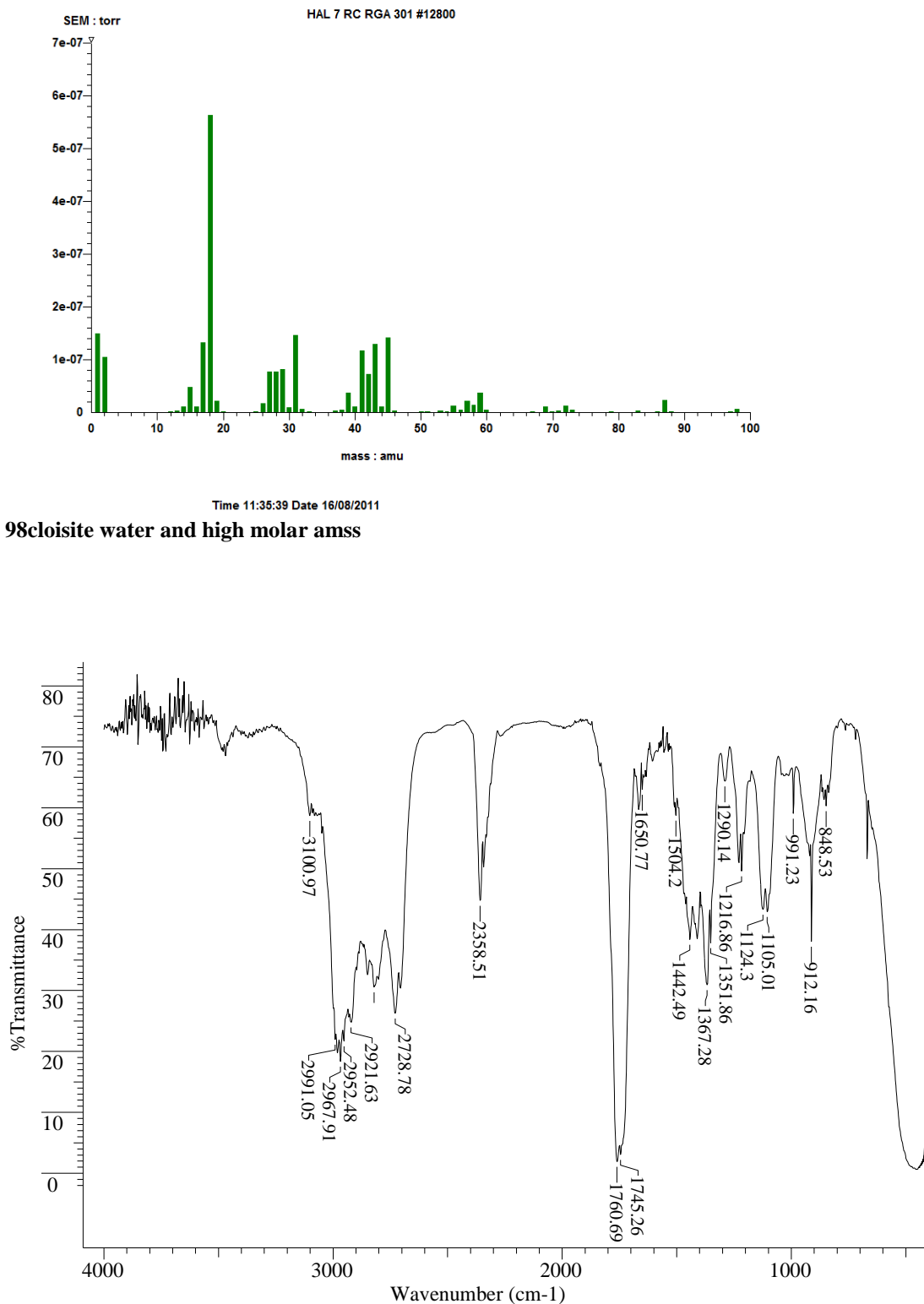


Figure 99: FTIR spectrum for fraction 1 collected from the vermiculite foam

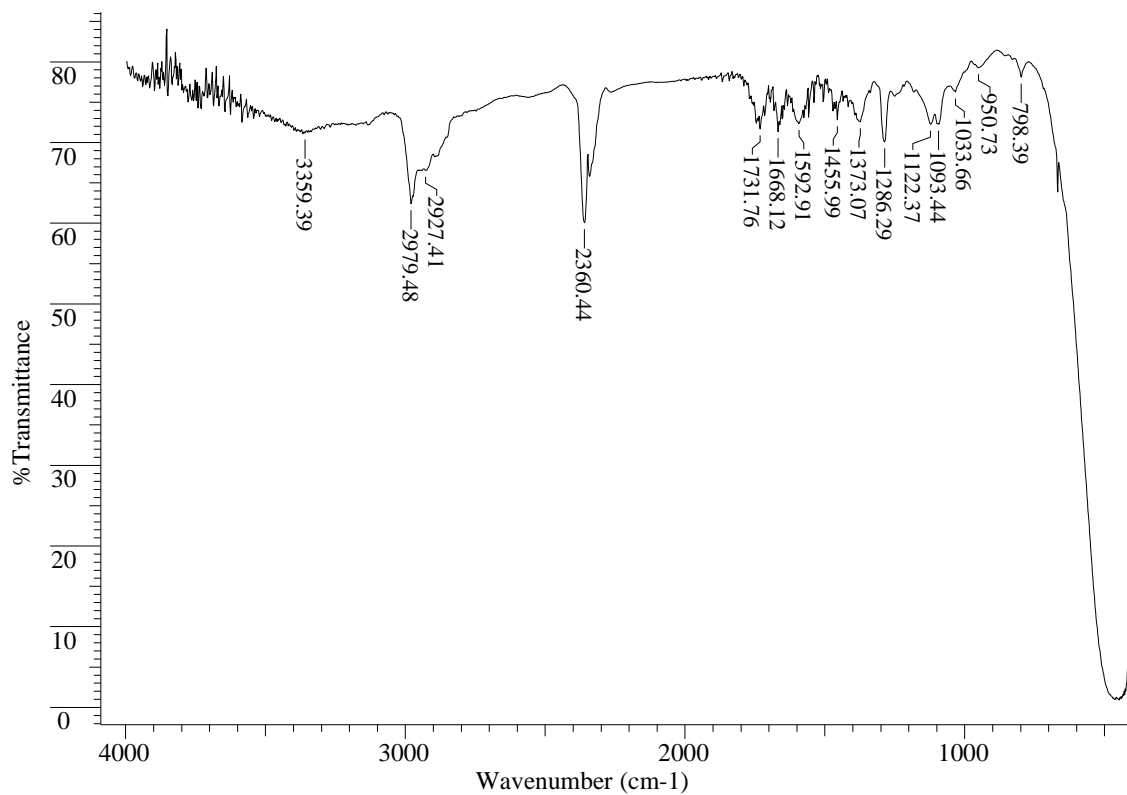


Figure 100: FTIR spectrum for fraction 2 collected from the vermiculite foam

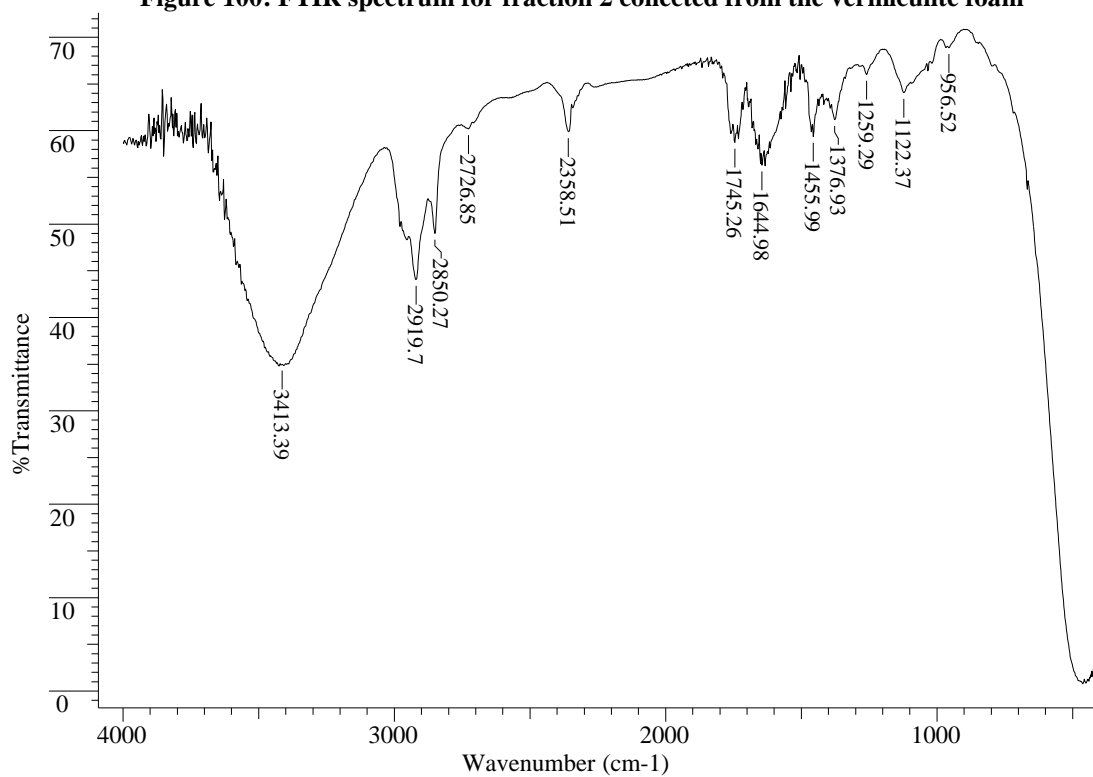


Figure 101: FTIR spectrum for fraction 3 collected from the vermiculite foam

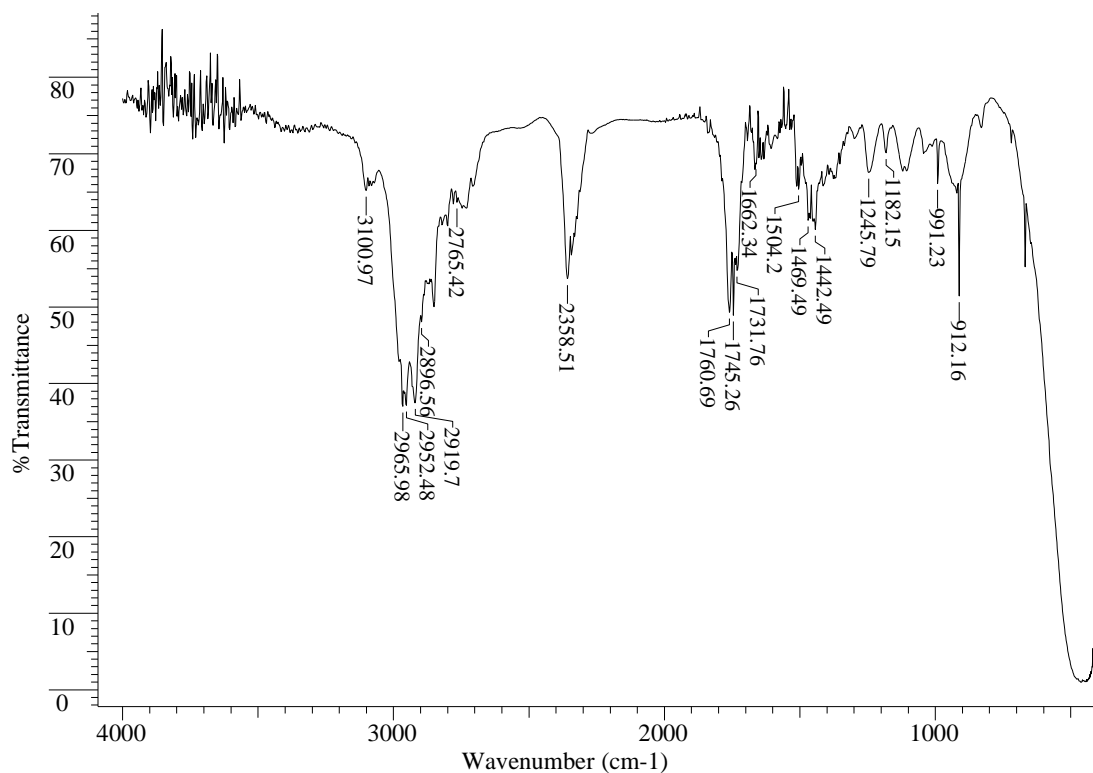


Figure 102: FTIR spectrum for fraction 1 collected from the Cloisite® 30B

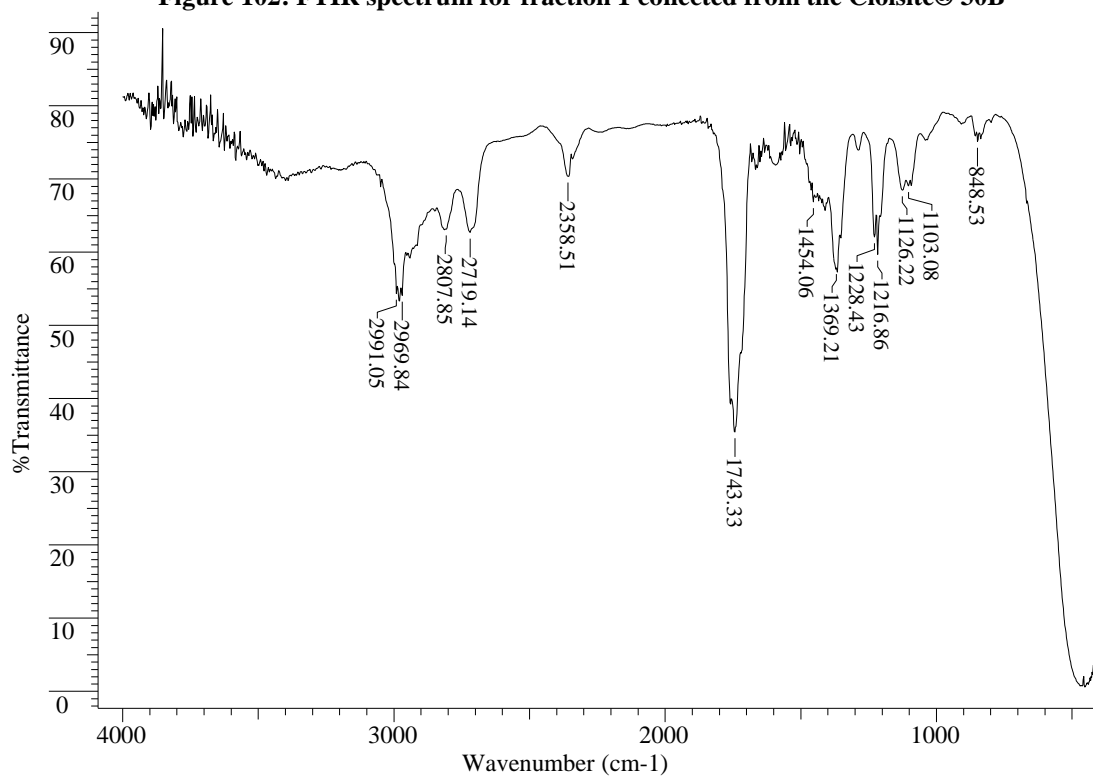


Figure 103: FTIR spectrum for fraction 2 collected from the Cloisite® 30B foam

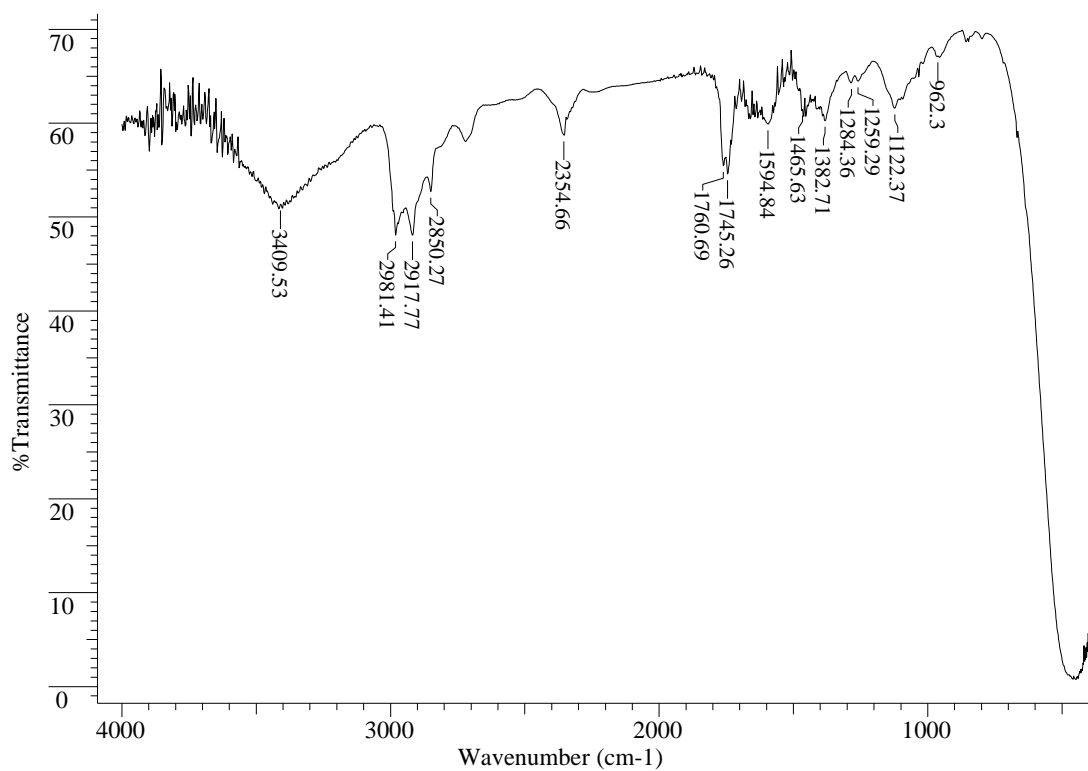


Figure 104: FTIR spectrum for fraction 3 collected from the Cloisite® 30B foam

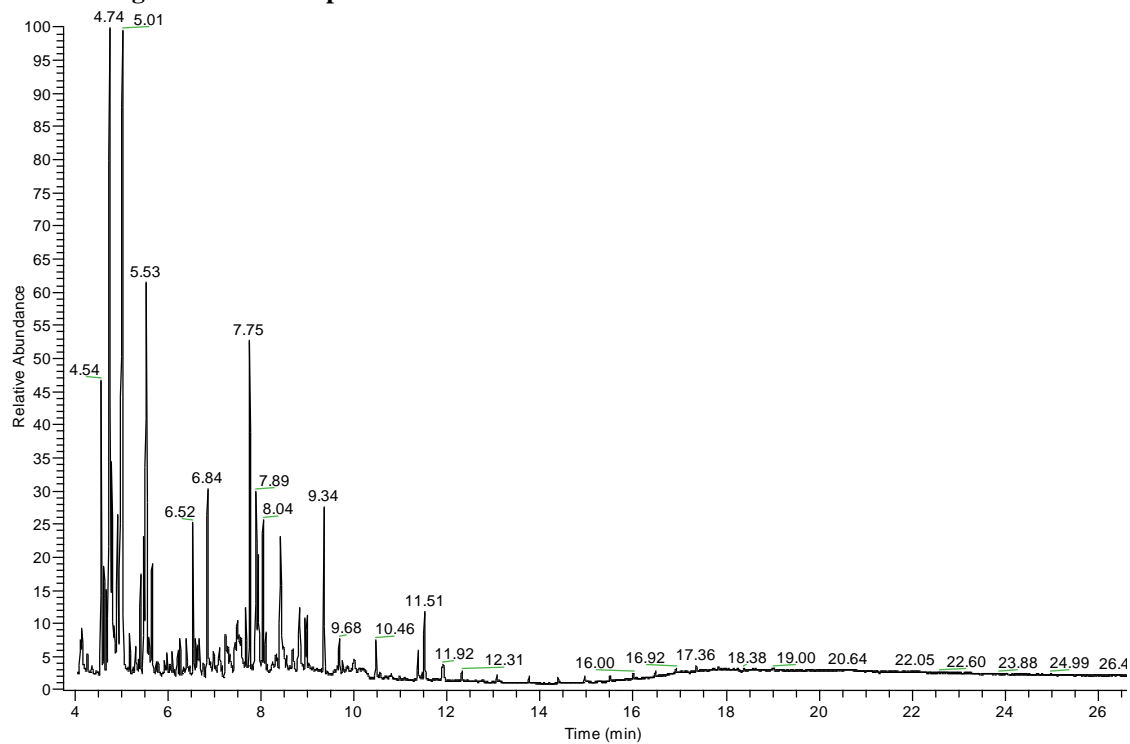


Figure 105: GC-MS total-ion chromatogram for fraction 3 from the vermiculite foam

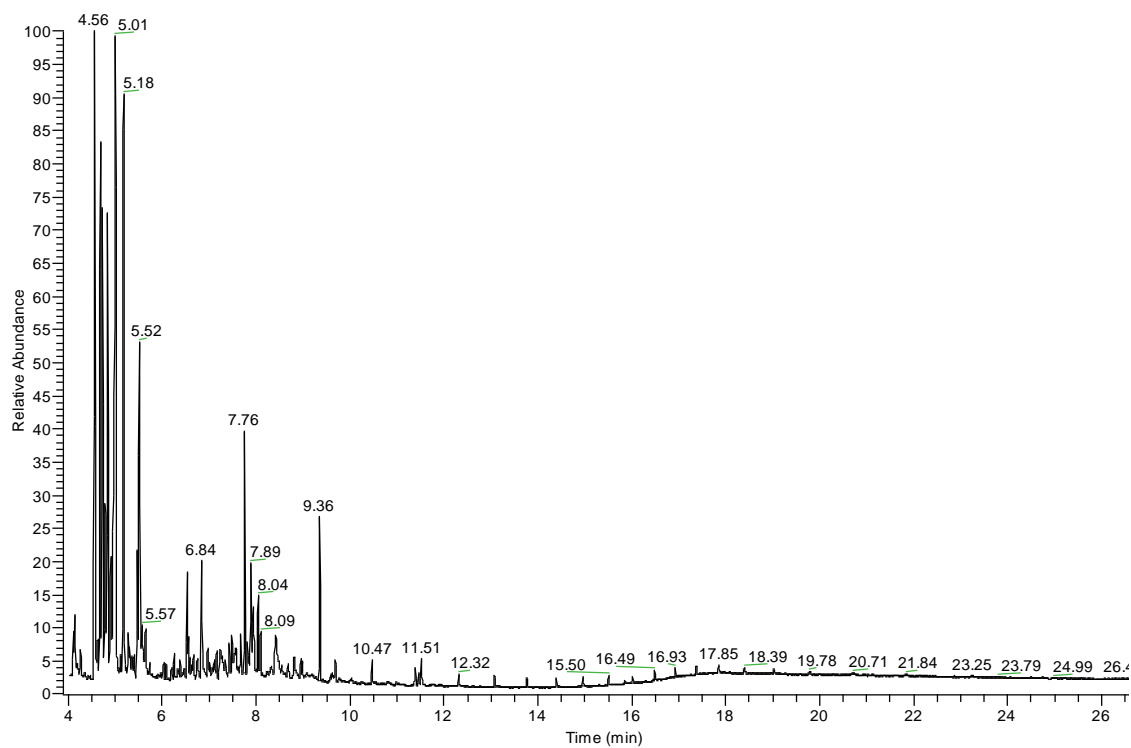


Figure 106: GC-MS total-ion chromatogram for fraction 3 from the Cloisite 30B foam