

Figure S1. (a) TEM (h) HRTEM and (c-e) TEM-EDS mapping images of γ -Al₂O₃

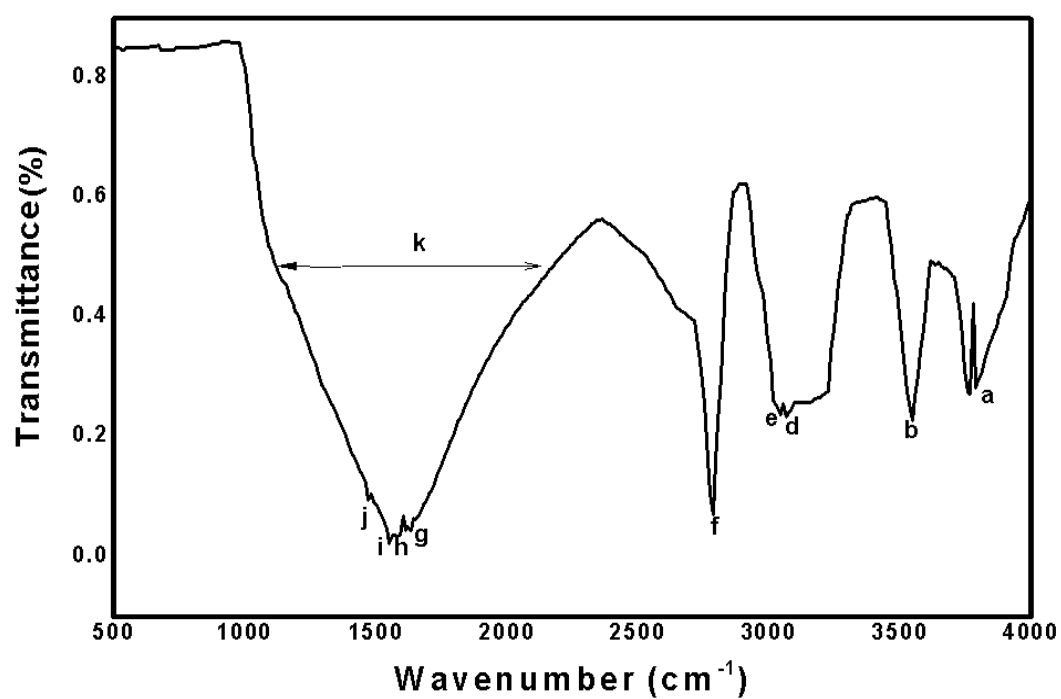


Figure S2. FTIR analysis of the oil precursors with trace amount of wax produced by degradation of polyethylene and 1-degradation, without any catalyst.

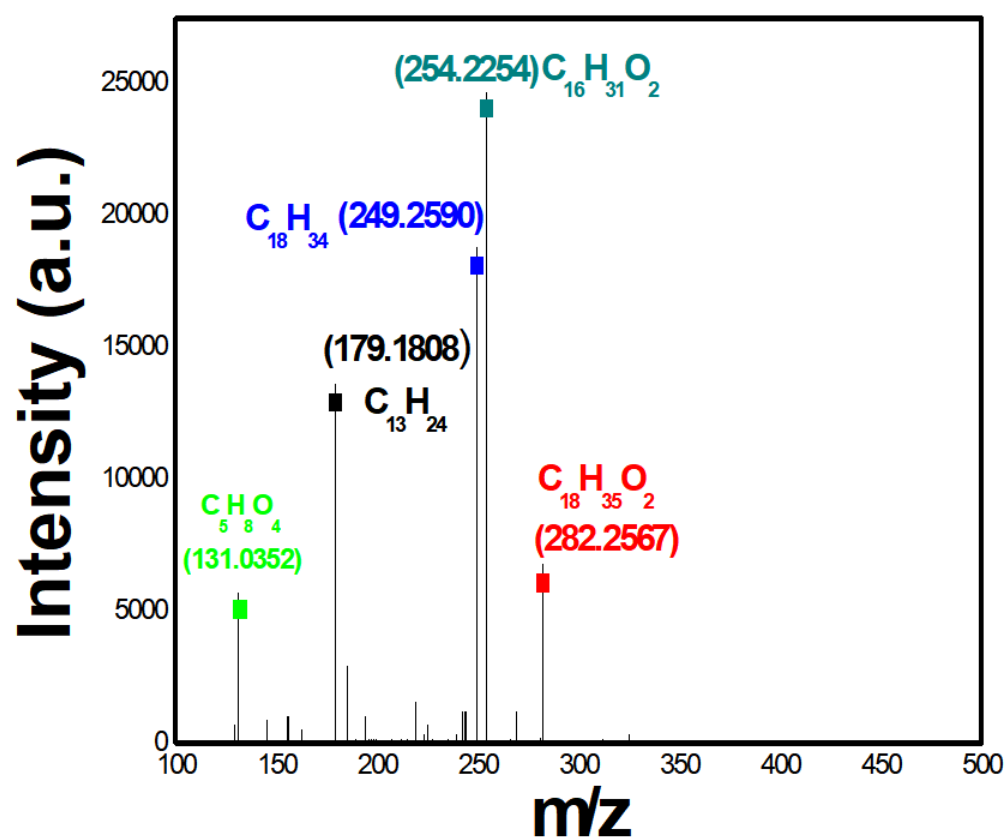


Figure S3. ESI-MS analysis of the oil precursors produced by the 1-octadecene degradation, without any catalyst.

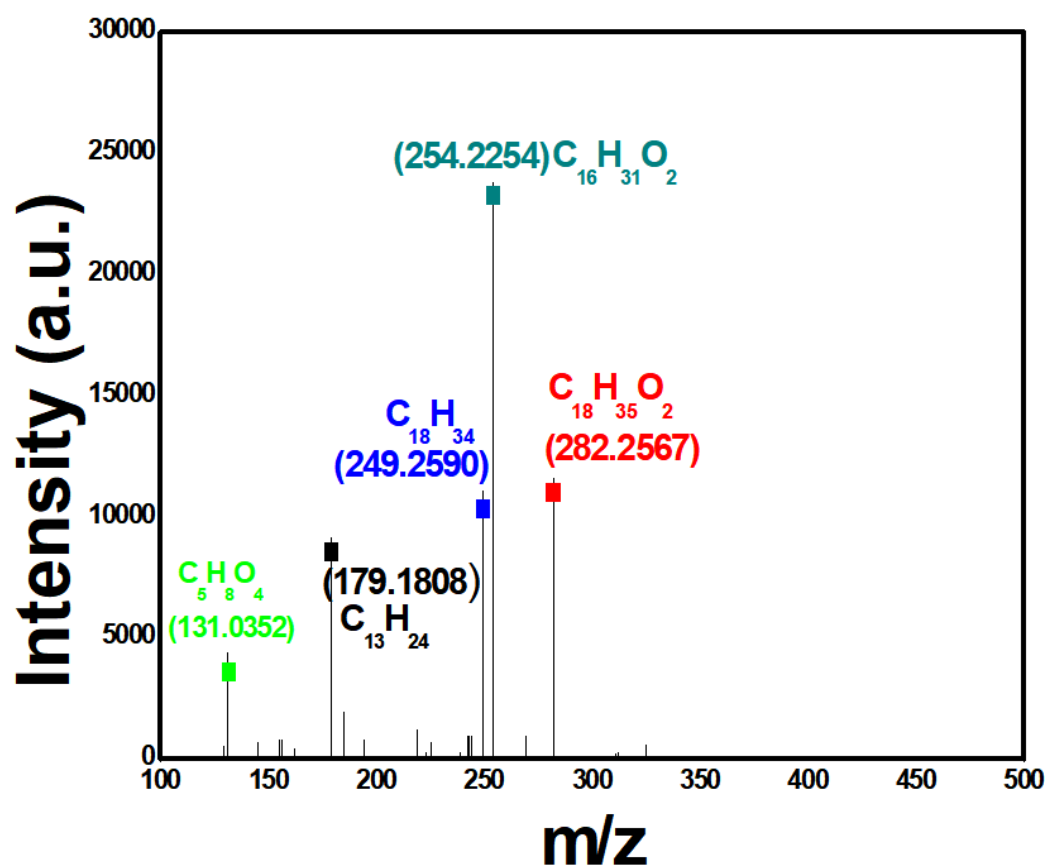


Figure S4. ESI-MS analysis of the oil precursors produced by the 1-octadecene degradation, catalyzed by $\gamma\text{-Al}_2\text{O}_3$.

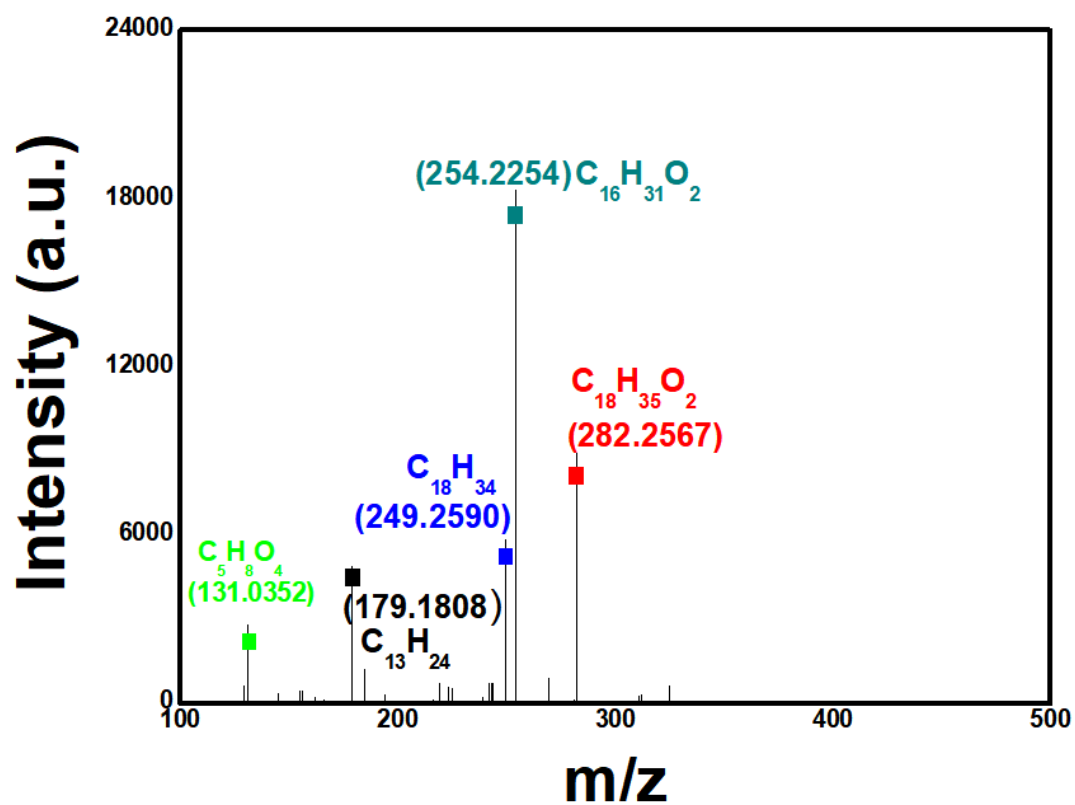


Figure S5. ESI-MS analysis of the oil precursors produced by the 1-octadecene degradation, catalyzed by Ga doped $\gamma\text{-Al}_2\text{O}_3$.

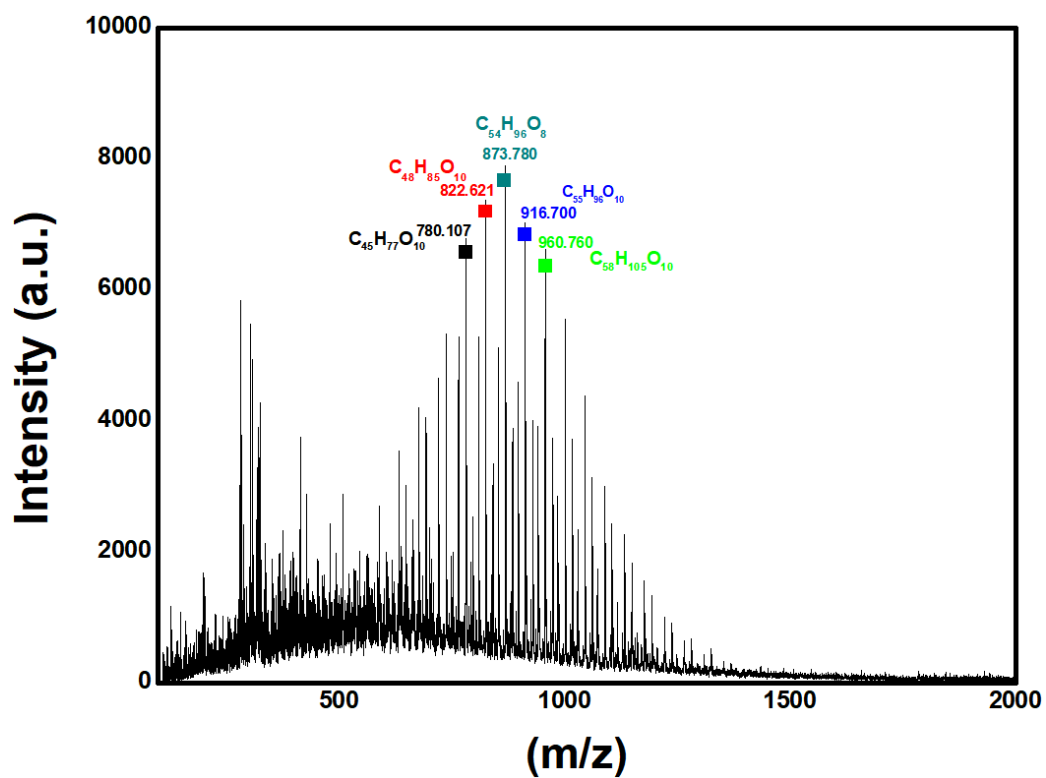


Figure S6. ESI-MS analysis of the wax produced by the polyethylene degradation, without any catalyst.

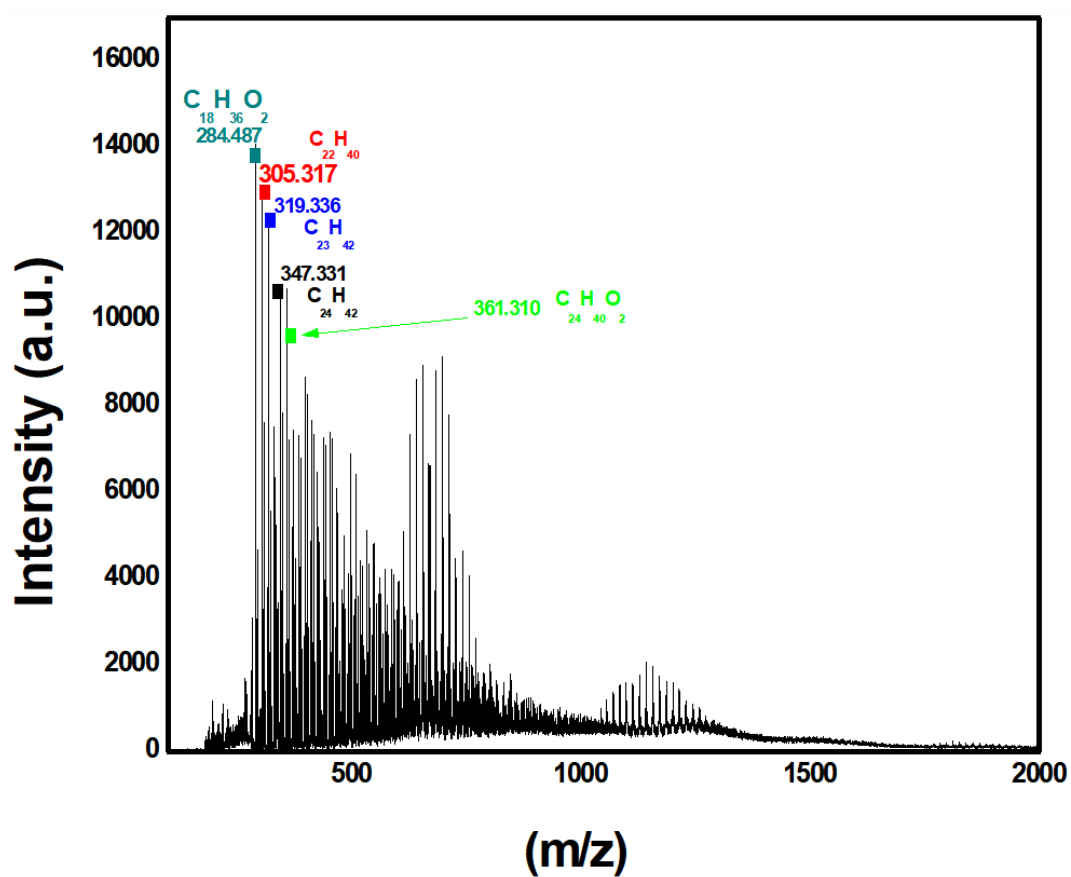


Figure S7. ESI-MS analysis of the wax produced by the polyethylene degradation, catalyzed by γ -Al₂O₃.

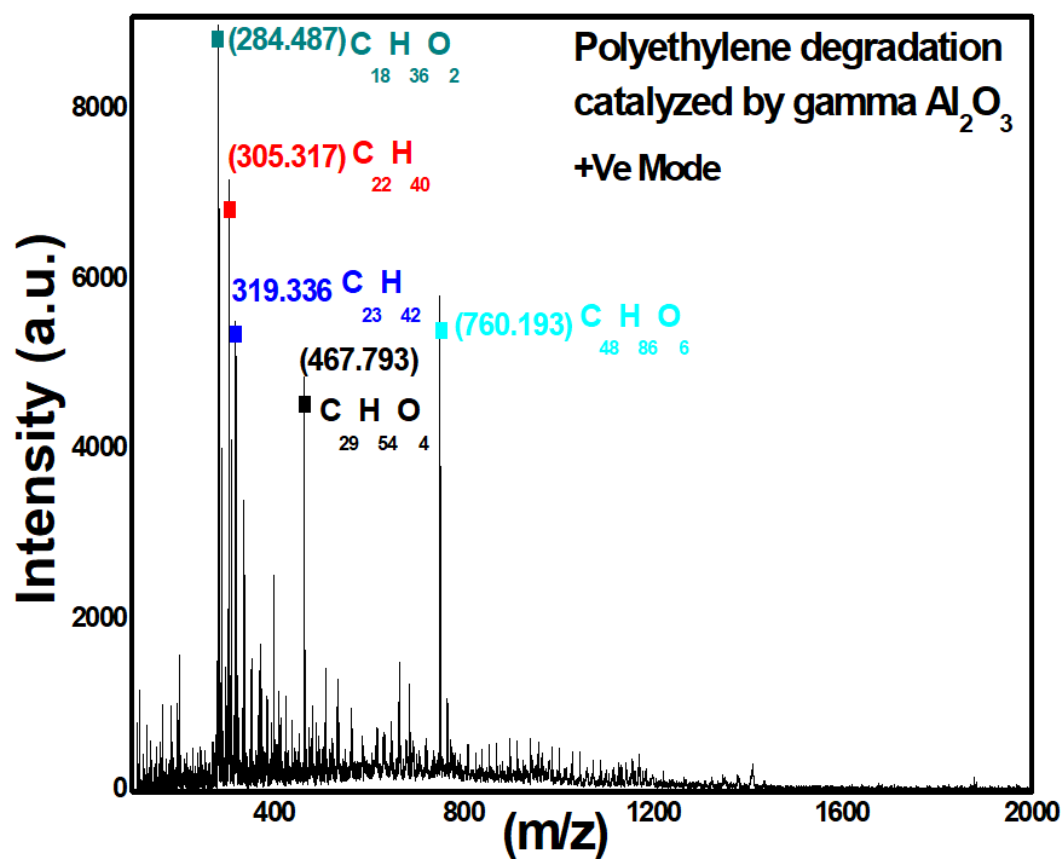


Figure S8. ESI-MS analysis of the wax produced by the polyethylene degradation, catalyzed by Ga doped $\gamma\text{-Al}_2\text{O}_3$.

Degradation Product	[M+H ⁺]*
C ₅ H ₈ O ₄	131.0352
C ₁₃ H ₂₄	179.1808
C ₁₈ H ₃₄	249.259
C ₁₆ H ₃₁ O ₂	254.2254
C ₁₈ H ₃₅ O ₂	282.2567
C ₂₂ H ₄₀	305.317
C ₂₃ H ₄₂	319.336
C ₂₄ H ₄₂	347.331
C ₂₄ H ₄₀ O ₂	361.310
C ₂₉ H ₅₄ O ₄	467.793
C ₄₈ H ₈₆ O ₆	760.193
C ₅₄ H ₉₆ O ₈	873.780
C ₄₈ H ₈₅ O ₁₀	822.621
C ₅₅ H ₉₆ O ₁₀	916.700
C ₄₅ H ₇₇ O ₁₀	780.107
C ₅₀ H ₈₈ O ₆	785.6651
C ₅₂ H ₉₂ O ₇	829.6913
C ₅₄ H ₉₃ O ₈	870.694
C ₅₄ H ₉₆ O ₈	873.780
C ₅₅ H ₉₆ O ₁₀	916.700
C ₅₆ H ₉₆ O ₉	913.7124
C ₅₈ H ₉₈ O ₁₀	955.723
C ₅₈ H ₁₀₅ O ₁₀	960.760

*[M+H⁺]= Molecular mass+mass of proton

Table S1. List of the products obtained during the polyethylene degradation.