Electronic Supplementary Material (ESI) for Nanoscale Advances.

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Supporting Information

Large-scale production of MXenes as nanoknives for antibacterial application

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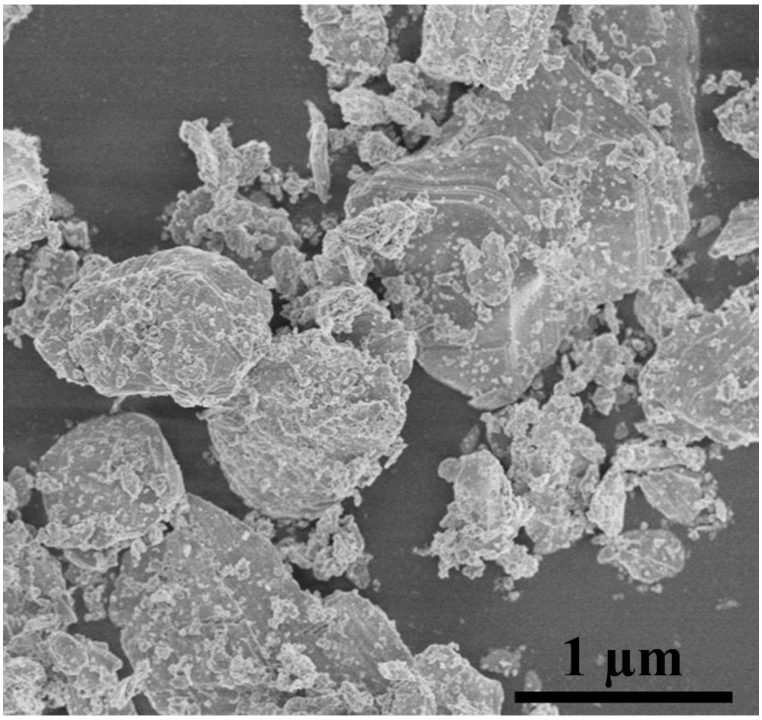

Fig. S1 Scanning electron microscopy image of the pristine Ti_3AlC_2 MAX phase.

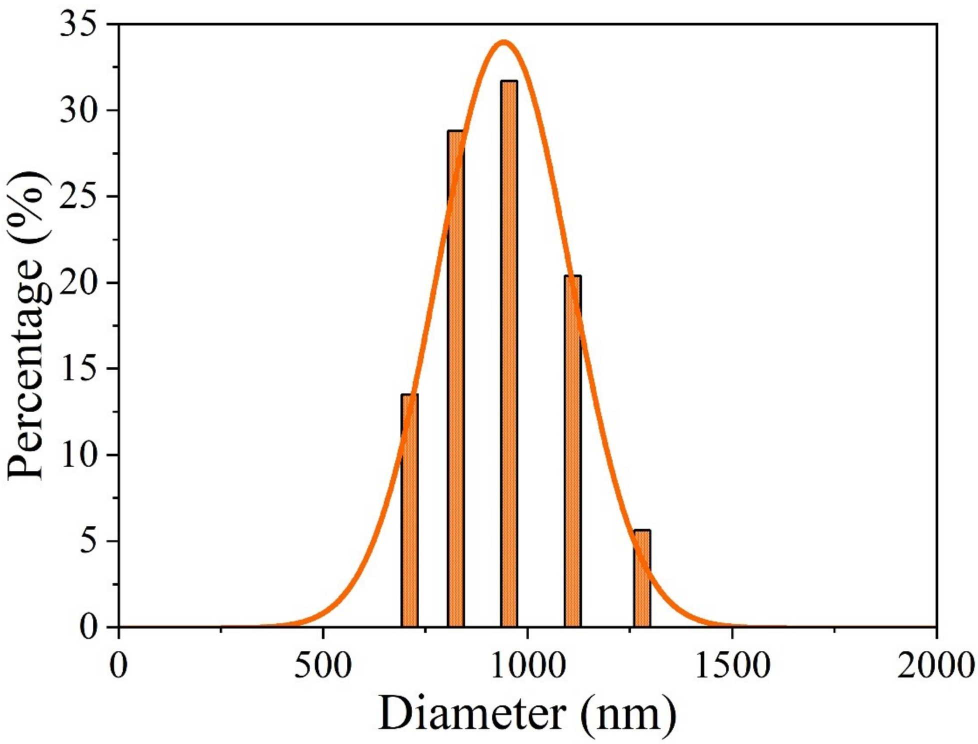

Fig. S2 The size distribution of the prepared E-Ti_3C_2 MXene nanosheets.

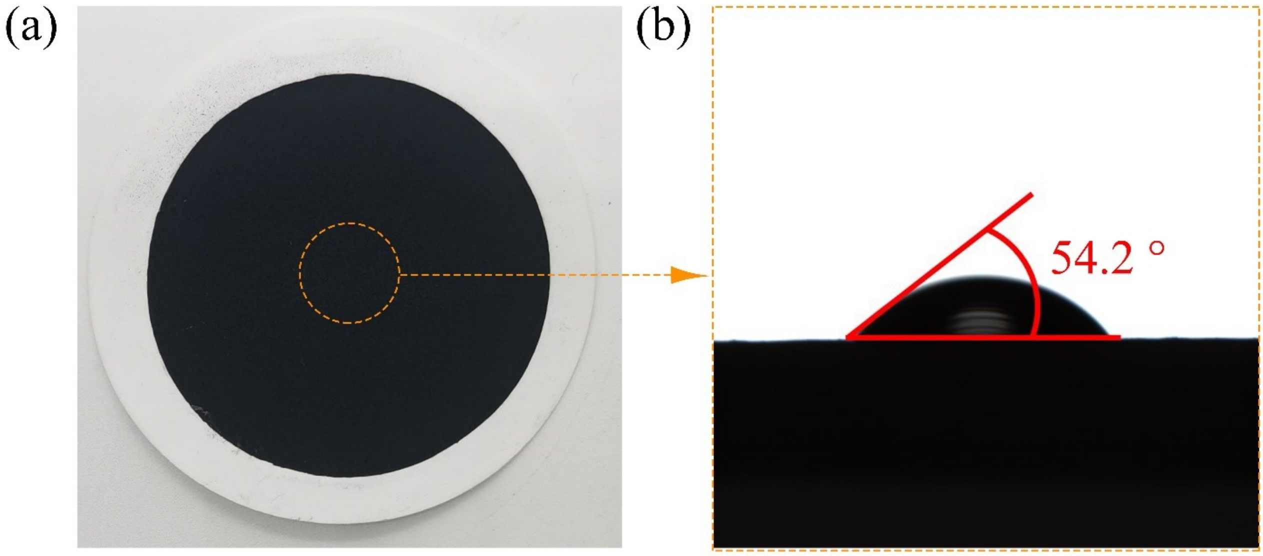

Fig. S3 (a) Digital photo of E-Ti_3C_2 on a nylon substrate. (b) Water contact angle of E-Ti_3C_2 on a nylon substrate.

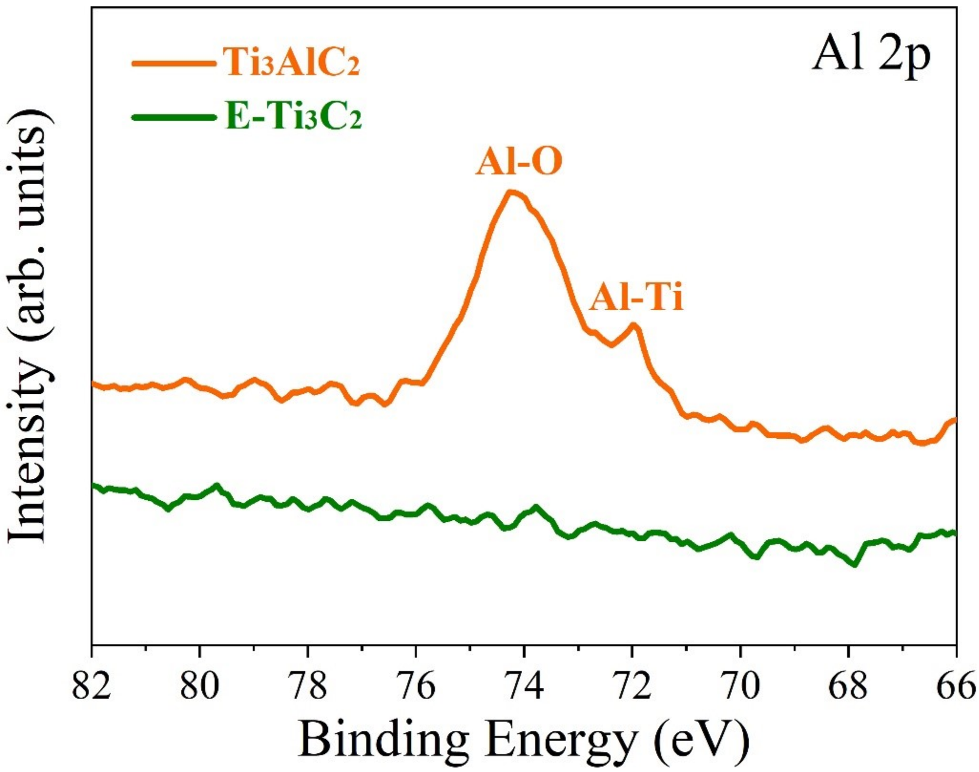

Fig. S4 High-resolution X-ray photoelectron spectroscopy results of the pristine Ti_3AlC_2 MAX phase and E-Ti_3C_2 in the Al 2p region.

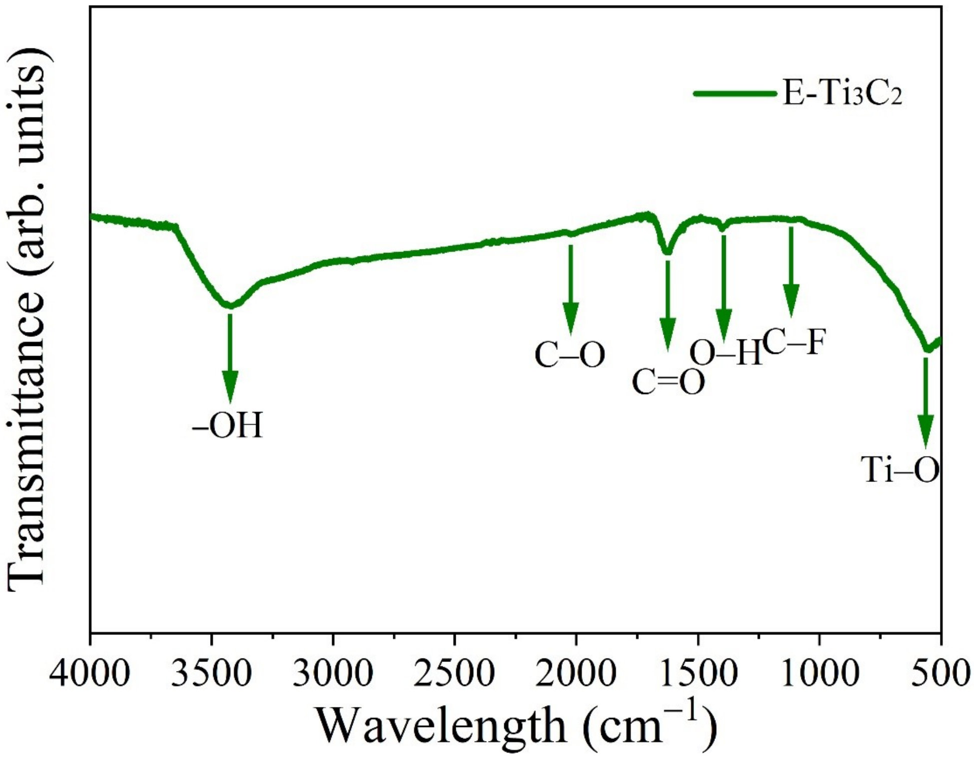

Fig. S5 Fourier transform infrared spectrum of the E-Ti_3C_2 MXene.

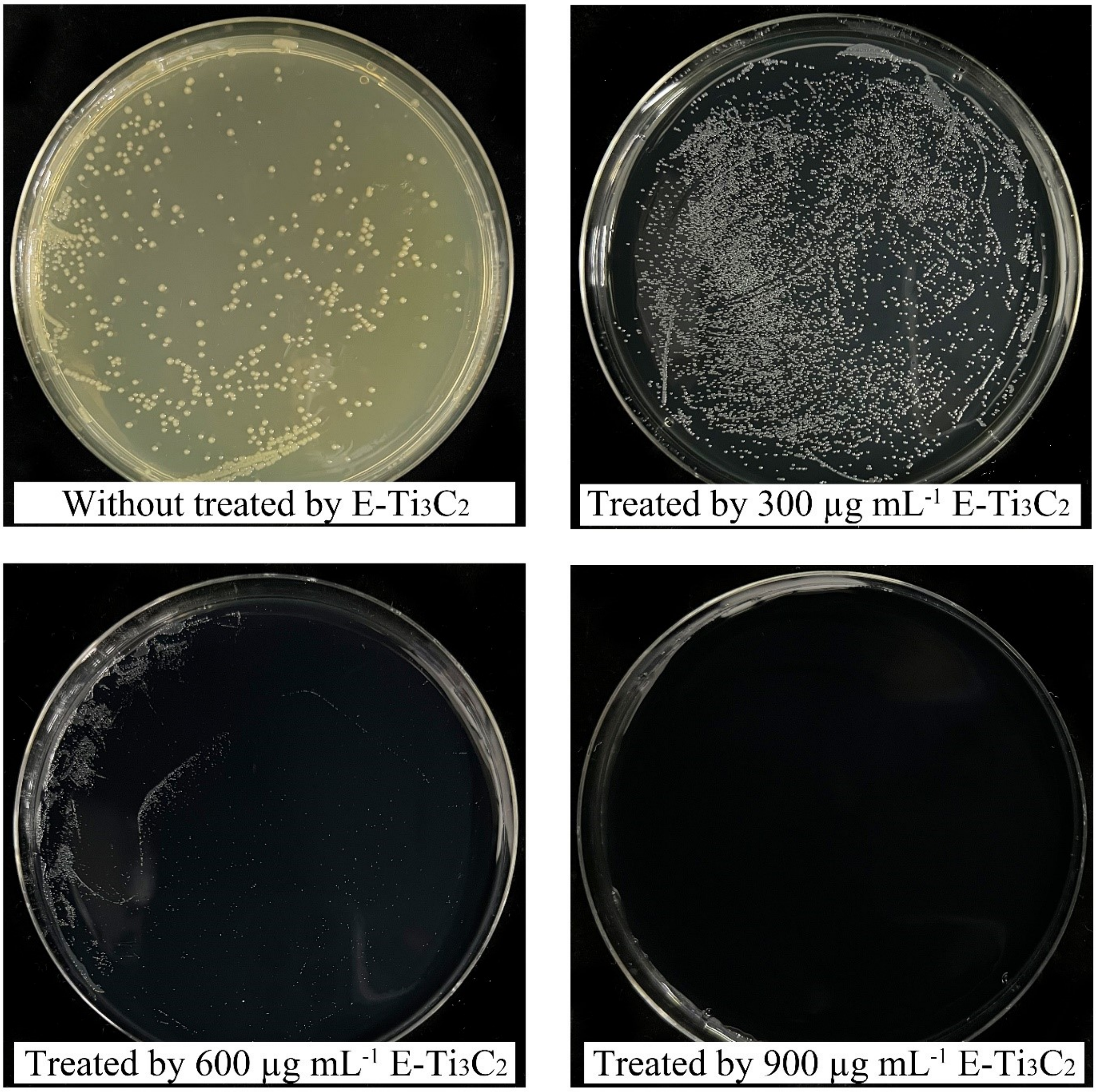

Fig. S6 Photographs of the first replicate samples of *E. coli* incubated in non-E-Ti_3C_2-treated and E-Ti_3C_2-treated LB media for 12 hours.

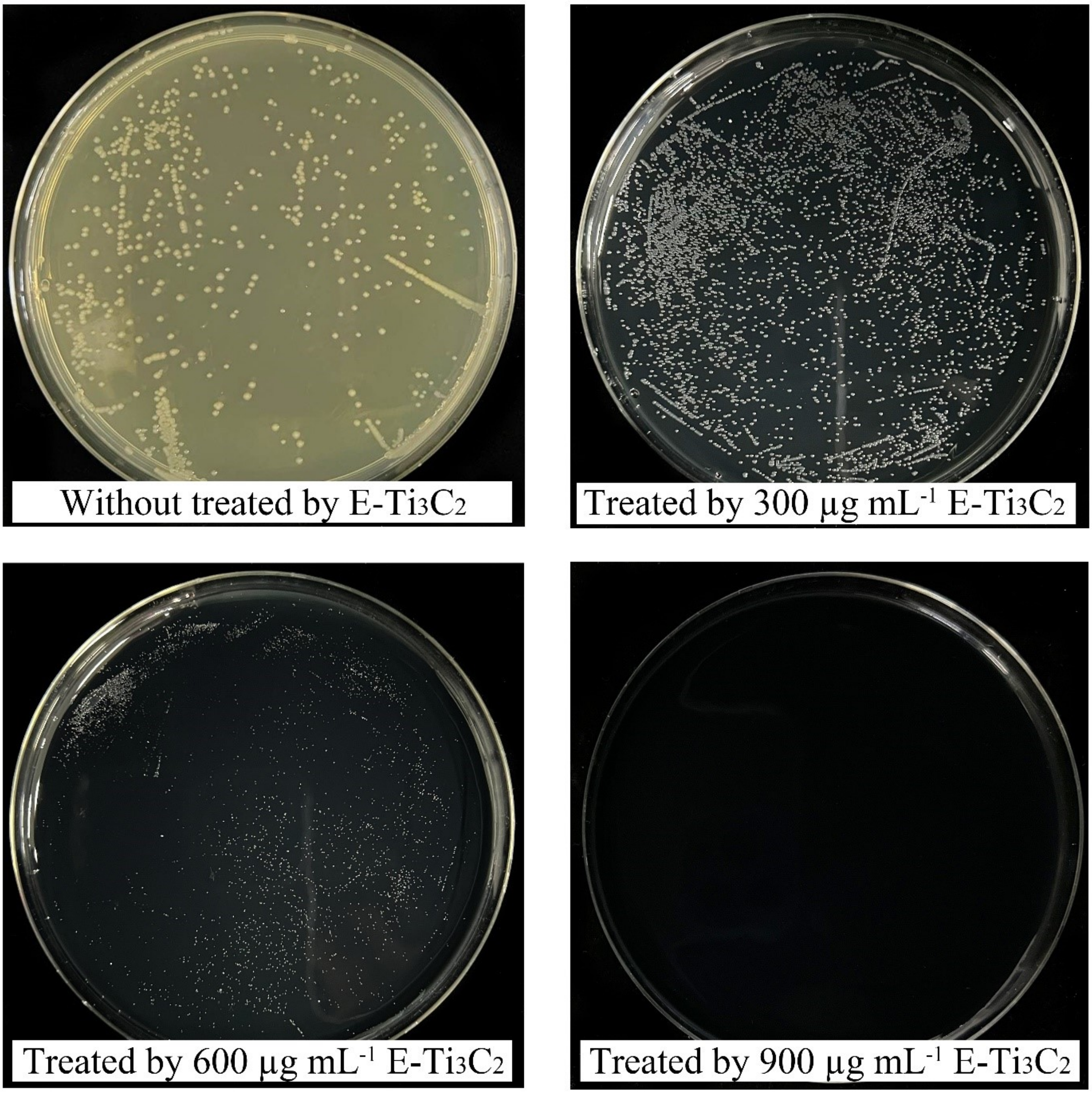

Fig. S7 Photographs of the second replicate samples of *E. coli* incubated in non-E-Ti_3C_2-treated and E-Ti_3C_2-treated LB media for 12 hours.

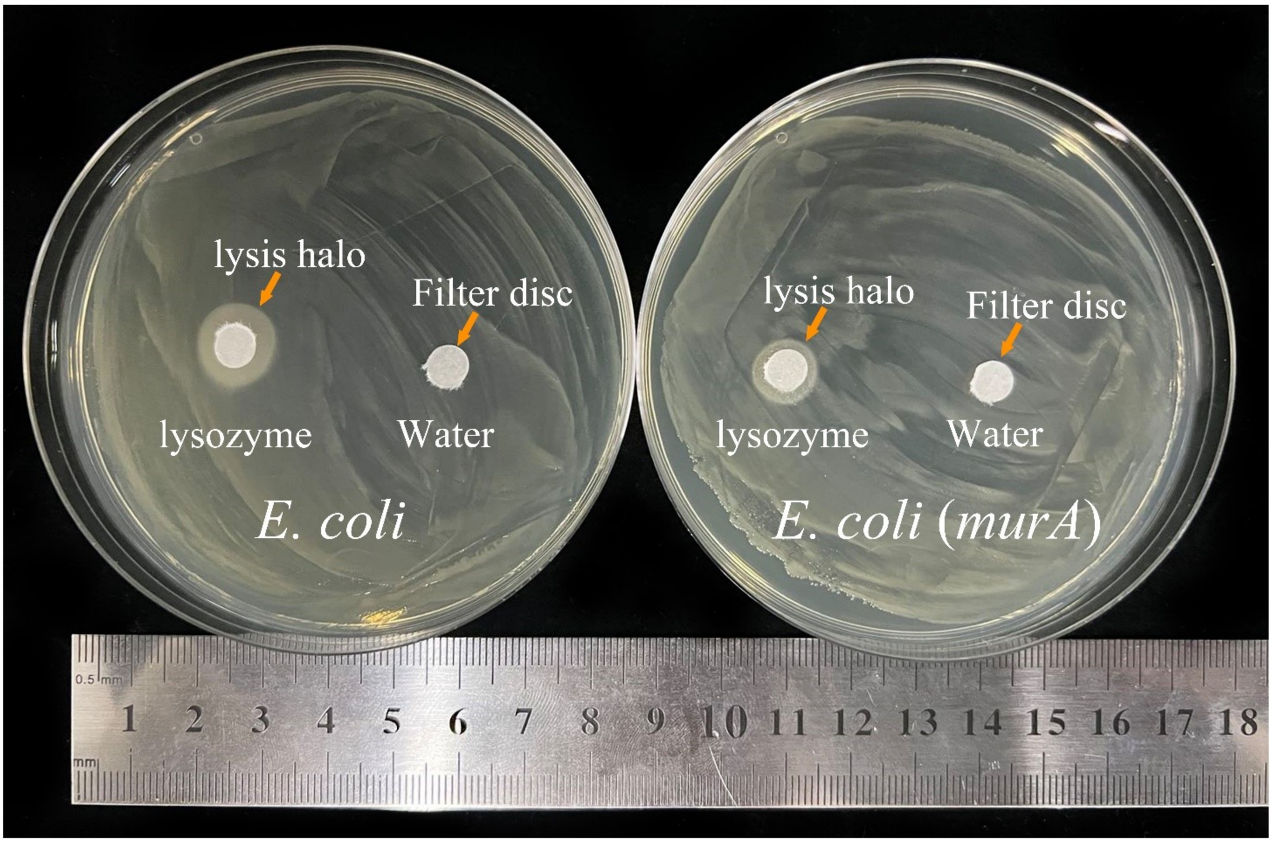

Fig. S8 Magnitude of the lysis halo from the same dose of lysozyme on *E. coli* with thickened (right) and normal cell walls (left).

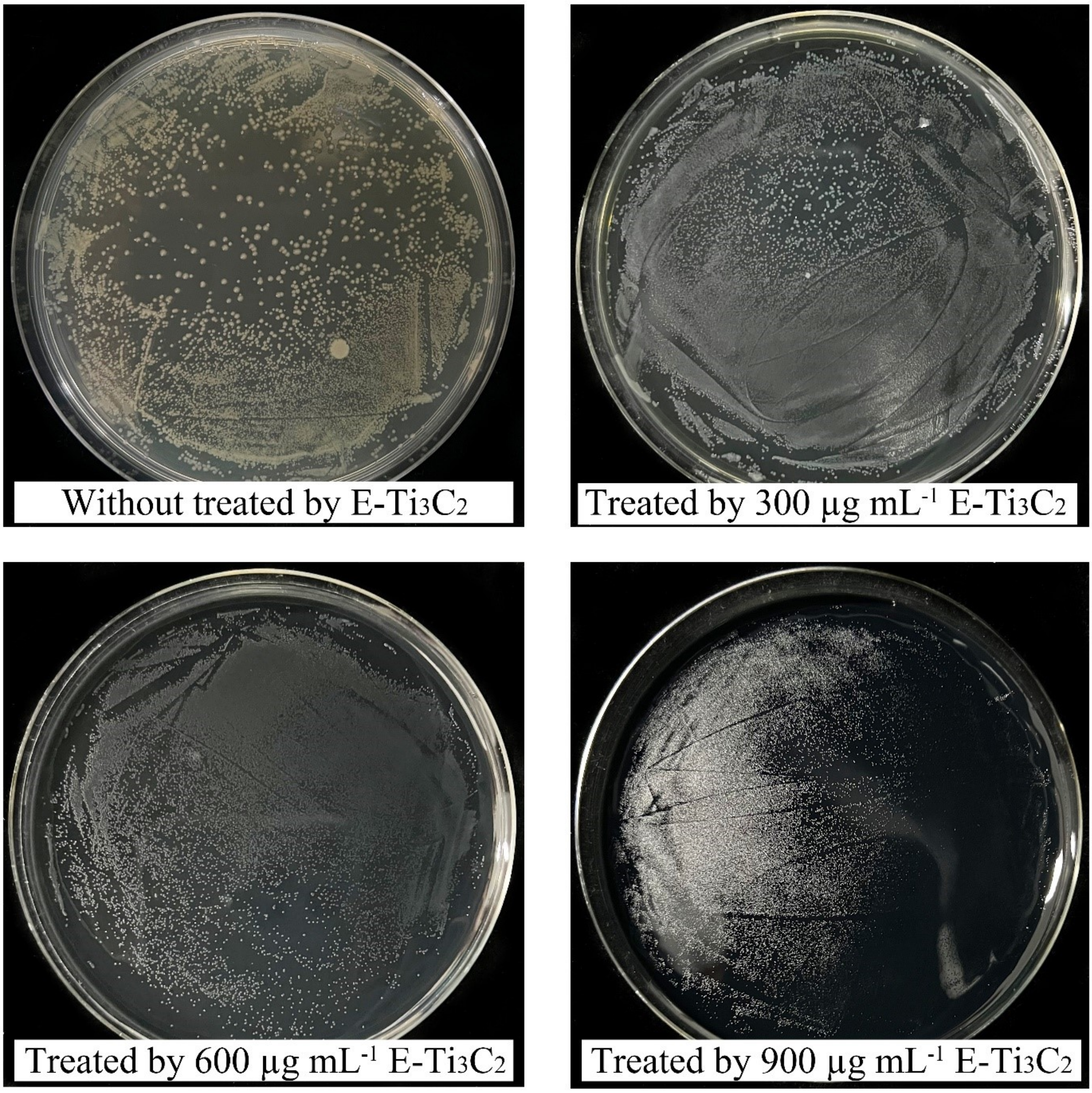

Fig. S9 Photographs of the first replicate samples of *E. coli* with thickened cell walls, incubated in non-E-Ti_3C_2-treated and E-Ti_3C_2-treated LB media for 12 hours.

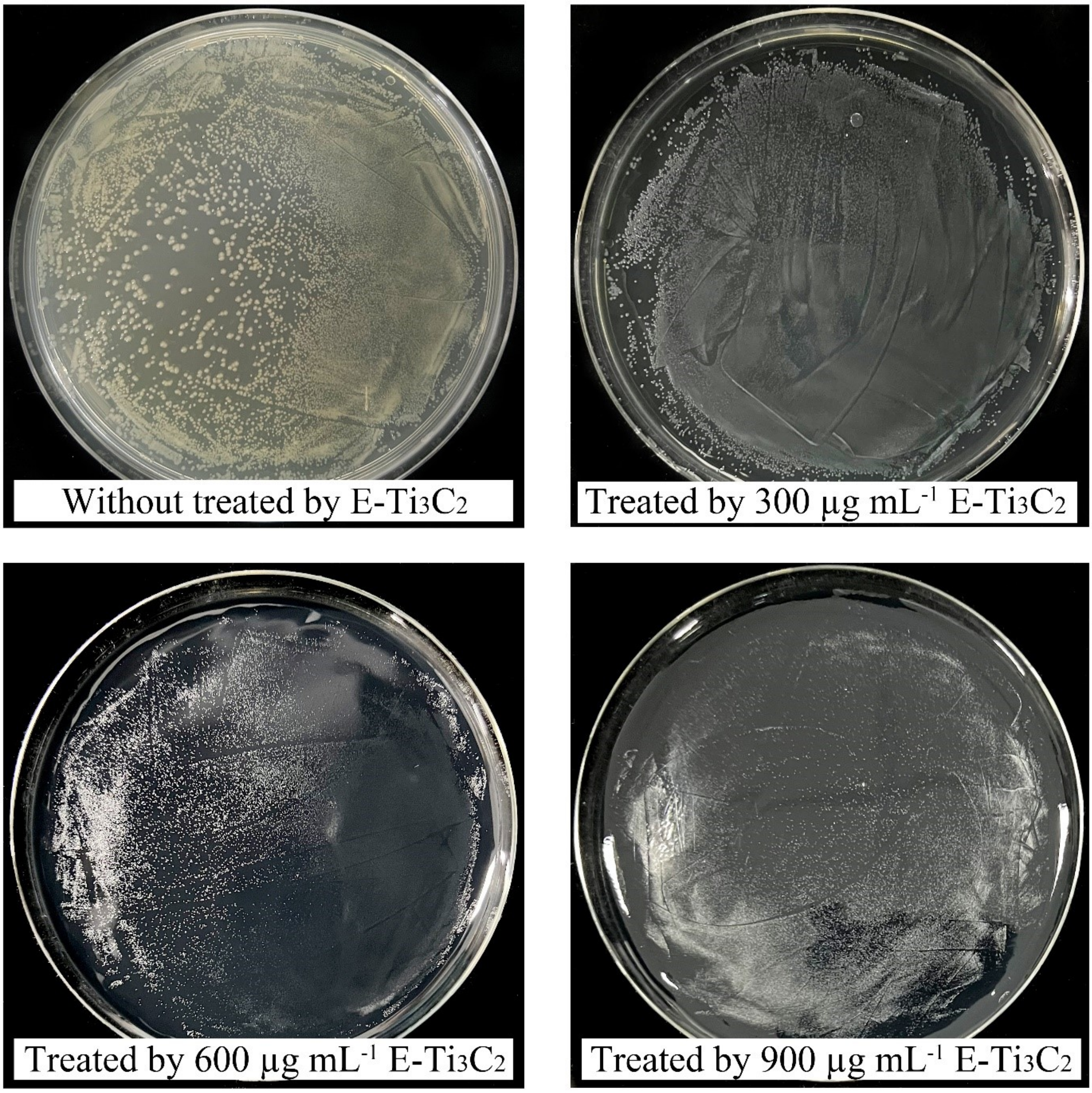

Fig. S10 Photographs of the second replicate samples of *E. coli* with thickened cell walls, incubated in non-E-Ti_3C_2-treated and E-Ti_3C_2-treated LB media for 12 hours.

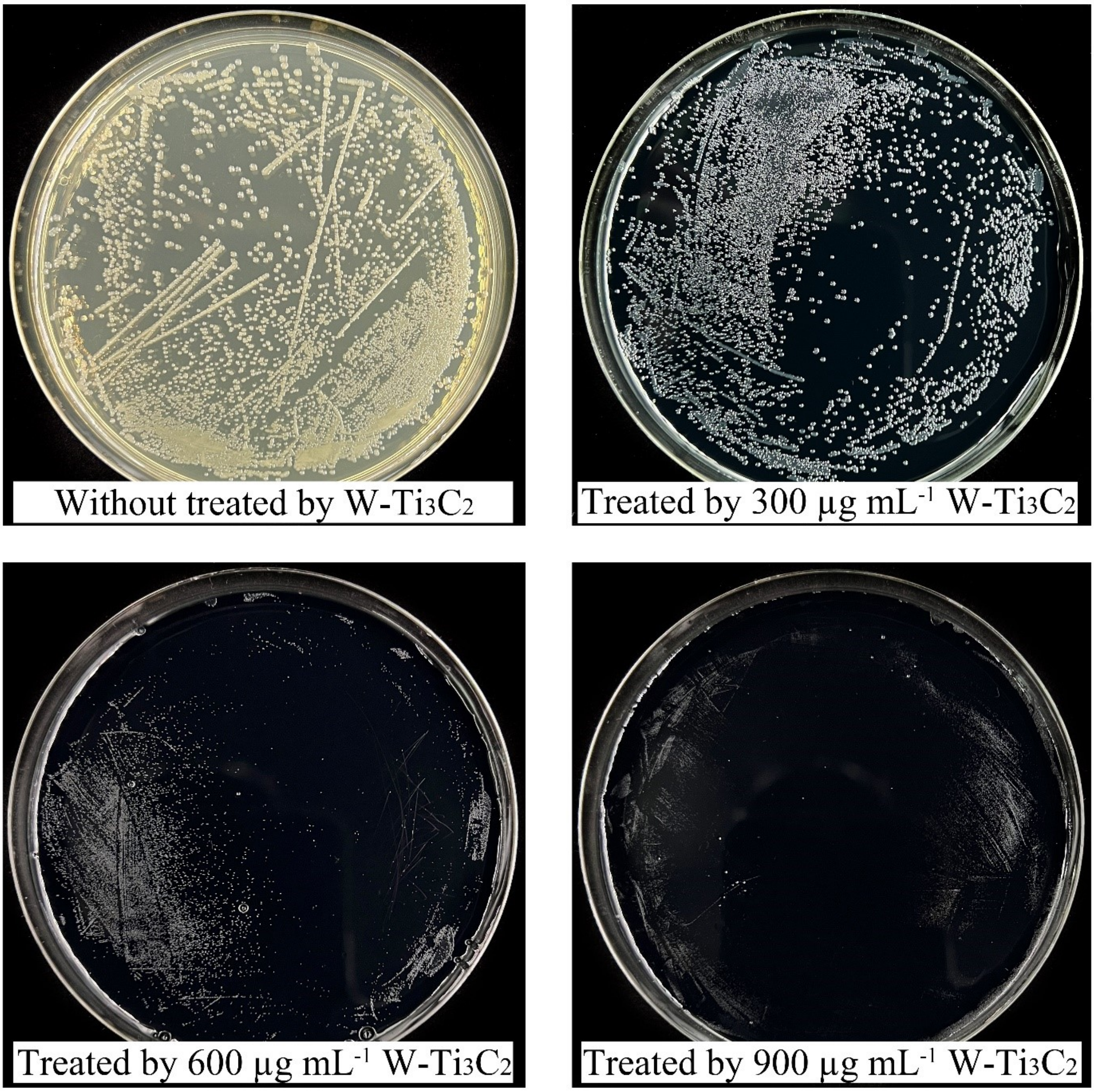

Fig. S11 Photographs of *E. coli* incubated in non-W-Ti_3C_2-treated and W-Ti_3C_2-treated LB media for 12 hours.

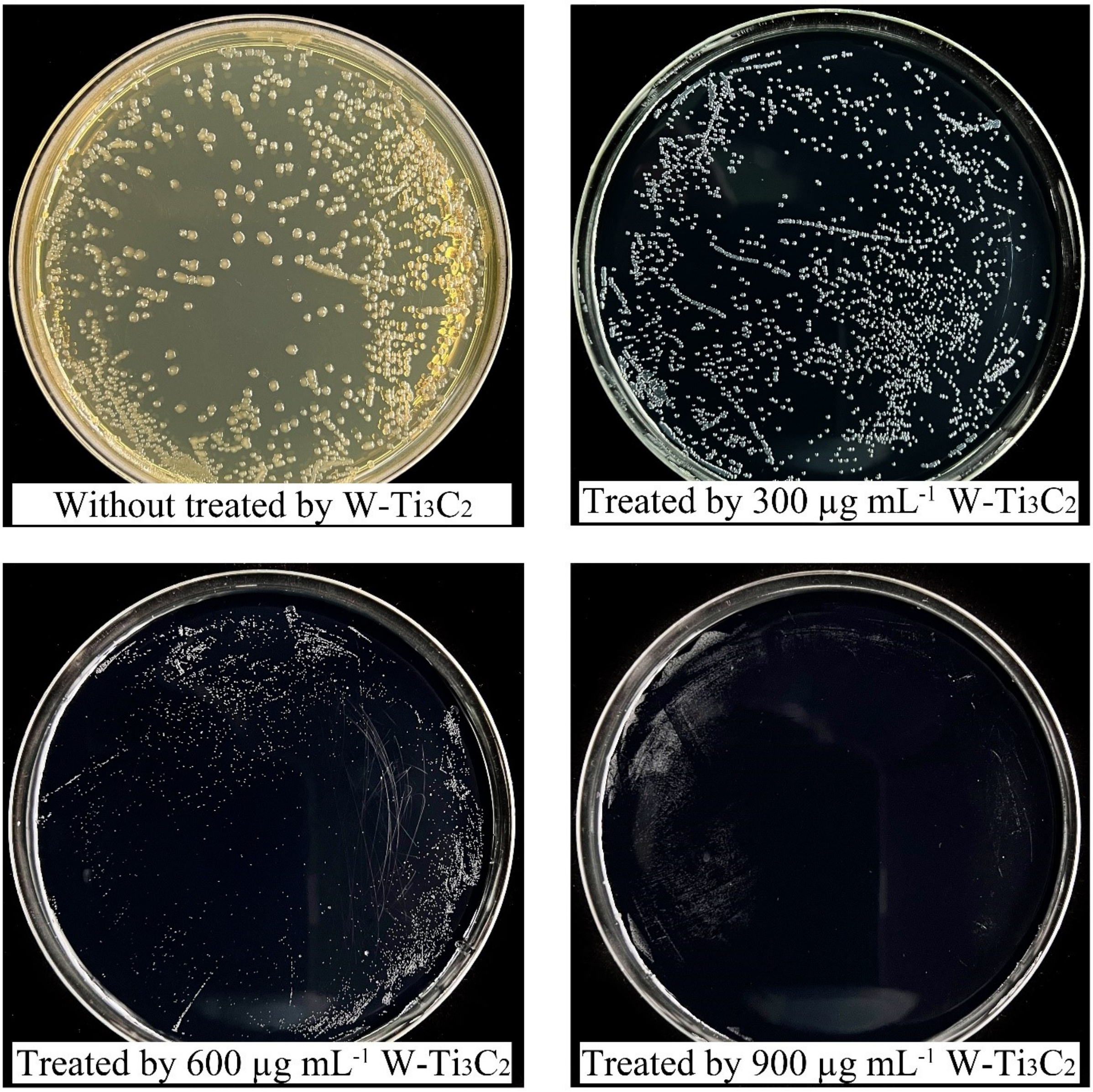

Fig. S12 Photographs of the first replicate samples of *E. coli* incubated in non-W-Ti_3C_2-treated and W-Ti_3C_2-treated LB media for 12 hours.

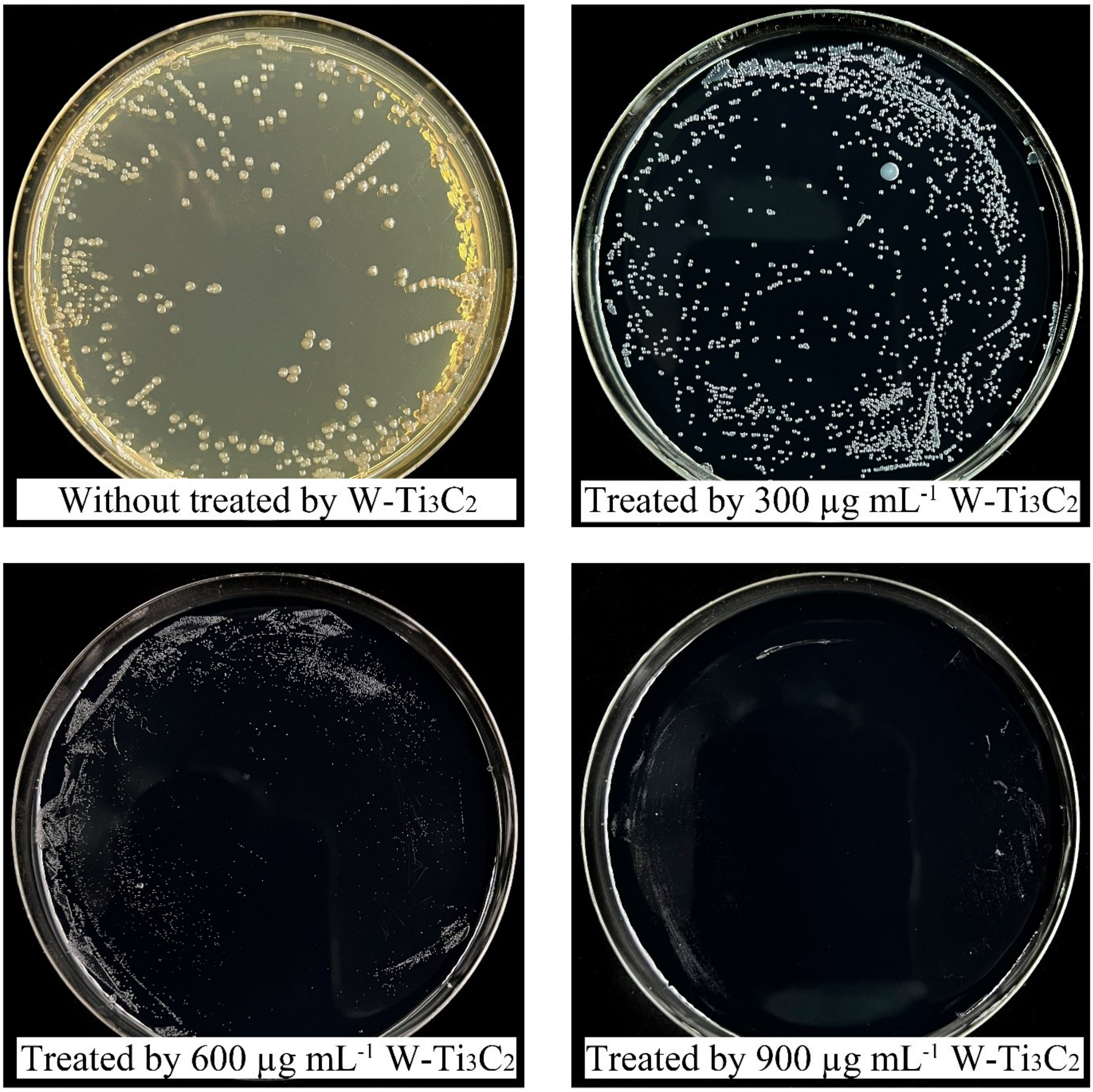

Fig. S13 Photographs of the second replicate samples of *E. coli* incubated in non-W-Ti_3C_2-treated and W-Ti_3C_2-treated LB media for 12 hours.

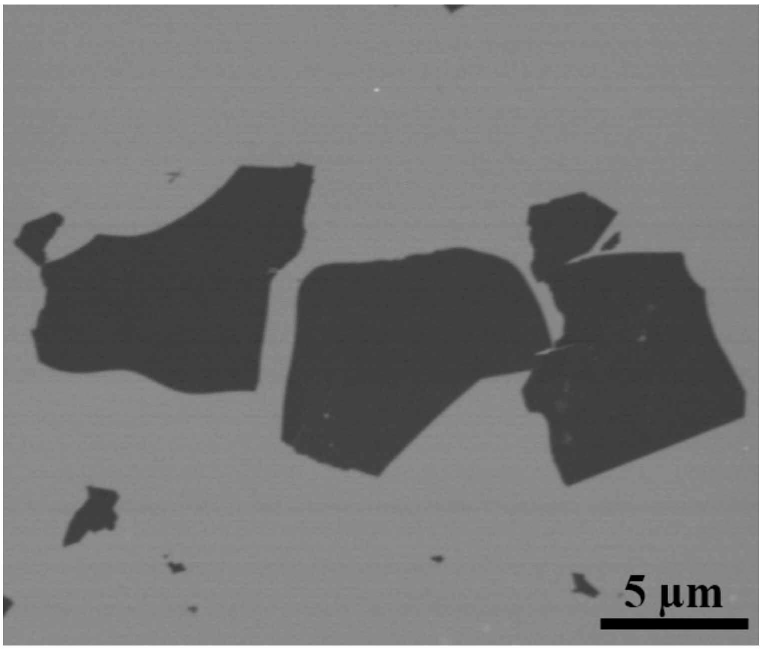

Fig. S14 SEM image of W-Ti_3C_2 prepared through conventional wet chemical etching method.

Table S1. Energy consumption of ECO-ME and conventional wet chemical etching methods.

Preparation methods	Equipment Model	Working hours (h)	Equipment-rated power (kW)	Electricity consumption (kW*h)
Wet-chemical etching method	Heidolph® Hei-Connect Magnetic Stirrers	30	0.8	24
ECO-ME method	MITR® YXQM-0.4L	2	0.55	1.1

Table S2. Elemental composition of the pristine MAX phase and E-Ti_3C_2.

Sample	Element (atomic%)				
	C	**O**	**Ti**	**Al**	**F**
Pristine MAX Phase	37.65	37.45	14.76	10.14	-
E-Ti_3C_2	42.25	19.14	27.64	-	10.97

Table S3. Summary of XPS peak fitting values for the prepared E-Ti_3C_2 MXene

Region	Binding energy (eV)	Assigned to	Reference
Ti 2p	455.0	Ti–C	[1]
	456.0	(OH)–Ti^{2+}–C	[2]
	457.2 (462.4)	(OH)–Ti^{3+}–C	[3 4]
	458.5 (463.9)	TiO_2	[5, 6]
	459.4	$TiO_{2-x}F_x$	[7]
	461.1	C–Ti–(O/OH)	[8]
C 1s	281.8	C–Ti	[8]
	284.6	C–C	[8]
	286.7	C–O	[8]
	288.39	O–C=O	[8]
O 1s	529.7	TiO_2	[9]
	530.8	$TiO_{2-x}F_x$	[10]
	532.2	C–Ti–$(OH)_x$	[11]
F 1s	684.9	C–Ti–F	[8]
	685.9	$TiO_{2-x}F_x$	[10]

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