

Figure 1 – Isomerization and Further Polymerization of Styrene Trimer Anion via Intramolecular Proton Transfer “Backbiting”.

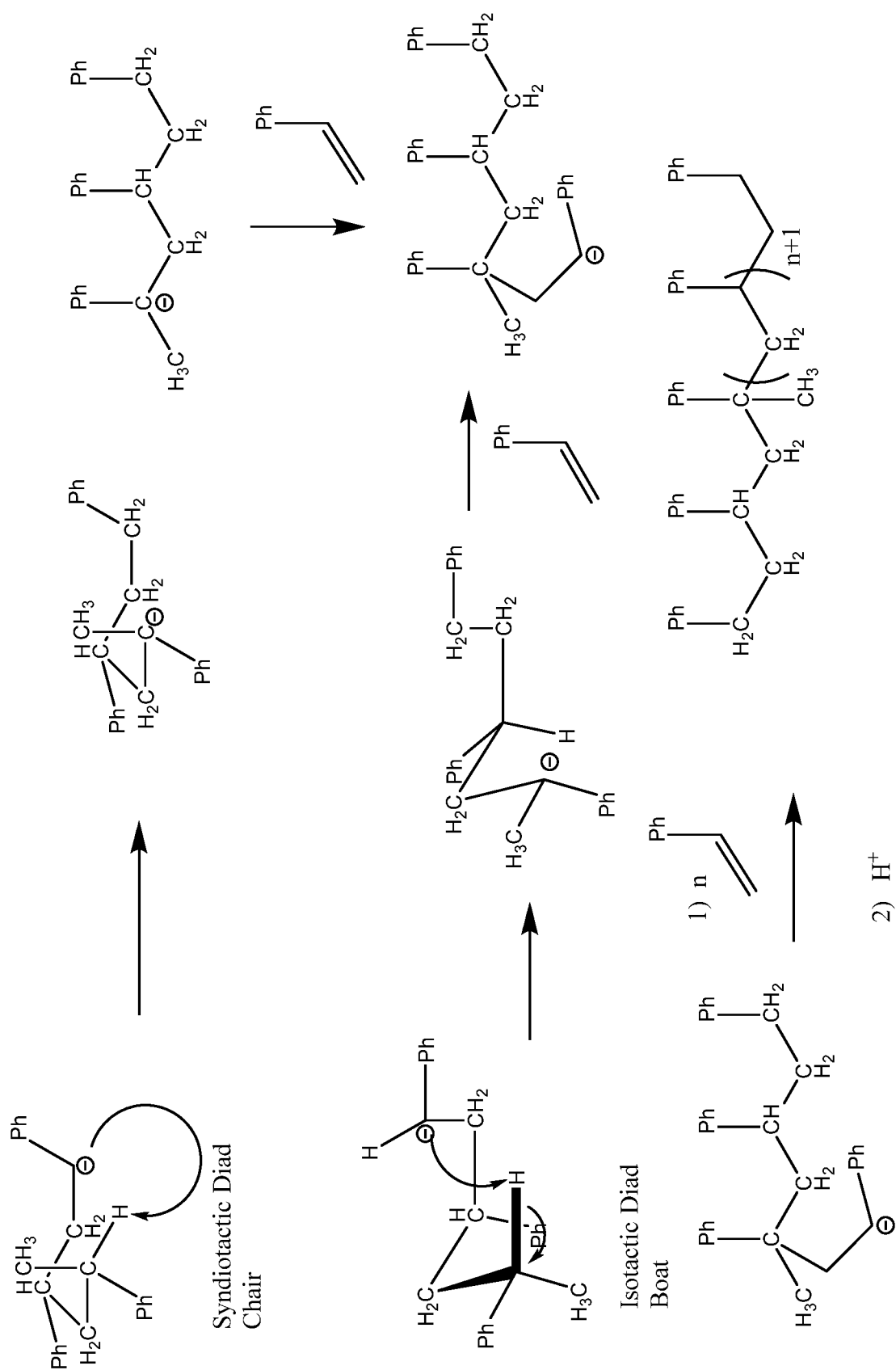


Figure 2 – Fragmentation of Isomerized Styrene Trimer Anion and Subsequent Polymerization of Fragments

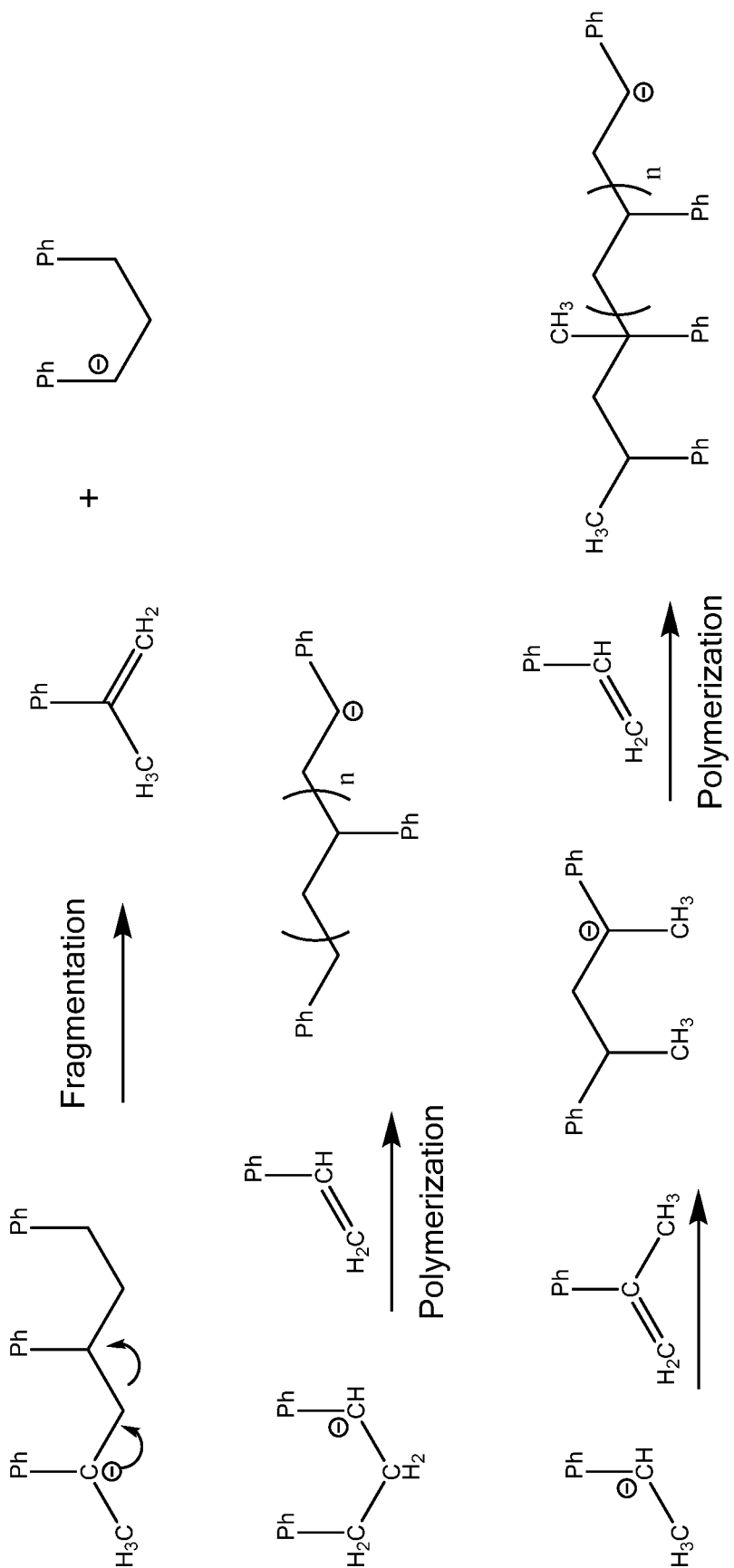


Figure 3- Gas chromatogram demonstrating oligomer microstructure purity for Examples 14 and 15 a LOXLiH 2:1 (IDMEA⁻]₄Li₆H₂) catalyzed hydrogen mediated saline hydride initiated polymerization process: 99.940% “Head to Tail” Microstructure.

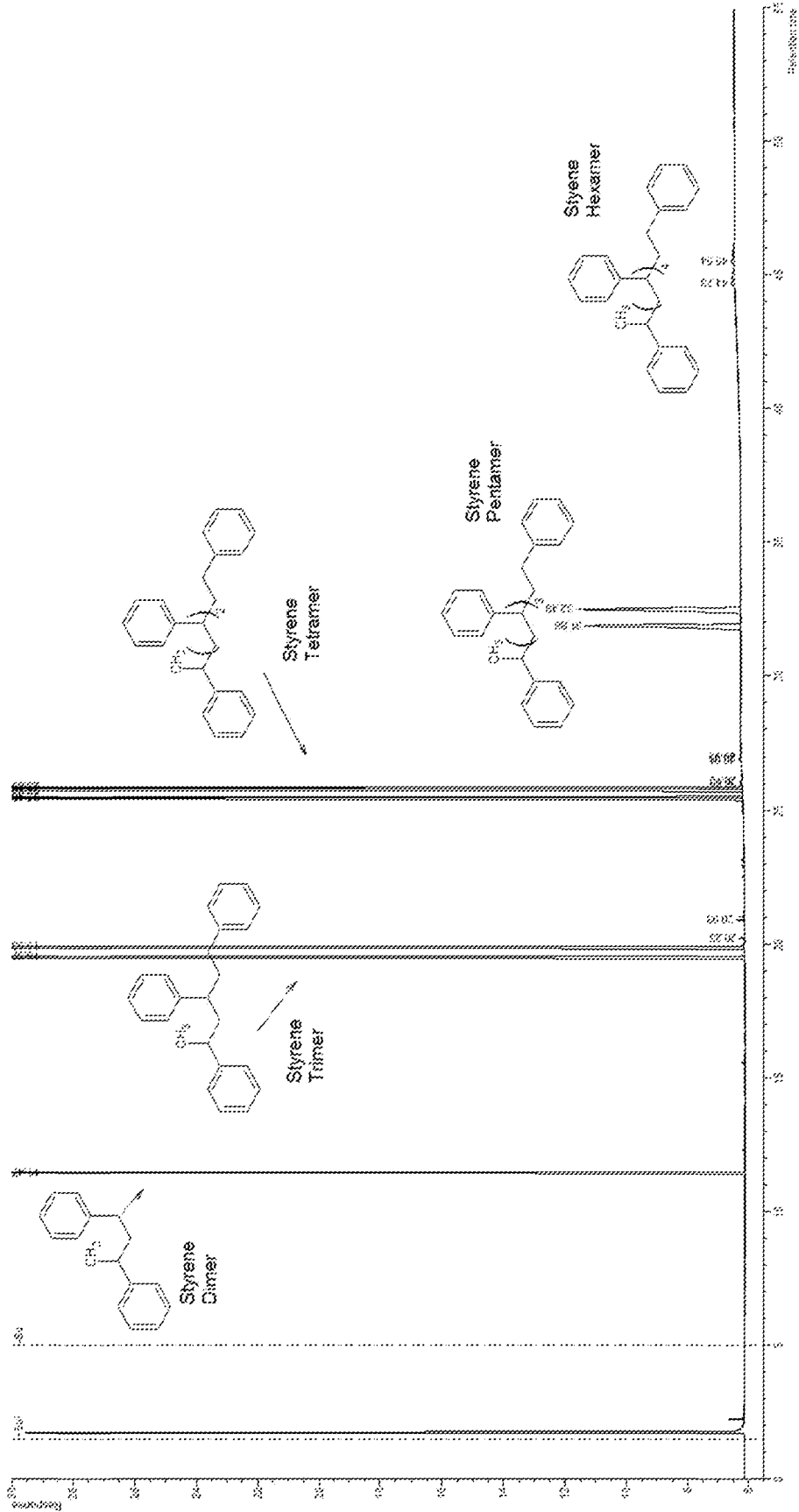


Figure 4 - Gas chromatogram demonstrating oligomer microstructure purity for Example 24 a LOXLiH 2:1 (IDMEA)₃LiLi₂H₇) catalyzed hydrogen mediated saline hydride initiated polymerization process: 99.82% “Head to Tail” Microstructure.

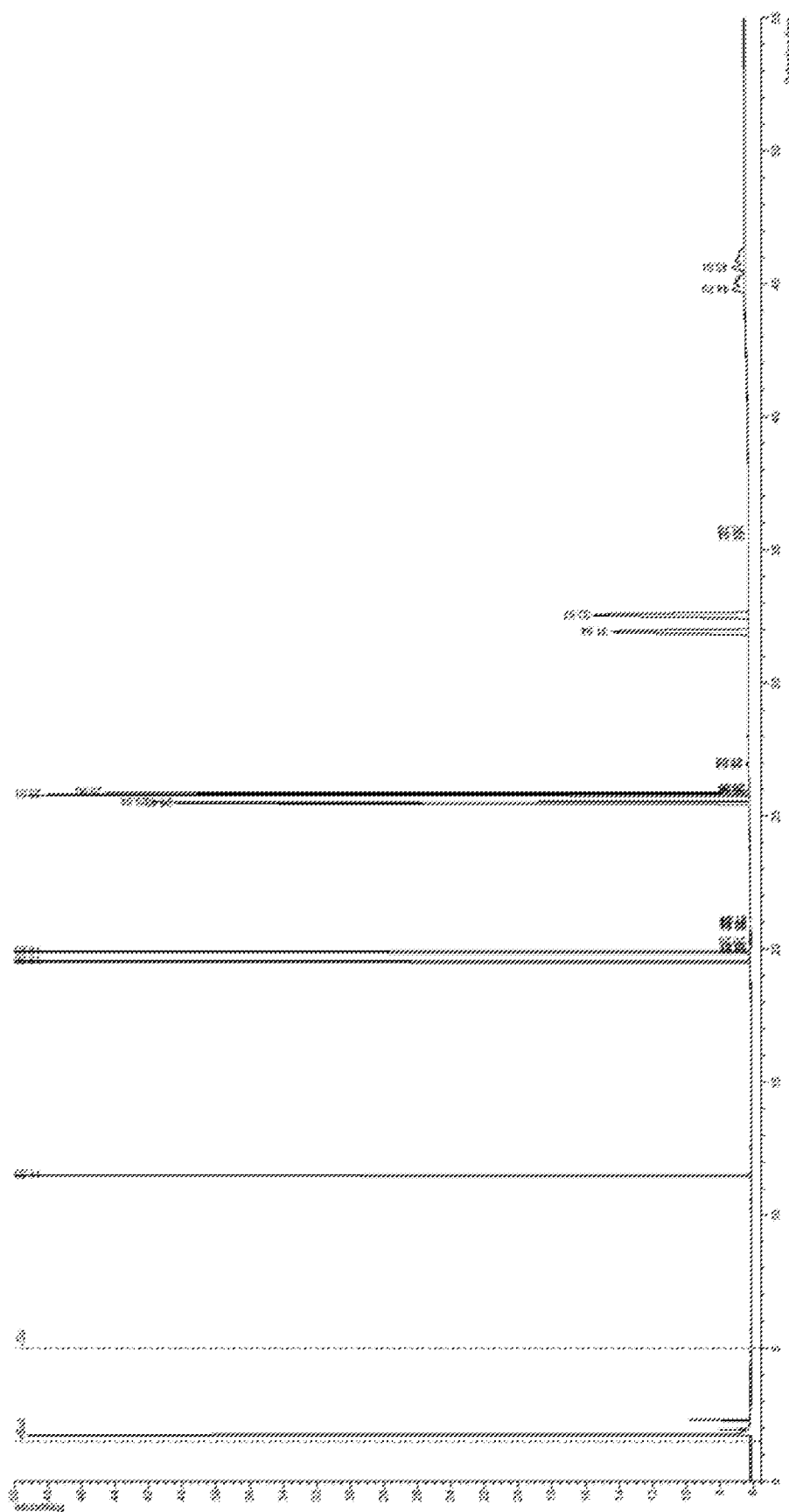


Figure 5 - Gas chromatogram oligomer mixture obtained from Example 40 Highly Active Saline Hydride (HASH) catalyst hydrogen mediated saline hydride initiated polymerization demonstrating complex mixture of microstructures which includes the desired "head to tail" linkages as well as undesired quaternary carbon linkages, fragmentation polymerization ($FW_i - 14$) and ($FW_i + 14$) oligomers as well as even "tail to tail" styrene coupling reactions.

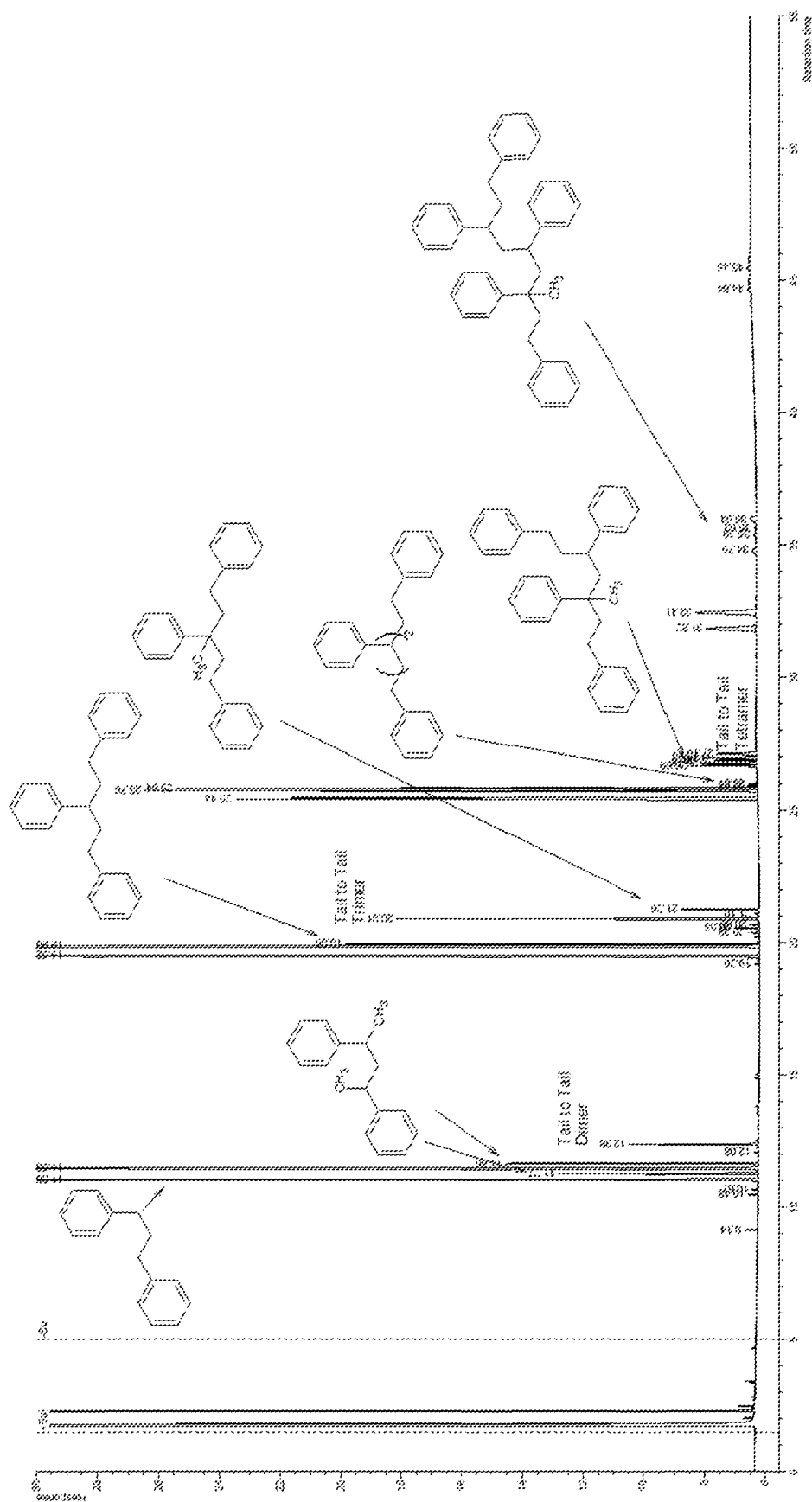


Figure 6 - Gas chromatogram demonstrating oligomer microstructure purity for Example 26 a LOXKH [DMEA]₄Li₇KH₄ catalyzed hydrogen mediated saline hydride initiated polymerization process: 89.53% “Head to Tail” Microstructure; 9.7% of oligomers w/ one quaternary “tail to head to tail” linkage; and 0.78% (FW₁ -14) fragmentation oligomers.

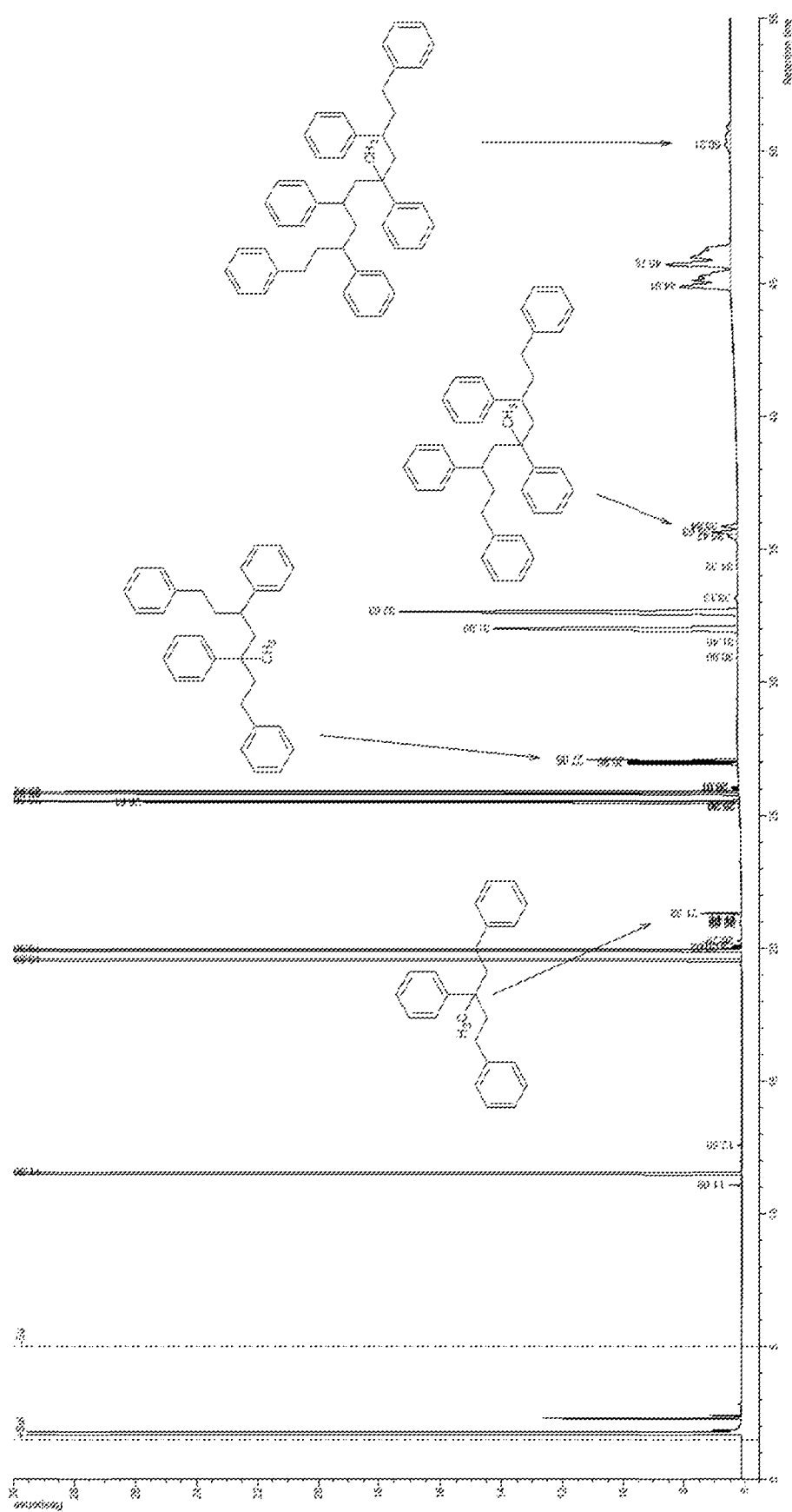


Figure 7 - Gas chromatogram demonstrating oligomer microstructure purity for Example 39 a Super Active Saline Hydride (SASH) Catalyzed hydrogen mediated saline hydride initiated polymerization process: 93.49% “Head to Tail” Microstructure; 6.4% of oligomers w/ one quaternary “tail to head to tail” linkage; and 0.11% fragmentation oligomers

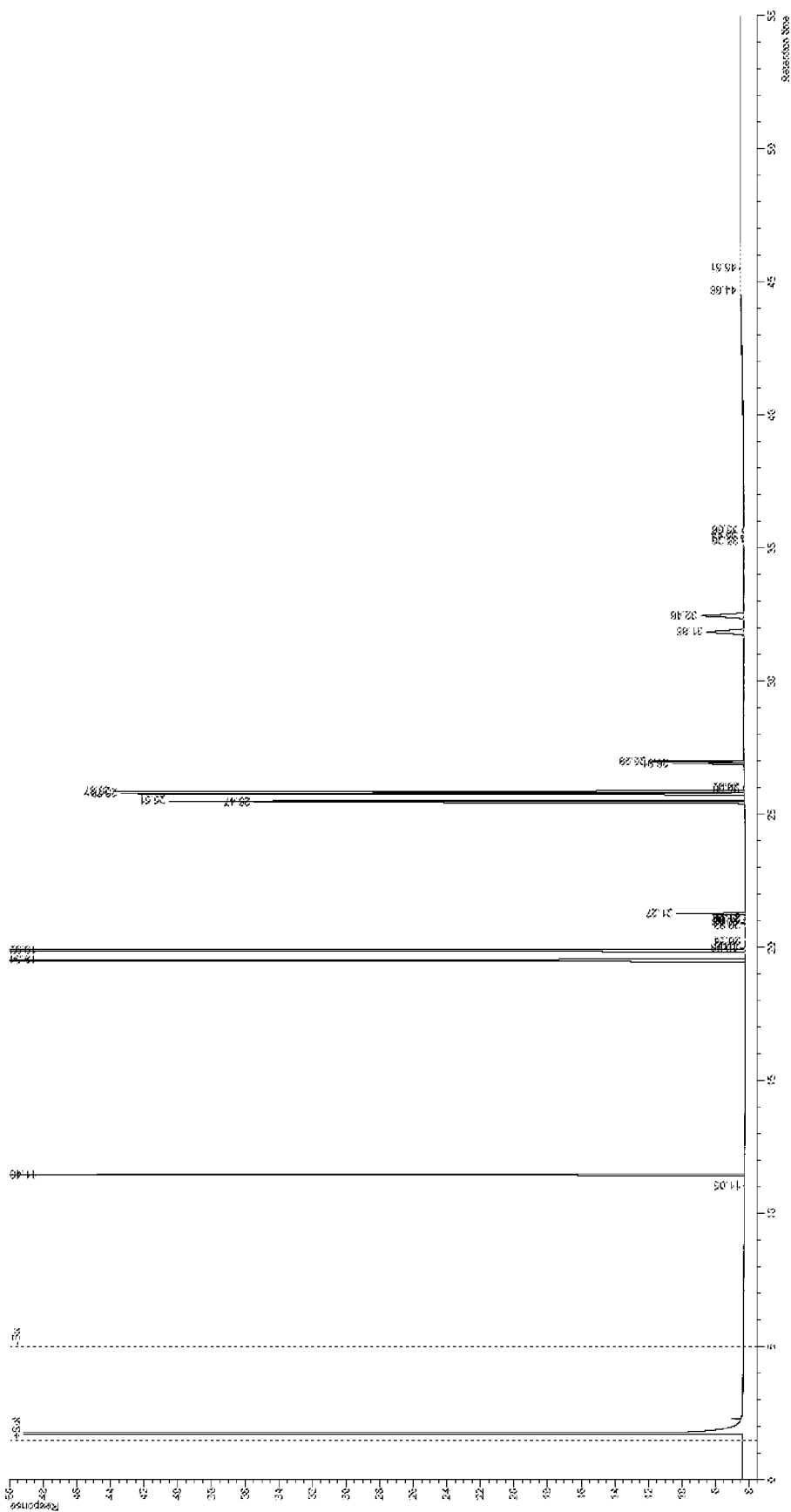


Figure 8 - Gas chromatogram demonstrating oligomer microstructure purity for Example 29 a LOXMgH₂ 2:1 ([DMEA]₄Li₄MgH₂) catalyzed hydrogen mediated saline hydride initiated polymerization process: 99.21% “Head to Tail” Microstructure; 0.0% fragmentation oligomers; and a trace of [*n*-butyl]MgH initiated styrene oligomers w/ 0.0% TEA ethyl end group incorporation.

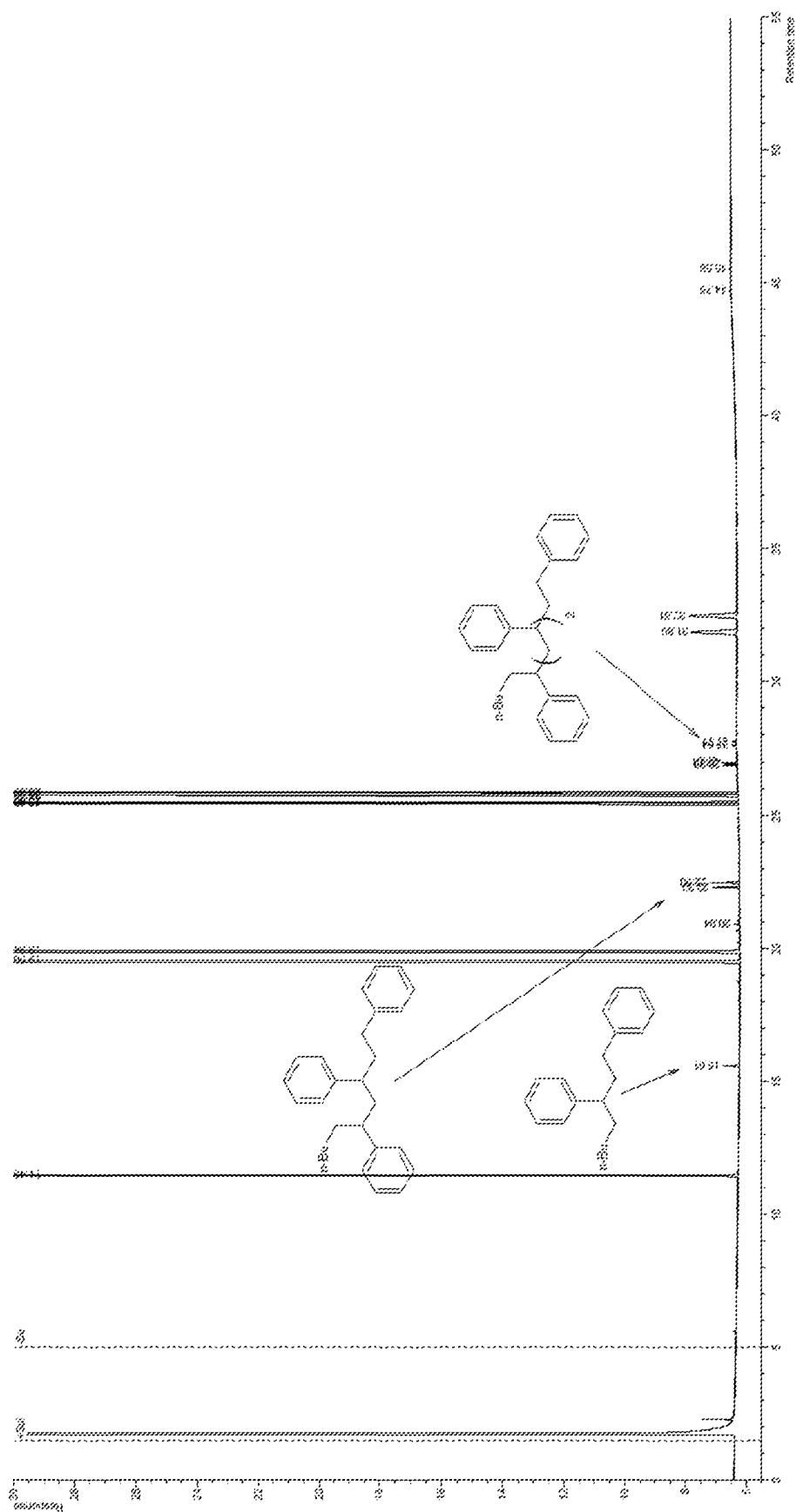


Figure 9 – Standard for comparison: gas chromatogram demonstrating oligomer microstructure purity for Comparative Example 44 demonstrating the polymer microstructure of an Anionic Chain Transfer Vinyl Aromatic Polymer (ACTVAP) of WO2008154453 formed from n-propylbenzene and styrene: 99.08 % “Head to Tail” Microstructure.

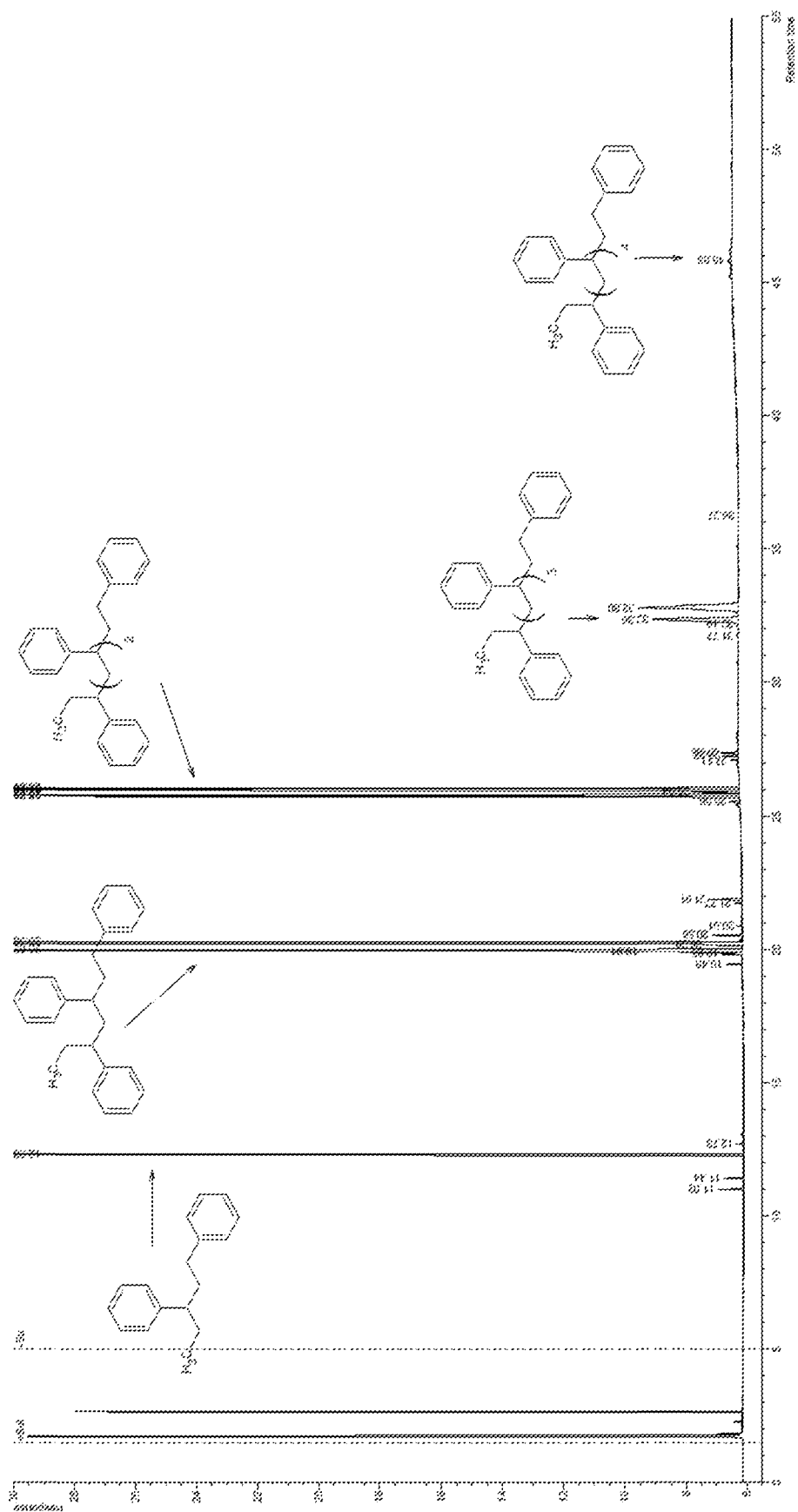


Figure 10 – Standard for comparison: gas chromatogram demonstrating oligomer microstructure purity for an anionic chain transfer styrene polymer (ACTVSP) of WO2008154453 low molecular weight toluene adducts; identical in structure to fragments ($FW_i - 14$ where $i = 1$ to 6) fragmentation oligomers formed in anionic styrene polymerizations that employ catalyst and/or initiators comprising potassium and/or sodium ions.

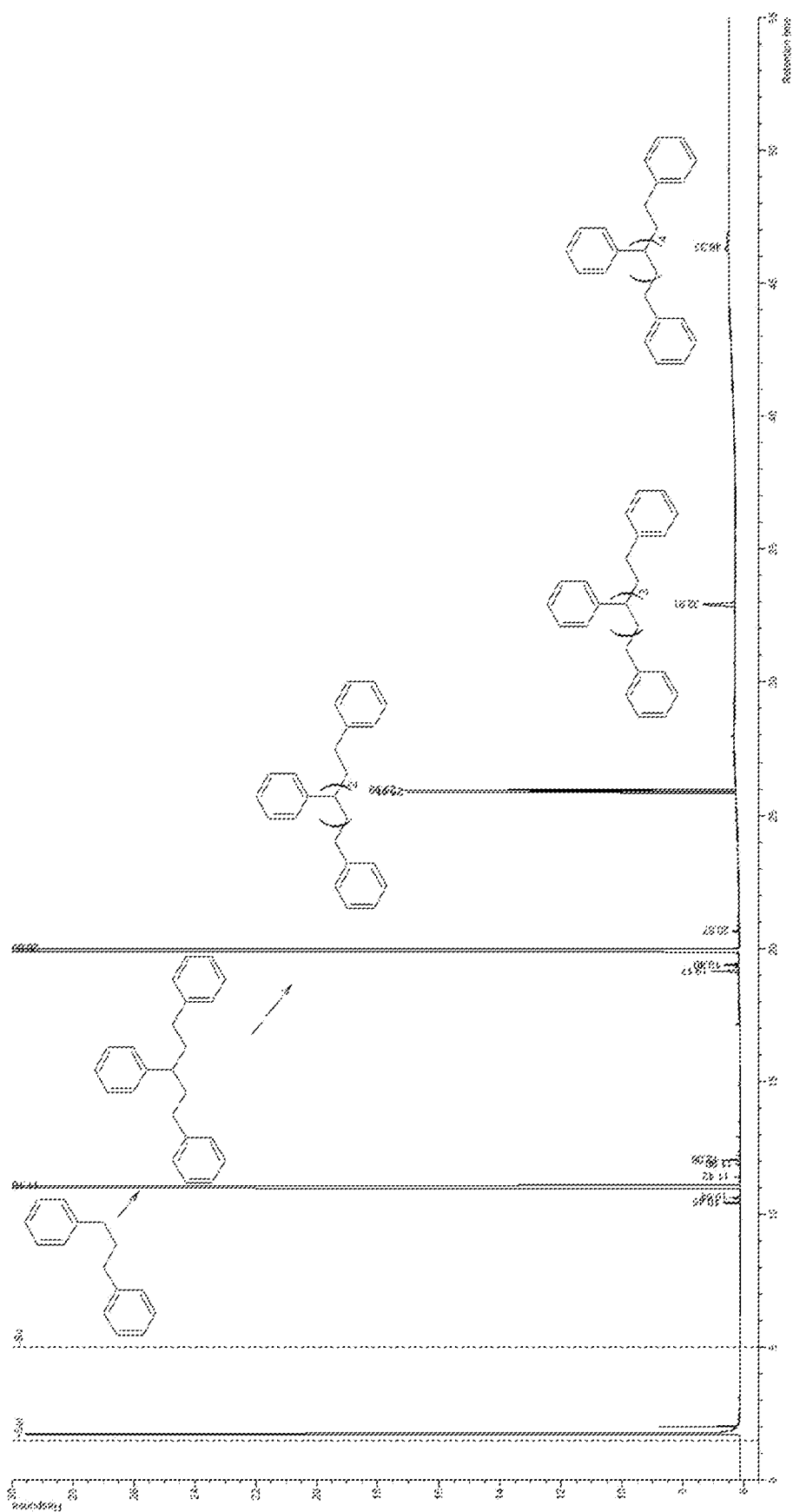


Figure 11 – Standard for comparison: gas chromatogram of the mono-addition product of α -methylstyrene to ethylbenzene identical in structure to the (FW_i + 14) fragments specifically where $i = 1$ (210 + 14 = 224 MW oligomer) formed in anionic styrene polymerizations employing catalyst and/or initiators comprising potassium and/or sodium ions.

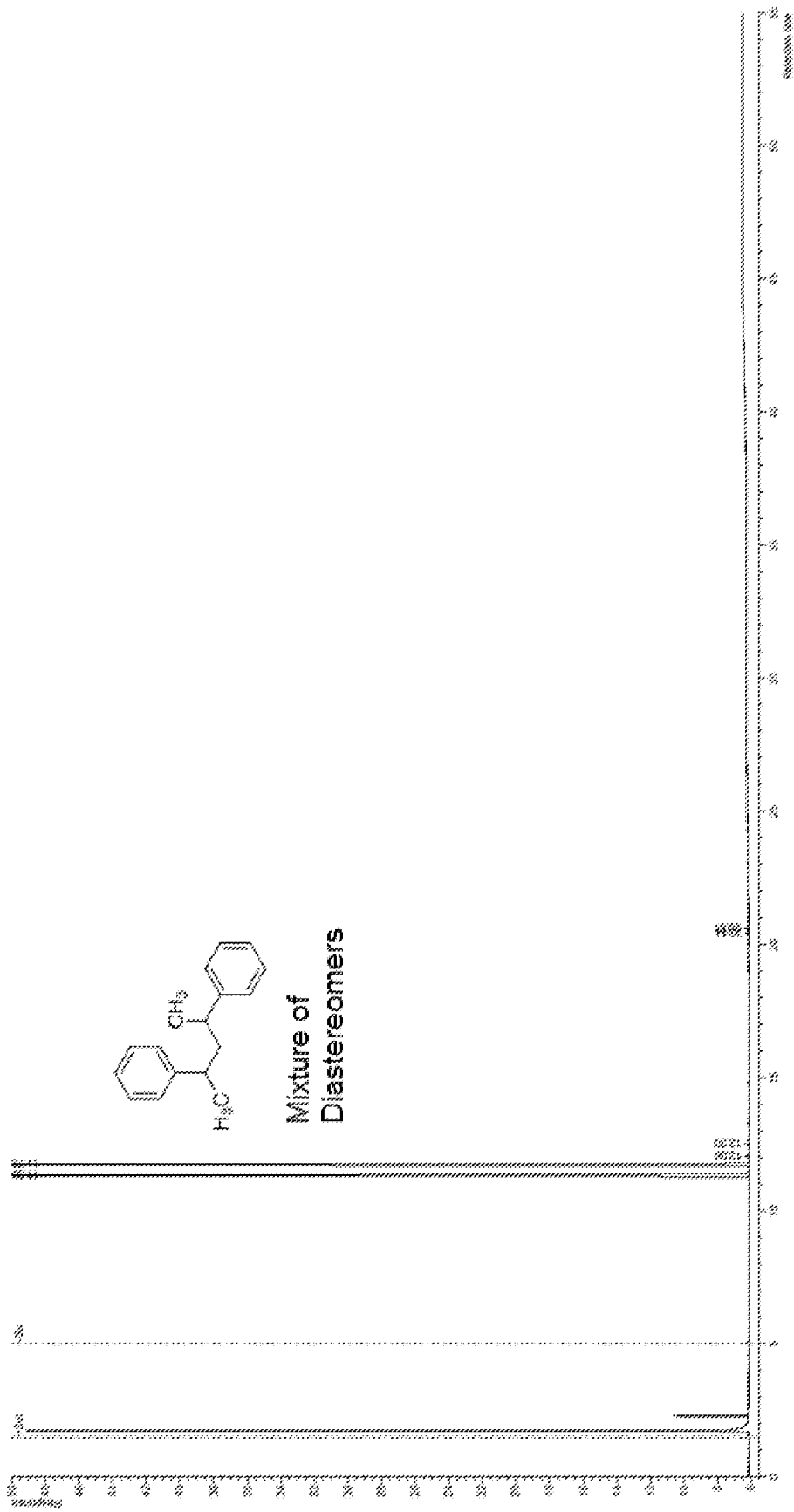


Figure 12 – Gas chromatogram demonstrating oligomer microstructure purity for Comparative Example 41 demonstrating the polymer microstructure of EPO 741147 anionic chain transfer composition formed w/ limiting ethylbenzene and styrene (in 316 stainless steel): 93% desired “Head to Tail” microstructure; 3.4% “Tail to Head to Tail” quaternary carbon linkage; 3.2% (FW_i – 14) fragmentation oligomers (of Figure 10), and also demonstrating large number of other unidentified impurities present.

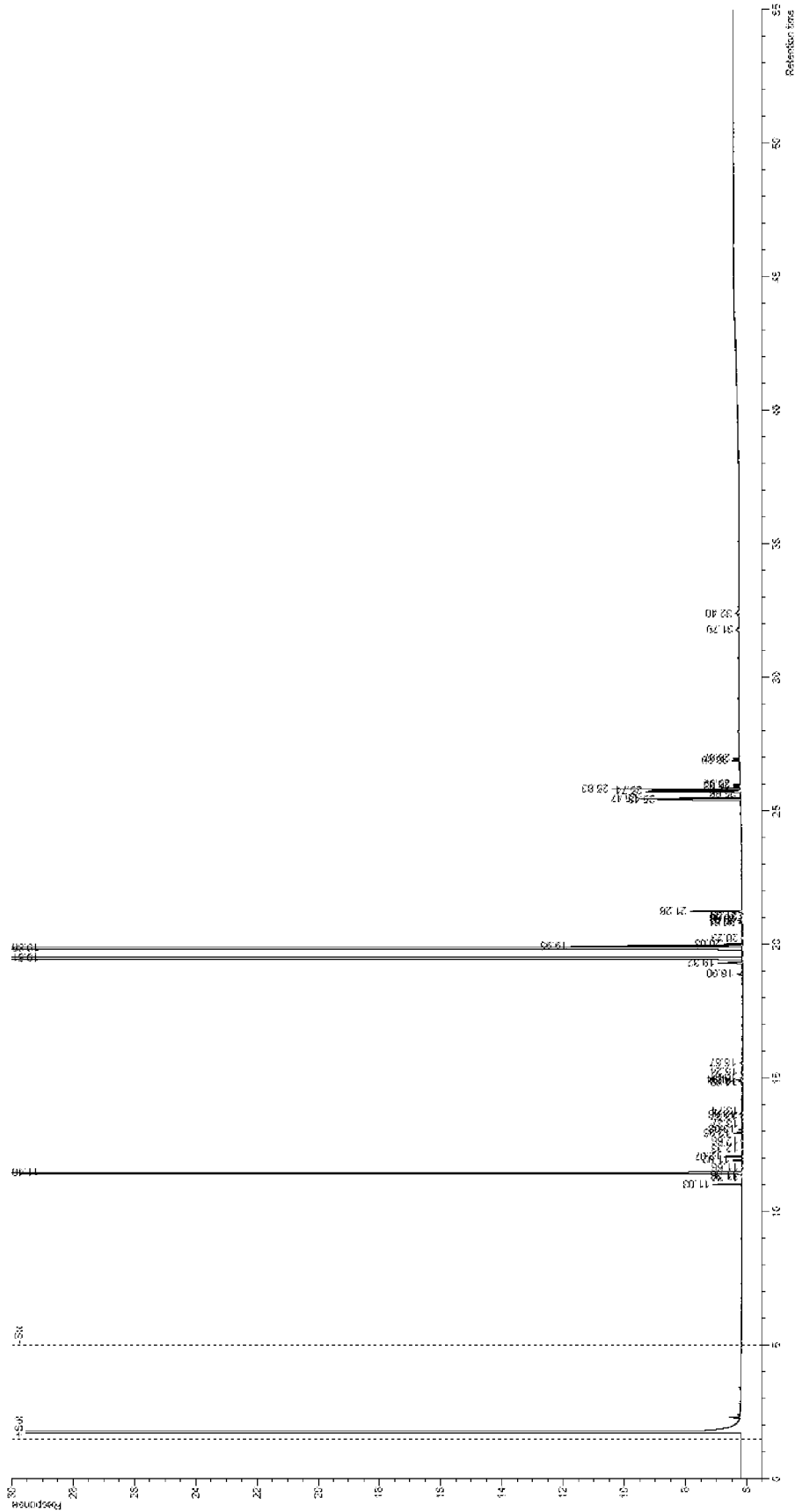


Figure 13 –Gas chromatogram obtained from Comparative Example 42 demonstrating the polymer microstructure of an Anionic Chain Transfer Vinyl Aromatic Polymer (ACTVAP) of WO2008154453 formed from 2 parts ethylbenzene and 1 part styrene (in glass): 91 % desired “Head to Tail” microstructure; 8.9% “Tail to Head to Tail” quaternary carbon linkage; and 0.22% FW_i oligomer – 14 fragmentation oligomers (of Figure 10).

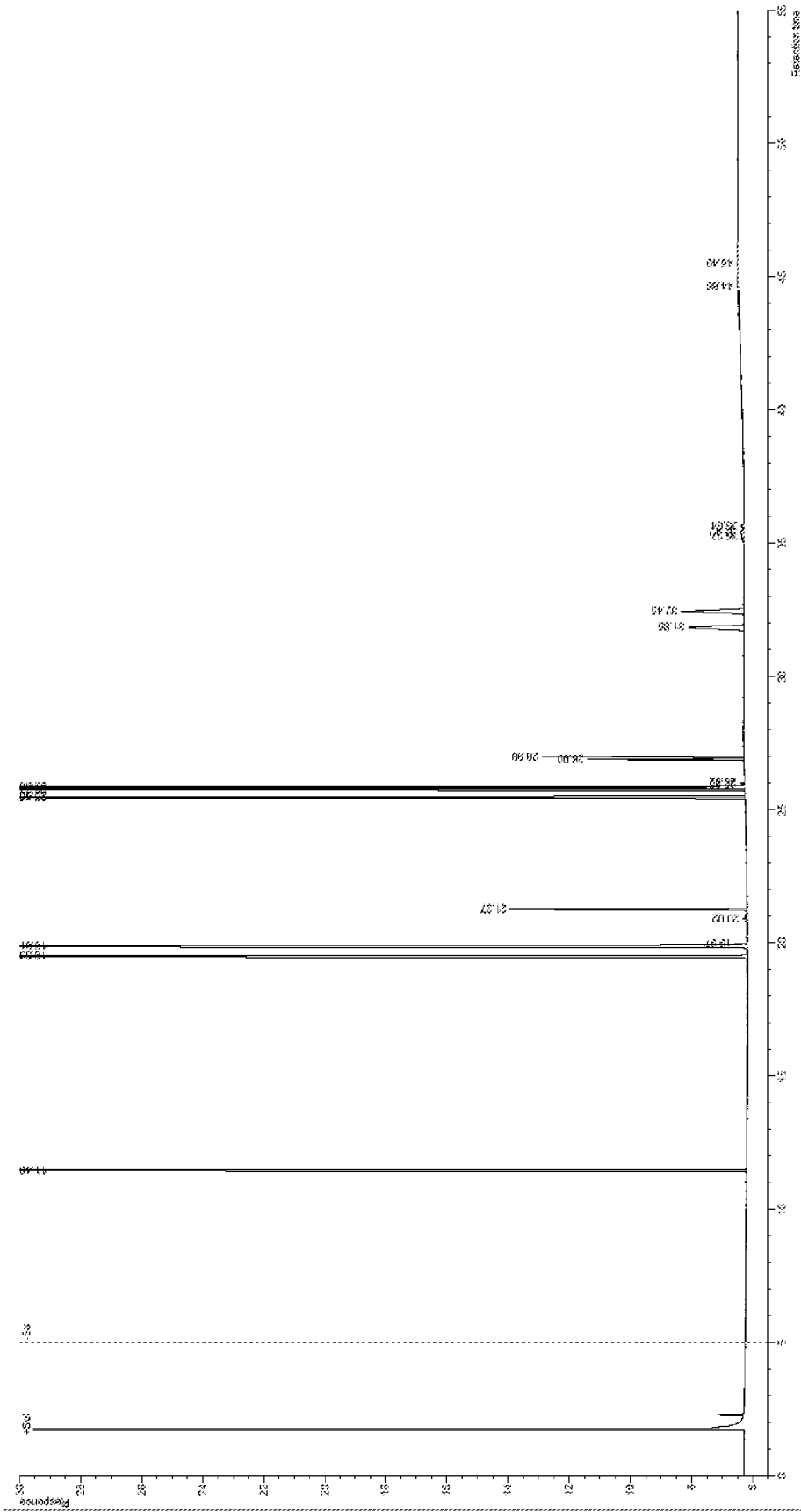


Figure 14: Gas chromatogram obtained from Comparative Example 43 demonstrating the polymer microstructure of an Anionic Chain Transfer Vinyl Aromatic Polymer (ACTVAP) of WO2008154453 formed from 1 part ethylbenzene and 2 parts styrene (in 316 stainless steel): 93 % desired “Head to Tail” microstructure; 5.0% “Tail to Head to Tail” quaternary carbon linkage; and 2.3% FW_i oligomer — 14 fragmentation oligomers (of Figure 10).

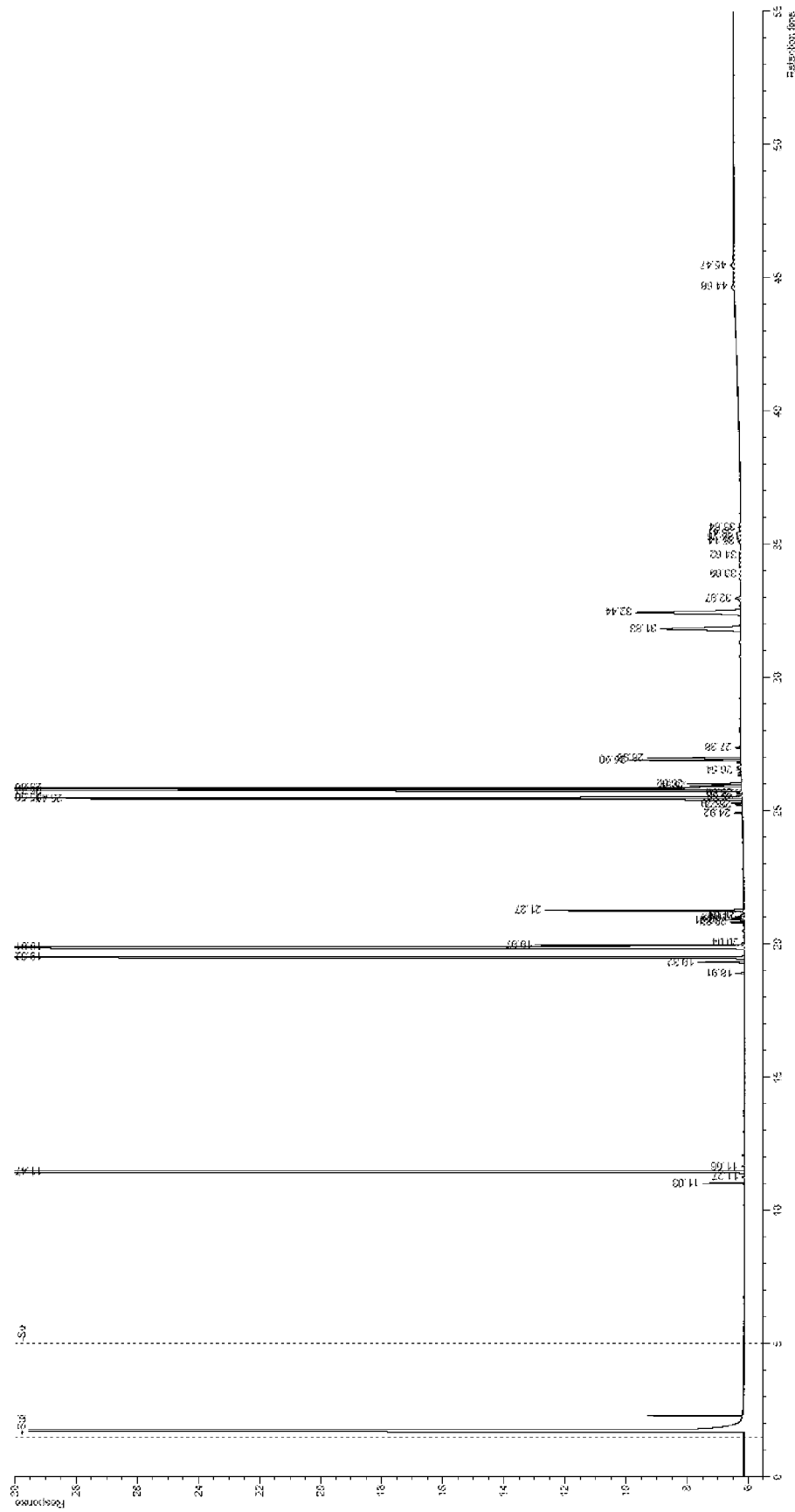


Figure 15: Gas chromatogram obtained from Example 52 and 53 demonstrating the polymer microstructure of an HMAPS Distribution showing $\geq 99.94\%$ head to tail microstructure.

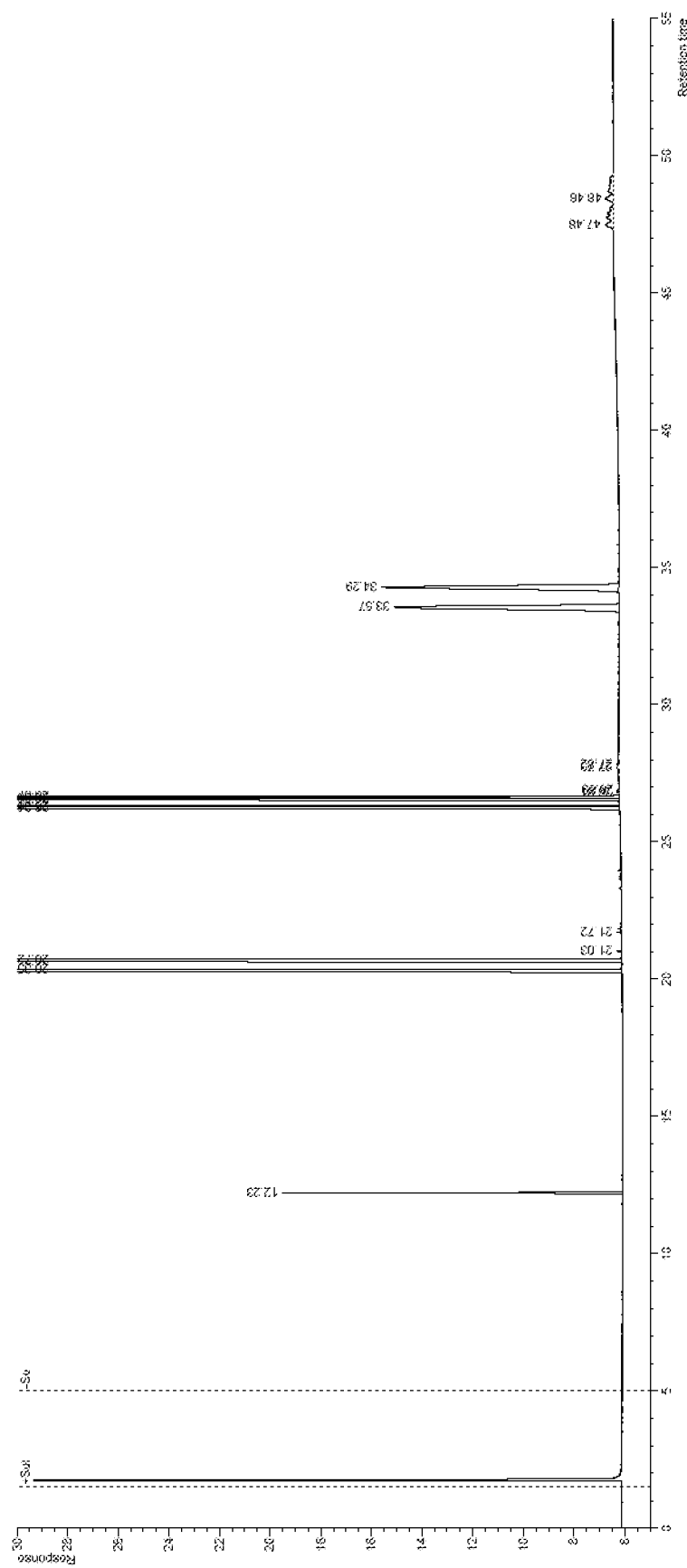


Figure 16: Gas chromatogram obtained from Examples 58 and 59 demonstrating the polymer microstructure of an HMAPS Distribution showing $\geq 99.97\%$ head to tail microstructure.

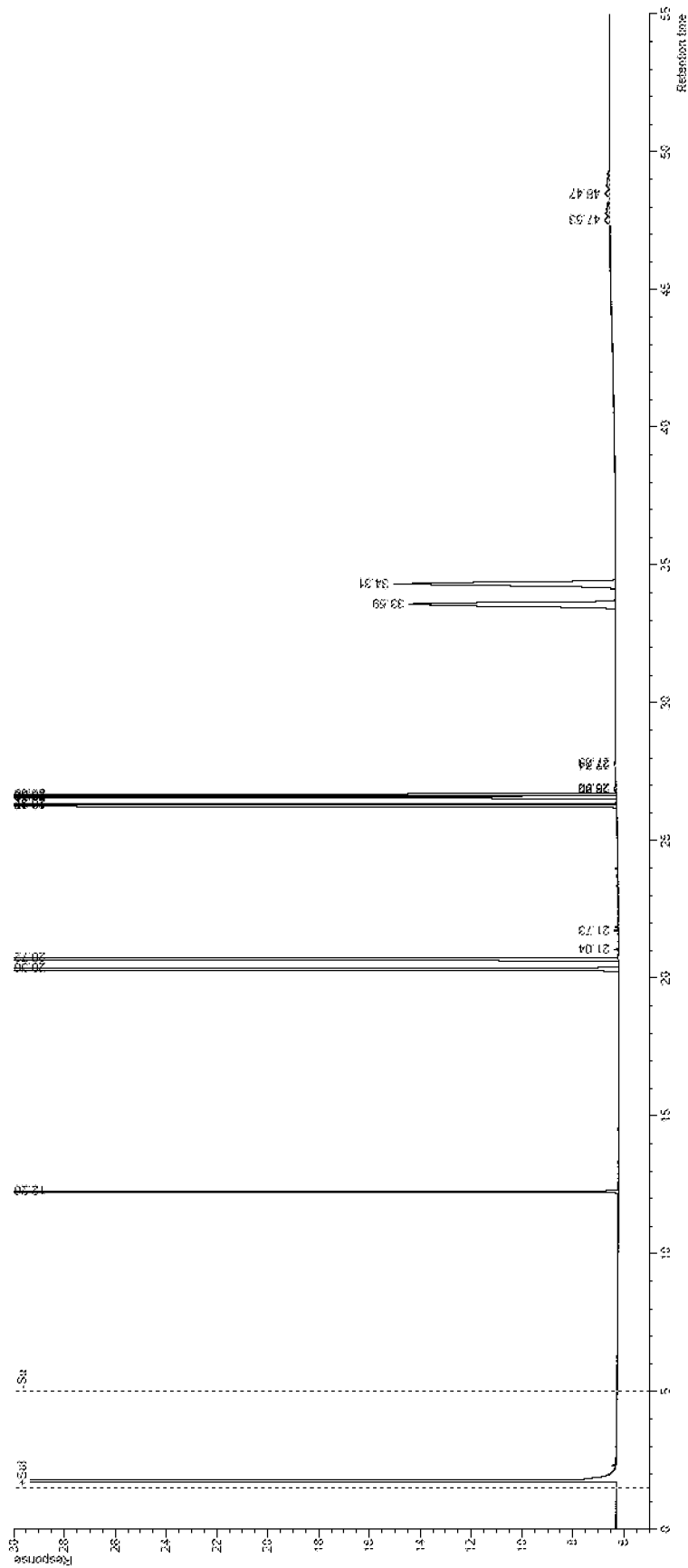


Figure 17: Gas chromatogram obtained from Example 64 and 65 demonstrating the polymer microstructure of an HMAPS Distribution showing $\geq 99.93\%$ head to tail microstructure.

