Upgrading Brønsted acidity of Zeolite Hβ via Phosphotungstates: Engineering a high-performance catalytic platform for the production of energy-efficient biofuel additives

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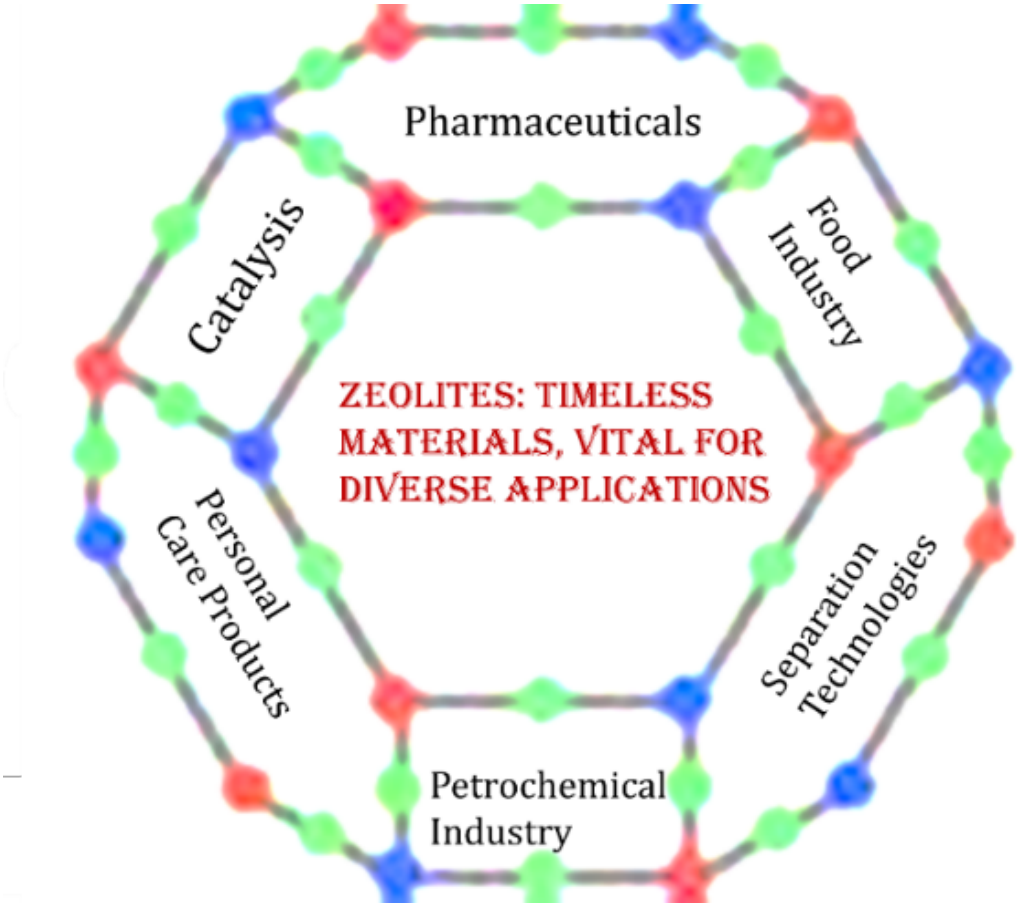
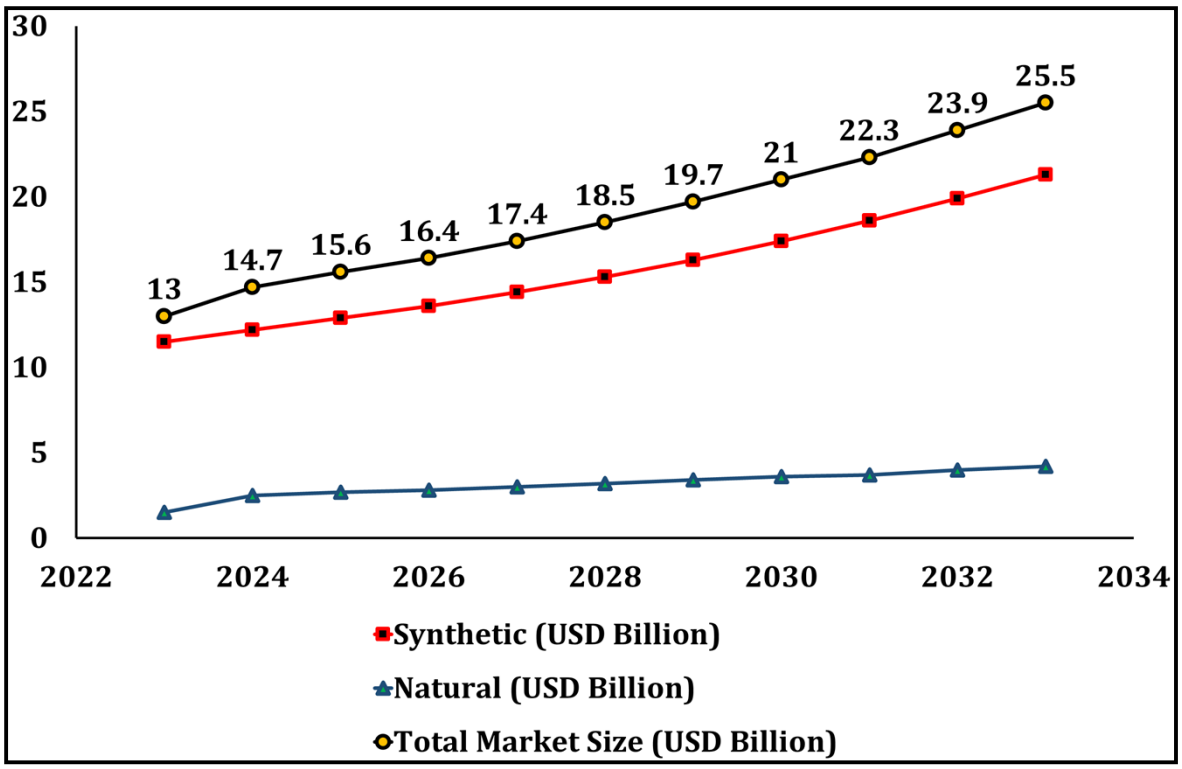
SUPPLEMENTARY INFORMATION

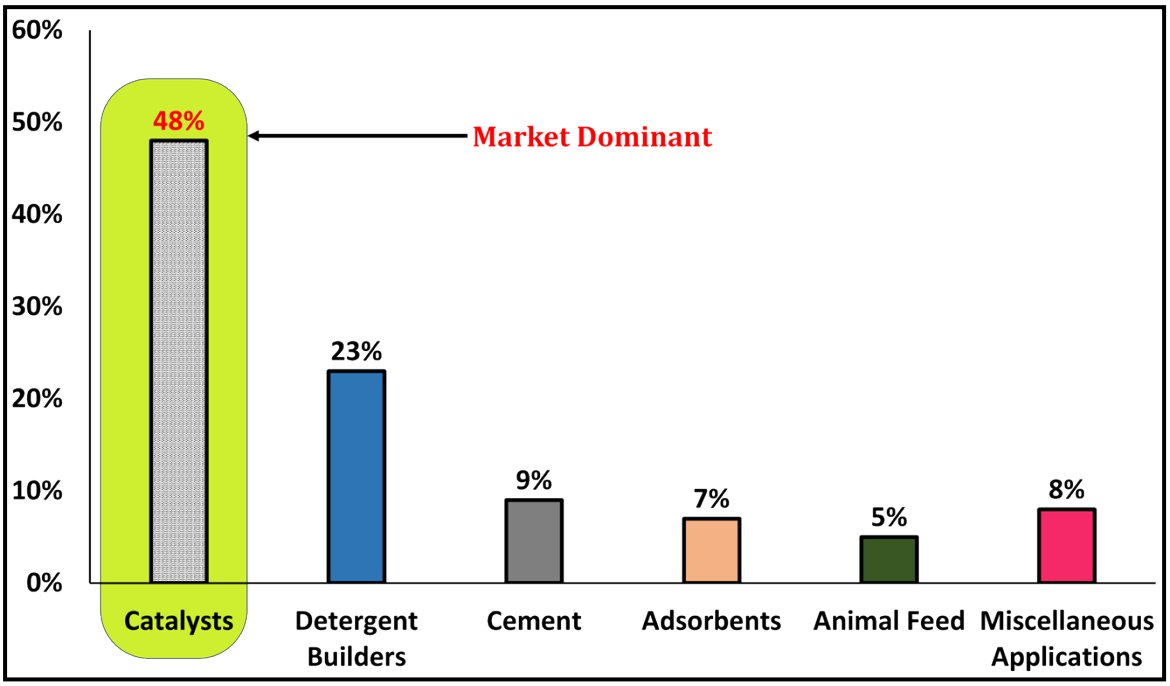
SUPPLEMENTARY FIGURES:



Supplementary Figure 1. Diverse applications of zeolites in various fields



Supplementary Figure 2. Global Zeolite Market Size by Product, 2023–2033 (USD Billion)



Supplementary Figure 3. Market share of zeolite applications

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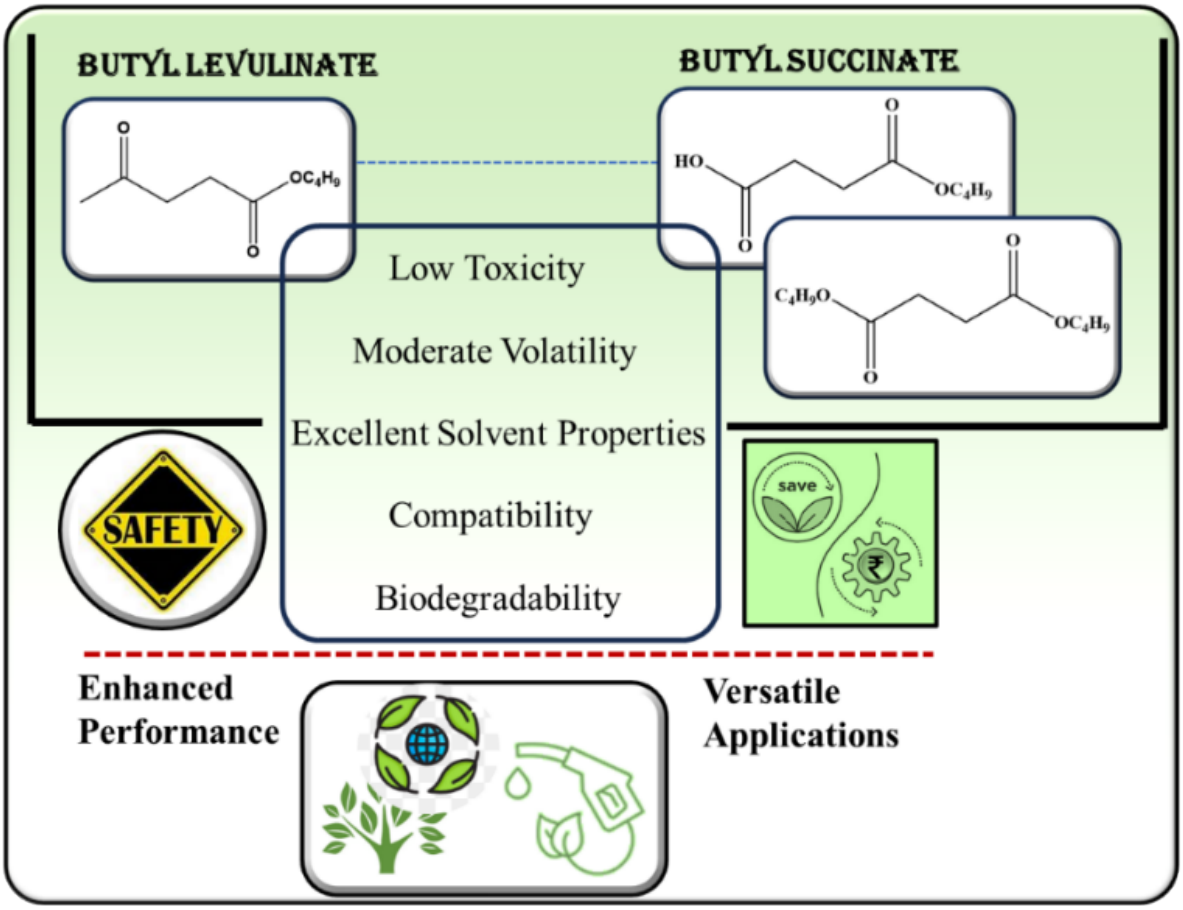

Supplementary Figure 4. Butyl esters leading to Safety, Performance and Sustainability

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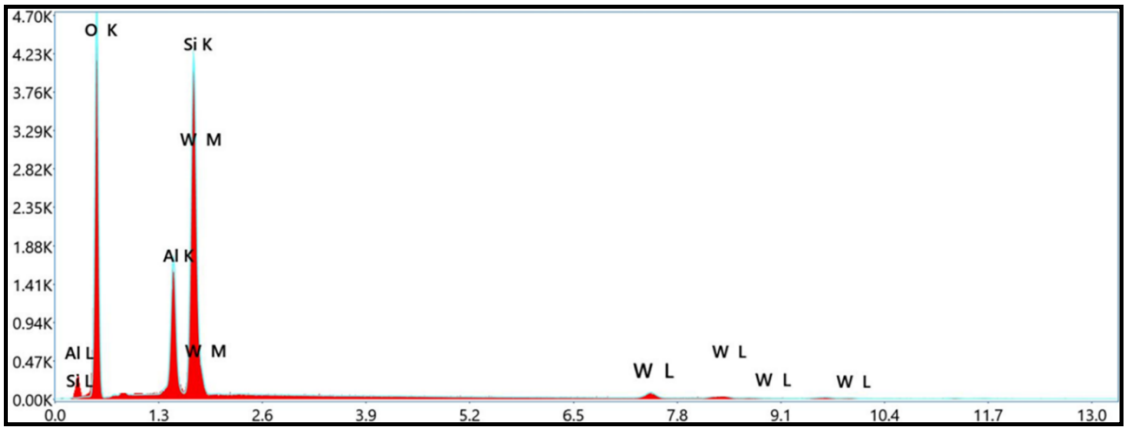
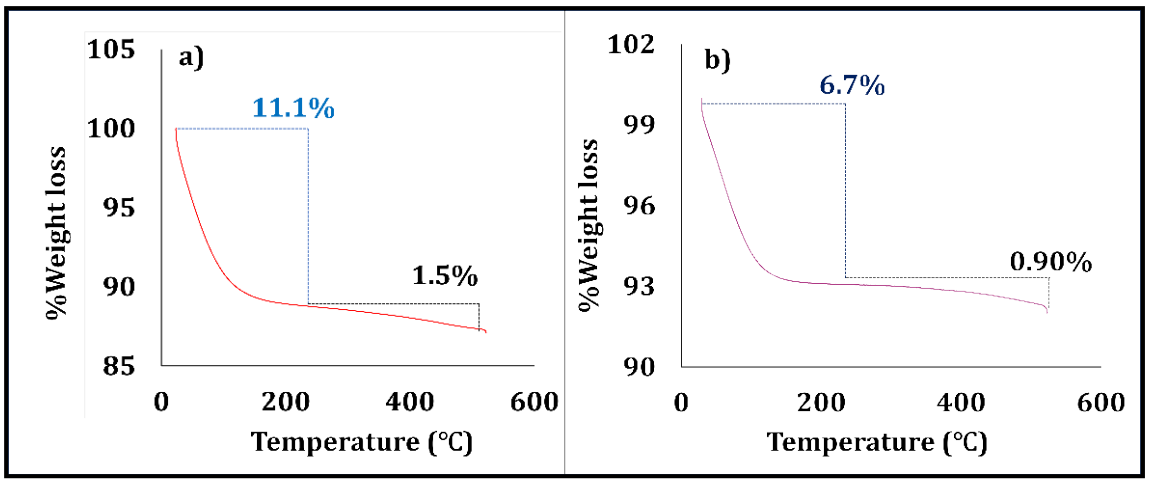


Supplementary Figure 5. EDS of PW_{12}/ZHβ



Supplementary Figure 6. TGA of a) ZHβ and b) PW_{12}/ZHβ

SUPPLEMENTARY TABLES:

Supplementary Table 1. Elemental analysis of catalyst

Material	Si (wt%)	O (wt%)	Al (wt%)	P (wt%)		W (wt%)	
				By EDX	Theoretical	By EDX	Theoretical
PW_{12}/ZHβ	26.70	54.07	1.50	0.23	0.24	17.50	17.56