

Supporting Information

Lanthanum Molybdenum Oxide as a New Platform for Highly Selective Adsorption and Fast Separation of Organic Dyes

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1. Crystal data and structure refinement for La-Mo

Table S1.Crystal data and structure refinement for La-Mo

Compounds	La-Mo
Formula	C ₂ H ₅ LaMoO ₇
Mr	375.91
T / K	298(2)
Cryst. Syst.	Triclinic
Space group	P-1
a/Å	9.7835(6)
b/Å	10.2650(6)
c/Å	14.8005(9)
α/°	91.4270(10)
β/°	107.7180(10)
γ/°	91.2630(10)
V/Å ³	1414.75(15)
Z	8
μ / mm ⁻¹	7.721
F(000)	1376
Refls	8195
Rint	0.0240
GOF	0.989
R1 [$I > 2\sigma(I)$] ^[a]	0.0307
wR ₂ (all data) ^[b]	0.0827
Δρ max,min/eÅ ⁻³	0.932 and -1.124

[a] R₁= $\sum||F_o|-|F_c||/\sum|F_o|$. [b] wR₂= $\sum[w(F_o^2-F_c^2)^2]/\sum[w(F_o^2)^2]^{1/2}$

2. Selected bond length (Å) and angles (°) of compound La-Mo

Table S2 Selected bond length (Å) and angles (°) of compound La-Mo

La(1)-O(7)	2.455(6)	La(1)-O(24)#1	2.478(10)
La(1)-O(21)	2.524(8)	La(1)-O(22)#2	2.526(7)
La(1)-O(14)#3	2.582(7)	La(1)-O(1W)	2.585(5)
La(1)-O(4)	2.667(7)	La(1)-O(15)	2.629(9)
La(1)-O(17)	2.663(9)	La(2)-O(23)	2.715(9)
La(2)-O(2)#1	2.444(10)	La(2)-O(12)	2.486(6)
La(2)-O(18)#4	2.521(7)	La(2)-O(1)	2.526(8)
La(2)-O(2W)	2.566(6)	La(2)-O(6)#5	2.567(9)
La(2)-O(13)	2.608(7)	La(2)-O(8)	2.645(7)
La(3)-O(3)#6	2.480(10)	La(3)-O(11)	2.492(7)
La(3)-O(23)#7	2.513(8)	La(3)-O(20)#8	2.514(8)
La(3)-O(10)	2.558(9)	La(3)-O(3W)	2.569(6)
La(3)-O(4)#5	2.610(7)	La(3)-O(14)#7	2.662(7)
La(3)-O(1)#7	2.707(8)	La(4)-O(21)	2.712(9)
La(4)-O(16)#9	2.436(10)	La(4)-O(5)	2.466(7)
La(4)-O(19)	2.505(7)	La(4)-O(17)	2.531(8)
La(4)-O(8)	2.565(7)	La(4)-O(4W)	2.588(6)
La(4)-O(9)#2	2.619(9)	La(4)-O(13)	2.668(8)
Mo(1)-O(11)	1.744(7)	Mo(1)-O(15)	1.761(9)
Mo(1)-O(3)	1.774(9)	Mo(1)-O(19)	1.782(8)
Mo(2)-O(5)	1.748(7)	Mo(2)-O(20)	1.753(8)
Mo(2)-O(6)	1.759(9)	Mo(2)-O(16)	1.778(9)
Mo(3)-O(7)	1.753(7)	Mo(3)-O(18)	1.767(8)
Mo(3)-O(2)	1.773(9)	Mo(3)-O(10)	1.777(9)
Mo(4)-O(12)	1.751(7)	Mo(4)-O(24)	1.762(9)

Mo(4)-O(9)	1.764(9)	Mo(4)-O(22)	1.779(8)
O(7)-La(1)-O(24)#1	74.4(3)	O(7)-La(1)-O(21)	73.5(2)
O(7)-La(1)-O(22)#2	134.8(3)	O(7)-La(1)-O(14)#3	135.5(2)
O(7)-La(1)-O(1W)	69.8(2)	O(7)-La(1)-O(15)	69.9(3)
O(7)-La(1)-O(17)	115.6(3)	O(7)-La(1)-O(4)	141.2(3)
O(2)#1-La(2)-O(12)	73.4(3)	O(2)#1-La(2)-O(23)	142.5(3)
O(2)#1-La(2)-O(18)#4	78.3(3)	O(2)#1-La(2)-O(1)	89.3(3)
O(2)#1-La(2)-O(2W)	93.3(3)	O(2)#1-La(2)-O(6)#5	143.8(2)
O(2)#1-La(2)-O(13)	78.1(3)	O(2)#1-La(2)-O(8)	139.0(2)
O(3)#6-La(3)-O(11)	72.4(3)	O(3)#6-La(3)-O(23)#7	86.0(3)
O(3)#6-La(3)-O(20)#8	77.9(3)	O(3)#6-La(3)-O(10)	143.6(2)
O(3)#6-La(3)-O(3W)	97.4(2)	O(3)#6-La(3)-O(4)#5	83.0(3)
O(3)#6-La(3)-O(14)#7	141.3(2)	O(3)#6-La(3)-O(1)#7	140.5(3)
O(16)#9-La(4)-O(5)	77.4(3)	O(16)#9-La(4)-O(21)	143.1(3)
O(16)#9-La(4)-O(19)	77.5(3)	O(16)#9-La(4)-O(17)	88.7(3)
O(16)#9-La(4)-O(8)	77.6(3)	O(16)#9-La(4)-O(4W)	84.7(2)
O(16)#9-La(4)-O(9)#2	145.2(2)	O(16)#9-La(4)-O(13)	138.8(2)
O(11)-Mo(1)-O(15)	108.9(3)	O(11)-Mo(1)-O(3)	109.1(4)
O(11)-Mo(1)-O(19)	107.6(4)	O(5)-Mo(2)-O(16)	108.9(4)
O(5)-Mo(2)-O(20)	108.0(3)	O(5)-Mo(2)-O(6)	109.6(4)
O(7)-Mo(3)-O(18)	107.4(3)	O(7)-Mo(3)-O(2)	108.9(4)
O(7)-Mo(3)-O(10)	109.5(4)	O(12)-Mo(4)-O(22)	106.8(3)
O(12)-Mo(4)-O(24)	109.0(4)	O(12)-Mo(4)-O(9)	108.7(3)

Symmetry transformations used to generate equivalent atoms: #1 -x,-y,-z

#2 x,y+1,z #3 x+1,y+1,z #4 x-1,y,z #5 x,y-1,z #6 -x,-y,-z-1 #7

x+1,y,z #8 x+1,y-1,z #9 -x-1,-y+1,-z-1

3. Physical Characterizations of La-Mo and La-Mo_T

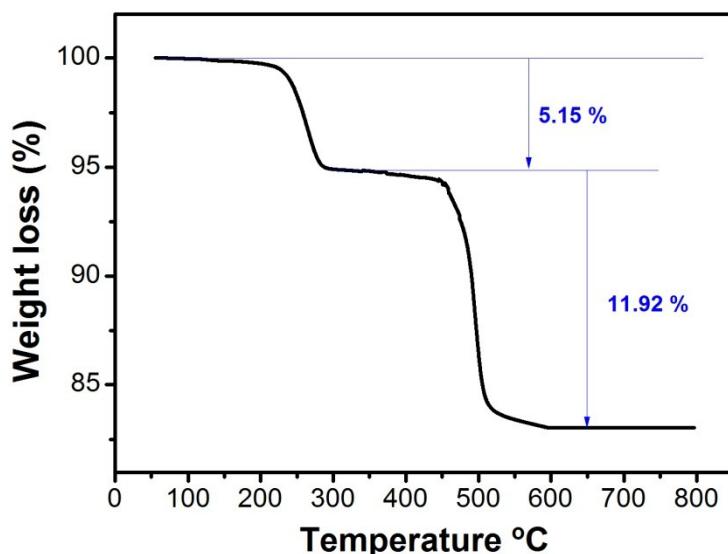


Fig. S1. The TG curve of compound **La-Mo** exhibits two weight loss stages in the temperature ranges 30-600°C. The first weight loss is 5.15% in the temperature range 30-350°C, corresponding to the release of all the lattice and coordinated water molecules in **La-Mo** (4.79%). And in the temperature range 350-600°C, the weight loss is 11.92 %, which can be assigned to the decomposition of acetates.

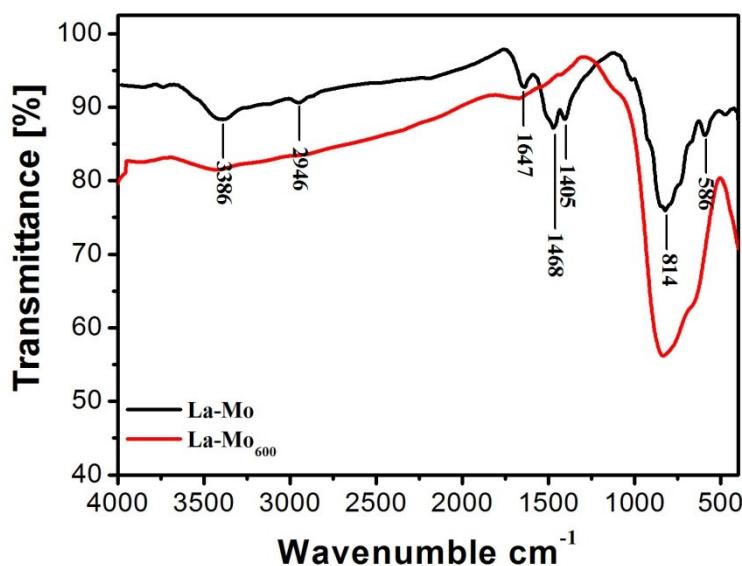


Fig. S2. The IR spectra of La-Mo and La-Mo₆₀₀.

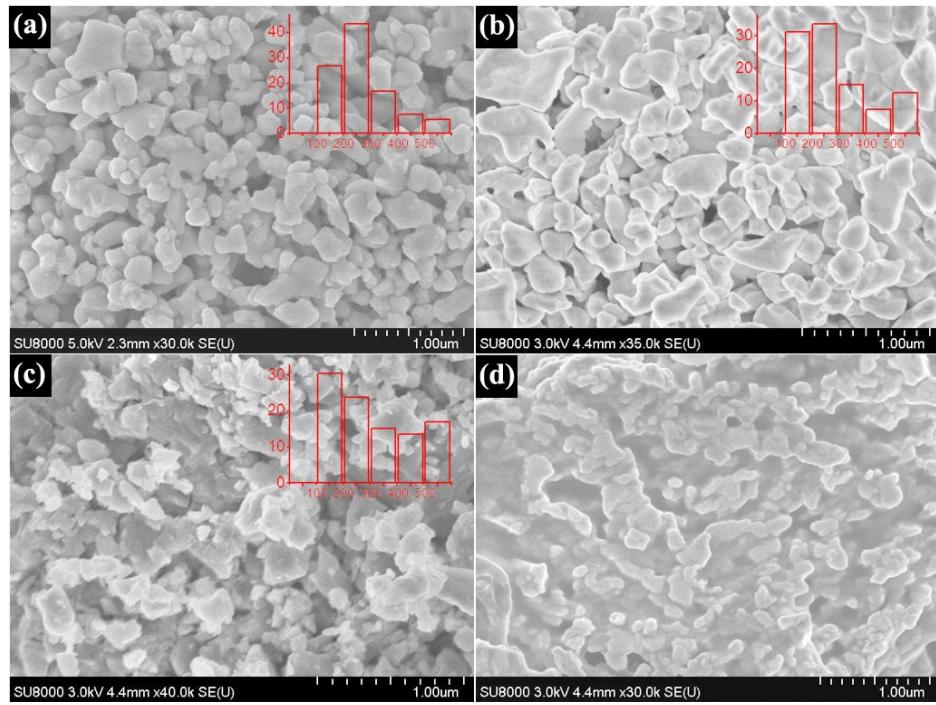


Fig. S3. The SEM of La-Mo_T: (a) La-Mo₆₀₀; (b) La-Mo₇₀₀; (c) La-Mo₈₀₀; (d) La-Mo₉₀₀.

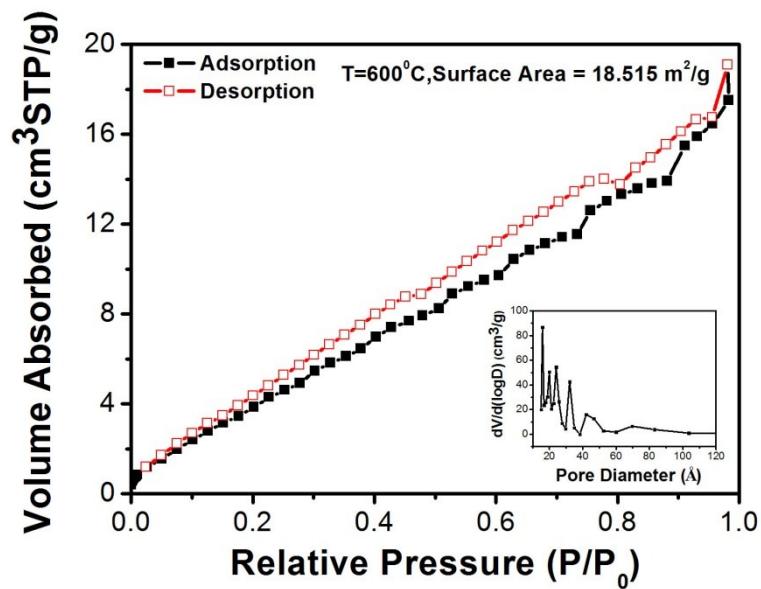


Fig. S4. The nitrogen adsorption-desorption isotherms curves of La-Mo₆₀₀.

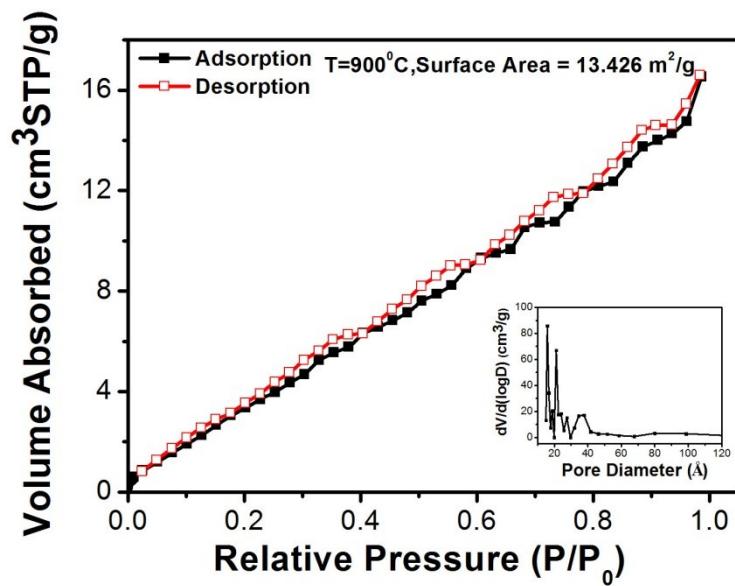


Fig. S5. The nitrogen adsorption-desorption isotherms curves of La-Mo₉₀₀.

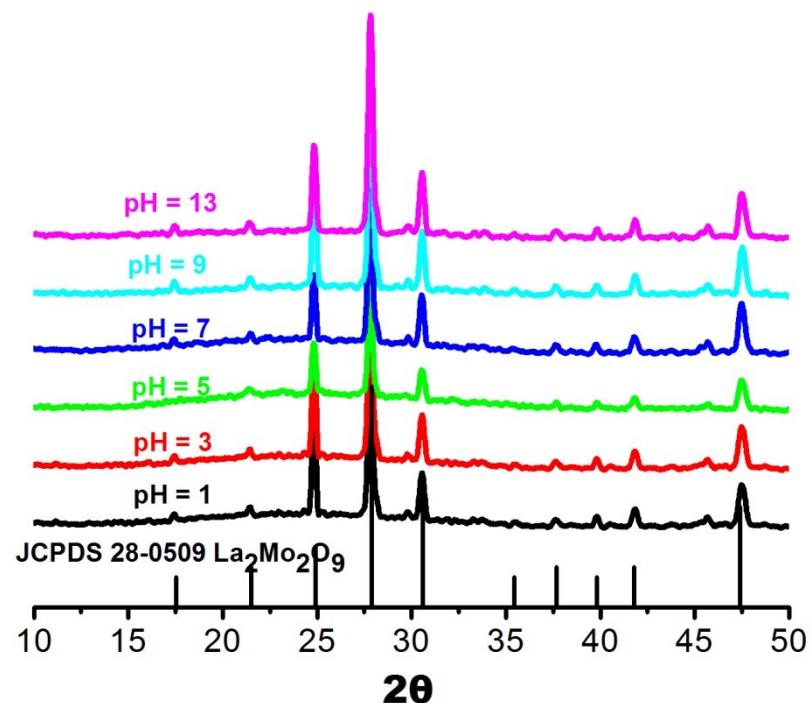


Fig. S6. The XRD patterns of La-Mo₆₀₀ after soaked in different pH solution for 12h.

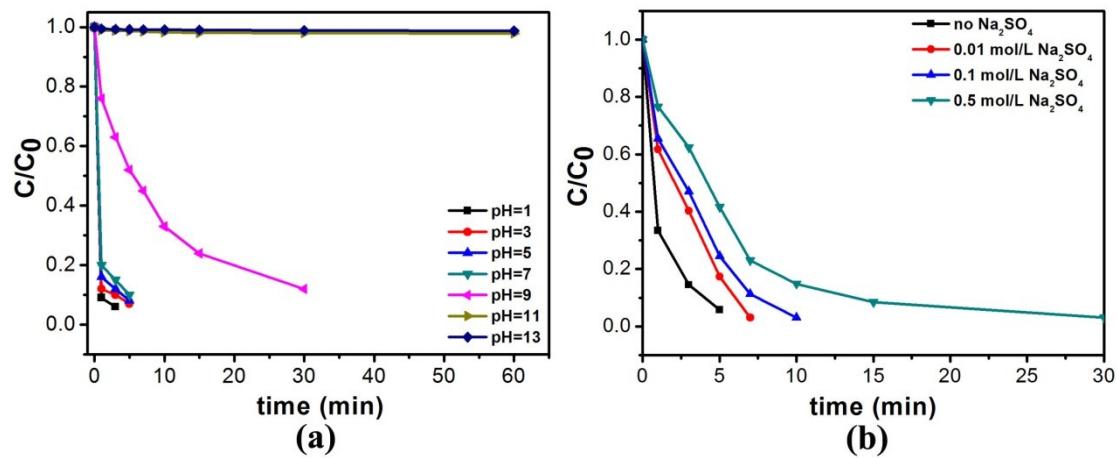


Fig. S7 (a) Concentration changes of EB vs. time in different pH solution with La-Mo600; (b) concentration changes of EB vs. time in different concentration of Na₂SO₄ solution.

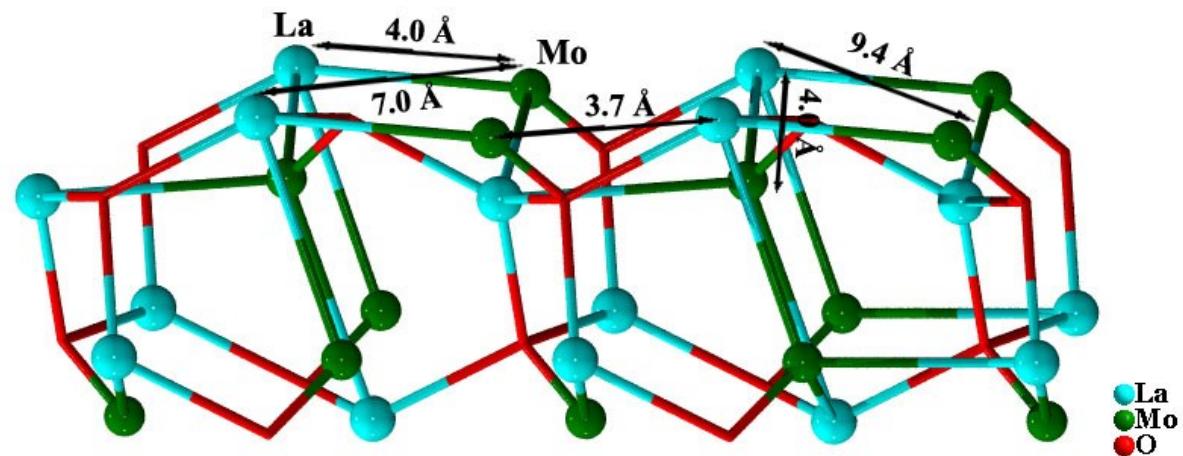


Fig. S8. Schematic surface structure of La₂Mo₂O₉, some of oxygen atoms were omitted in order to clearly display the distance between La and Mo atoms.

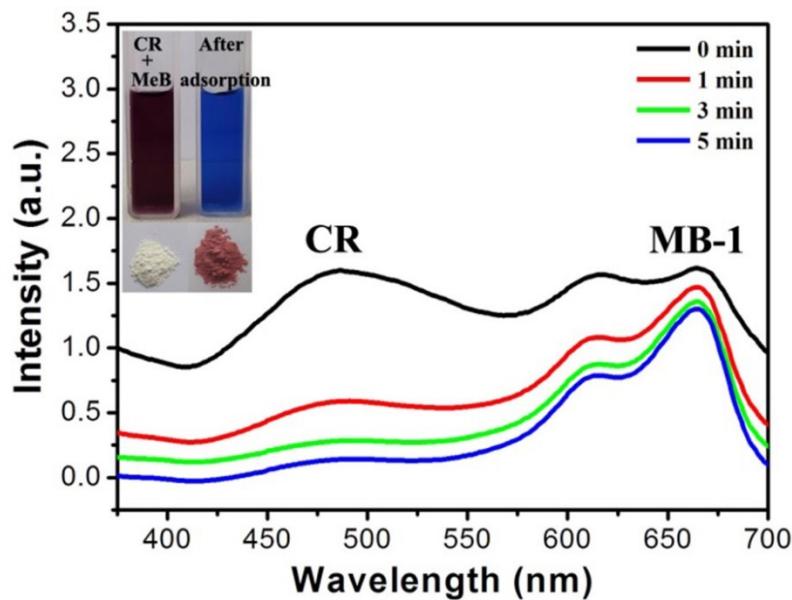


Fig. S9. Temporal evolution of UV-Vis absorption spectra of bi-component dye mixture (CR and MB-1) in pH = 7 aqueous solution with **La-Mo₆₀₀** adsorbent (Inset: the colorful photographs of the mixed dye solution and the **La-Mo₆₀₀** adsorbent material before and after dye absorption).

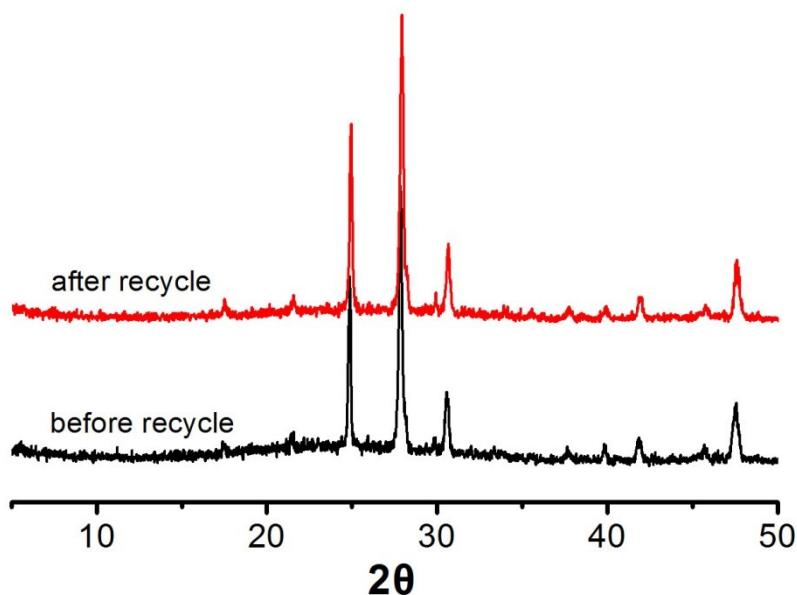


Fig. S10. The XRD of **La-Mo₆₀₀** before and after recycle.

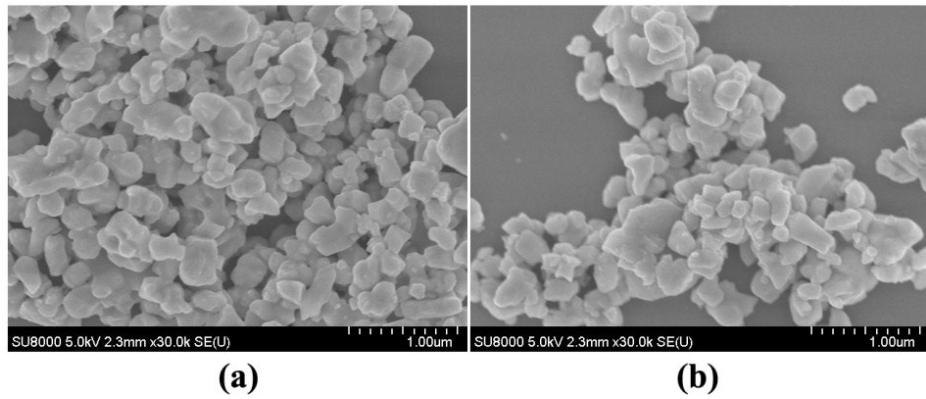


Fig. S11. The SEM of La-Mo₆₀₀ before and after recycle.

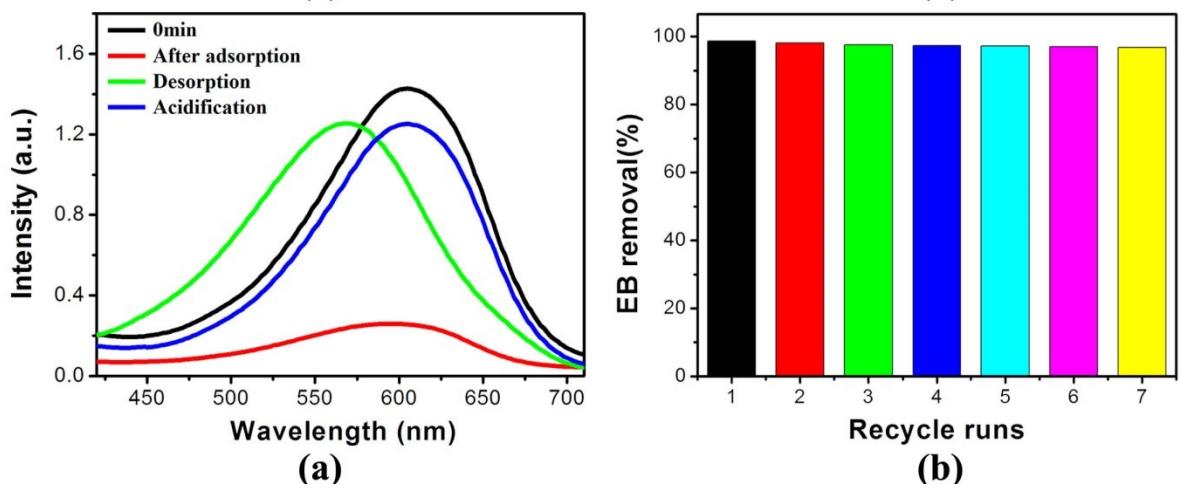


Fig. S12. (a) The UV-Vis absorption spectra of 20 ppm EB solution before and after adsorption, desorption and after acidification; (b) The recycle experiments for EB removal using La-Mo₆₀₀ as adsorbant.

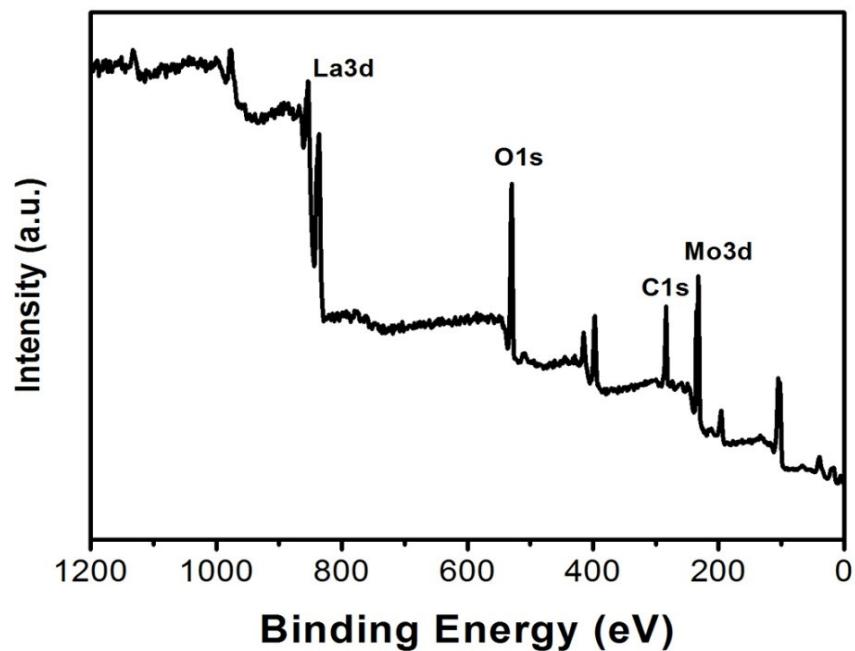


Fig. S13 The XPS of La-Mo₆₀₀.

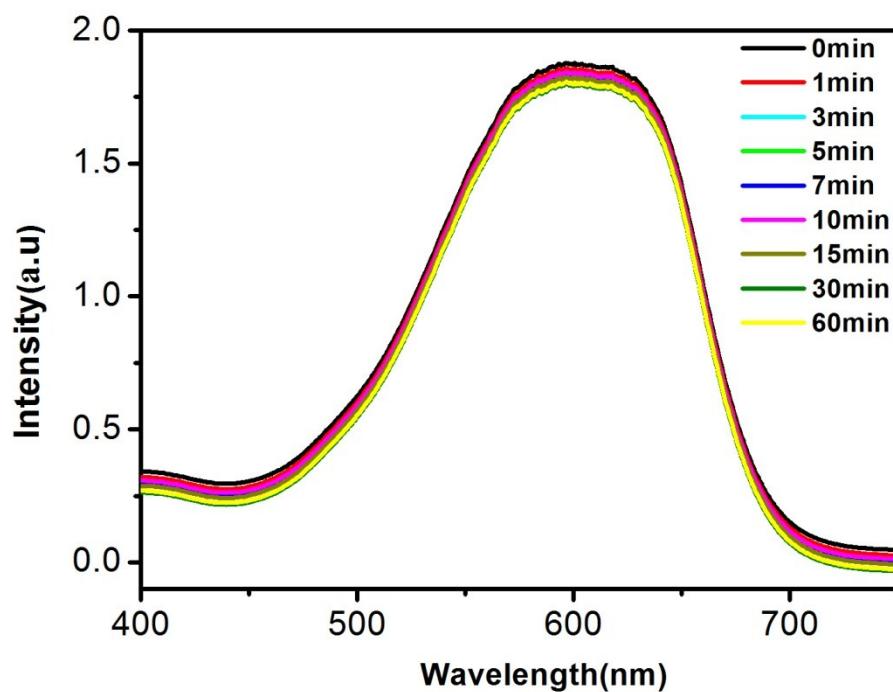


Fig. S14 Temporal evolution of UV-Vis absorption spectra of EB using active carbon as adsorbents.