Supplementary Information (SI) for RSC Advances.
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Efficient synthesis of tributyl citrate plasticizer by esterification reaction using SO_4^{2-}/ZrO_2-TiO_2 as catalysts

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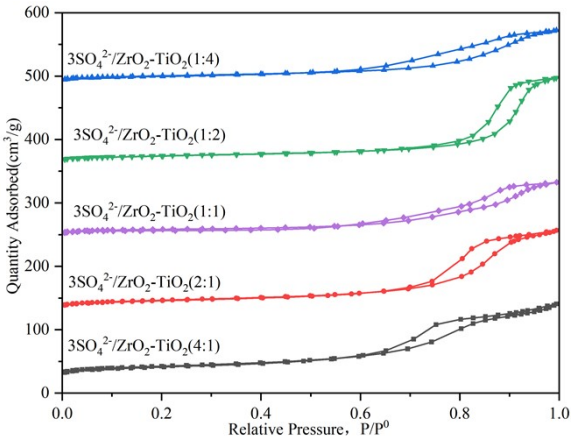

Figure S1 N_2 adsorption and desorption isotherms of SO_4^{2-}/ZrO_2-TiO_2 catalysts with different Zr/Ti molar ratios.

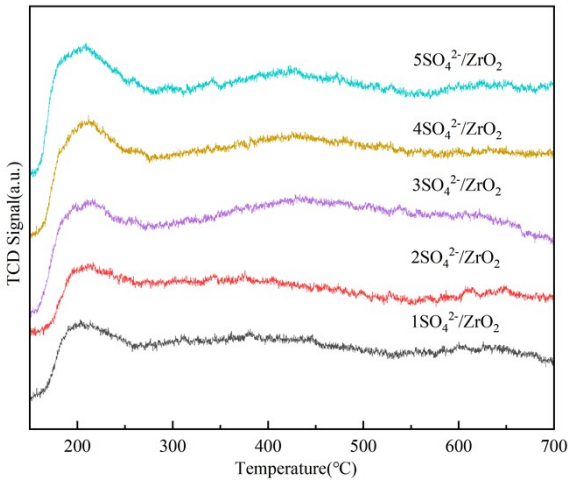

Figure S2 NH_3-TPD profiles of prepared catalysts

Table S1 Acid strength of different SO_4^{2-}/ZrO_2 catalysts

Catalyst	Acitidy (μmol g^{-1})			Sum
	Weak	Moderate	Strong	
$1SO_4^{2-}/ZrO_2$	44.8	76.8	42.3	163.9
$2SO_4^{2-}/ZrO_2$	36.3	63.0	34.3	133.6
$3SO_4^{2-}/ZrO_2$	77.7	155.2	87.3	320.2
$4SO_4^{2-}/ZrO_2$	67.8	125.5	74.7	268
$5SO_4^{2-}/ZrO_2$	82.9	131.2	81.1	295.2

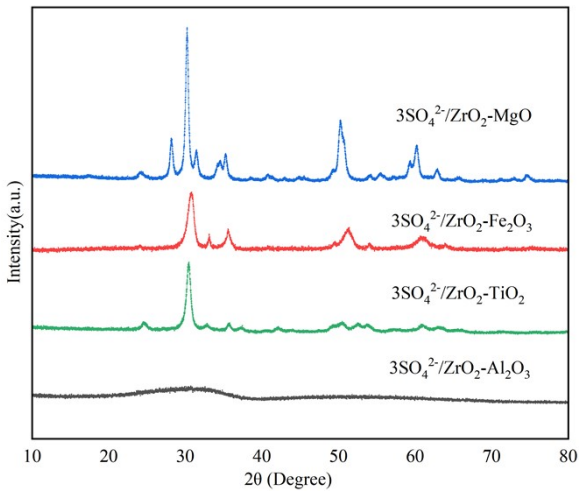

Figure S3 XRD patterns of SO_4^{2-}/ZrO_2 catalysts supported by different oxides

Table S2 Physical N_2 adsorption and desorption isotherms analysis results

catalyst	Surface area(m^2g^{-1})	Pore volume(cm^2g^{-1})	Pore size(nm)
$3SO_4^{2-}/ZrO_2$-TiO_2	34.8	0.13	15
$3SO_4^{2-}/ZrO_2$-Al_2O_3	47.6	0.05	3.9
$3SO_4^{2-}/ZrO_2$-Fe_2O_3	30.2	0.14	17.9
$3SO_4^{2-}/ZrO_2$-MgO	24.8	0.08	12.2

Table S3 Results of BET and elementary analysis of $3SO_4^{2-}/ZrO_2$-TiO_2 (4:1) catalyst before and after recycle test.

catalyst	Surface area(m^2g^{-1})	Pore volume(cm^2g^{-1})	Pore size(nm)	S contents(wt.%)
Fresh	58.9	0.18	12.0	0.48
Used	44.5	0.16	14.7	0.22