Electronic Supplementary Information (ESI)

Different effect of fluoride and phosphate anions on TiO_2 photocatalysis (rutile)

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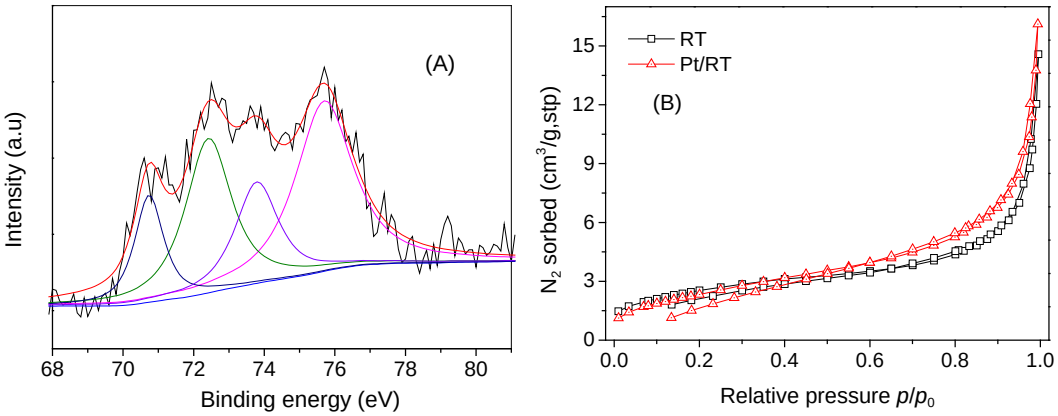

Fig. S1 (A) XPS spectra of Pt 2f for Pt/RT. (B) N_2 adsorption–desorption isotherms on RT and Pt/RT.

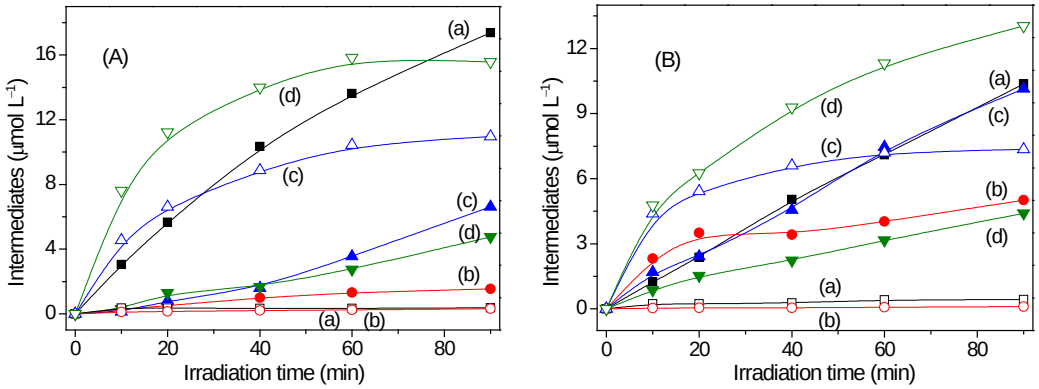

Fig. S2 Anion effect of (A) fluoride, and (B) phosphate, on the formation of hydroquinone (HQ, solid symbols) and benzoquinone (BQ, open symbols) in aqueous solution, measured from phenol degradation over (a) RT, (b) RT + anion, (c) Pt/RT, and (d) Pt/RT + anion.

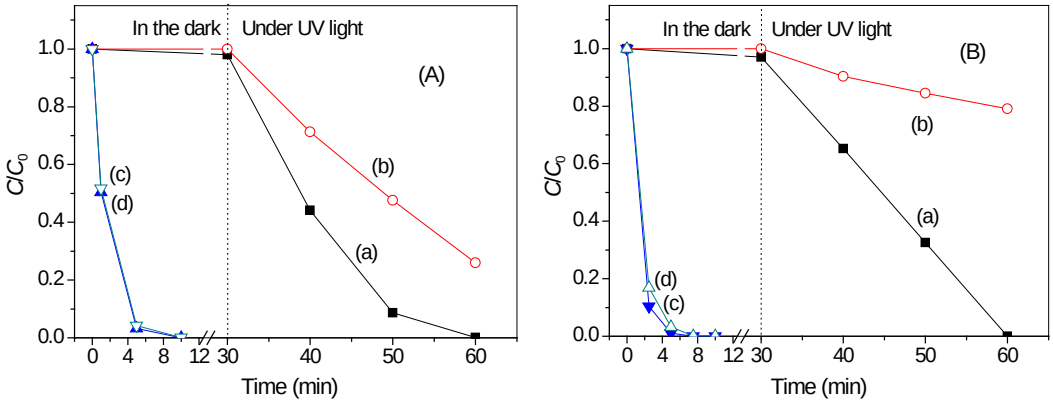

Fig. S3 Effect of (A) fluoride, and (B) phosphate, on 10 mM H_2O_2 adsorption and decomposition in absence of phenol, with (a) RT, (b) RT + 1.0 mM anion, (c) Pt/RT, and (d) Pt/RT + 1.0 mM anion.

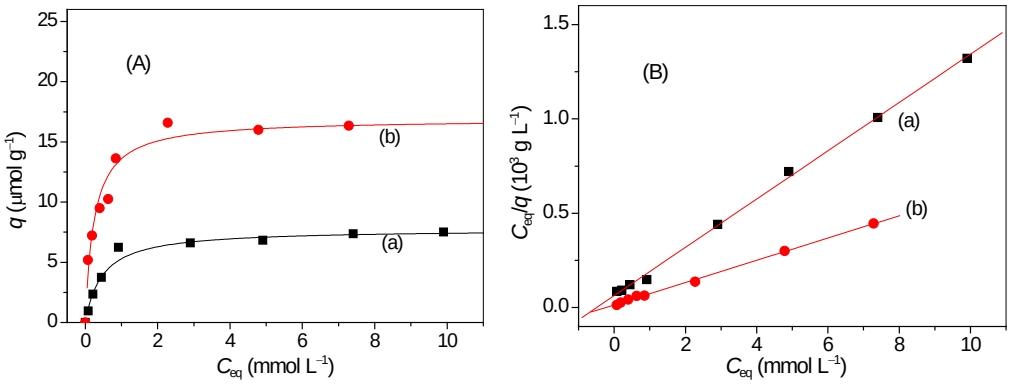

Fig. S4 (A) Adsorption isotherms on Pt/RT of (a) fluoride, and (b) phosphate in aqueous solution, measured without phenol. (B) Fitting with Langmuir adsorption equation, $q/q_m=KC_{eq}/(1+KC_{eq})$, where q_m is the maximum amount of adsorption, K is adsorption constant, C_{eq} is the equilibrium concentration in aqueous phase, and q is the amount of adsorption at C_{eq}.

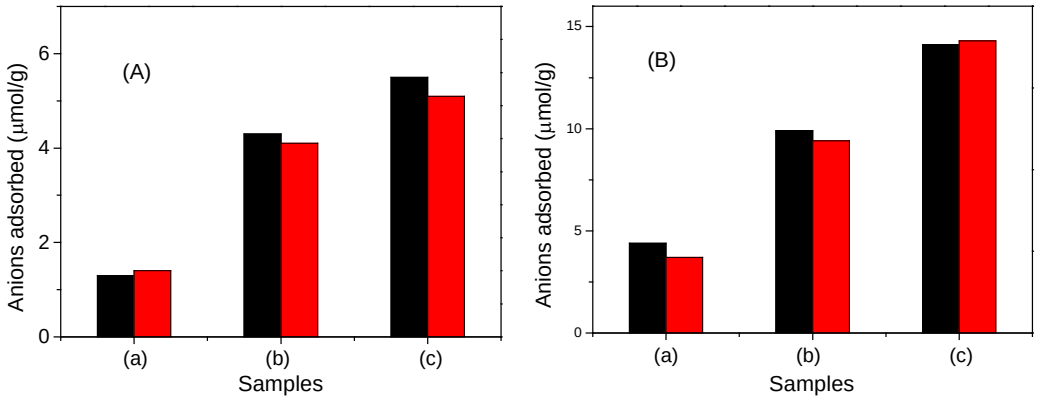

Fig. S5 Amounts of (A) fluoride, and (B) phosphate, adsorbed on Pt/RT in aqueous solution, at initial concentration of (a) 0.1, (b) 1.0, and (c) 5 mM, measured in the dark (black symbols) and under UV light for 1 h (red symbols). Analysis was made as quick as possible.

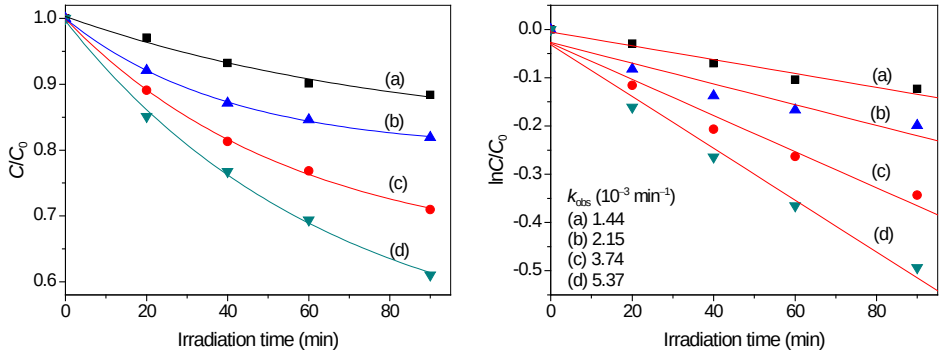

Fig. S6 Phenol degradation in aqueous solutionon (a) RT, (b) AT, (c) Pt/RT, and Pt/AT. Experiment was carried under similar condition (1 g/L TiO_2, 0.43 mM phenol, initial pH 5.2, and UV light).

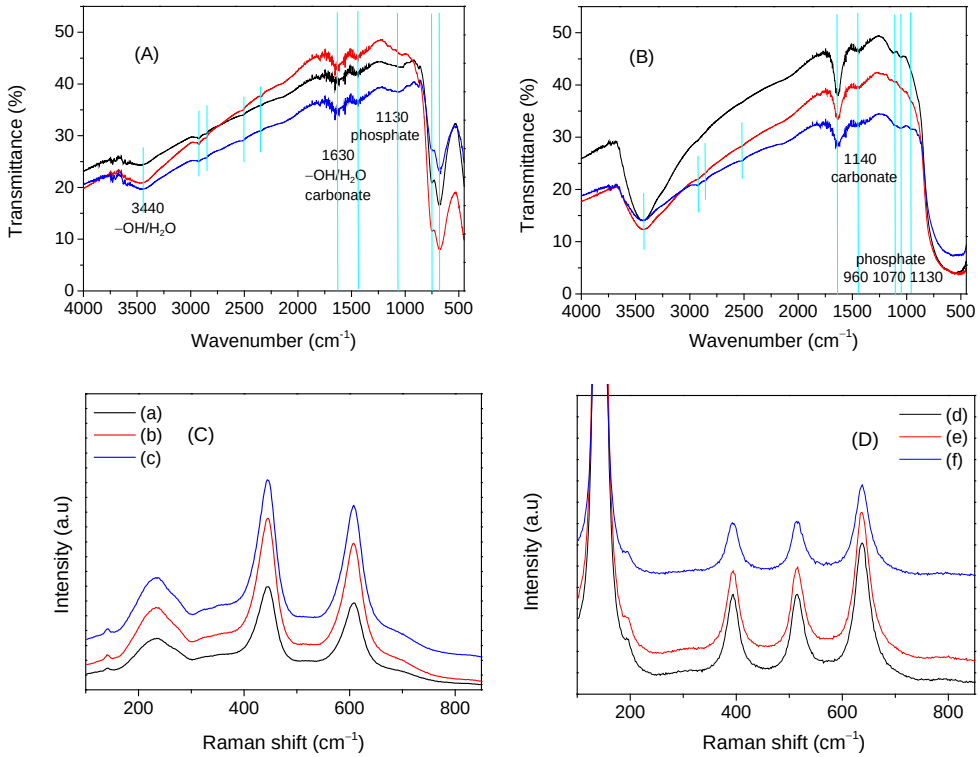

Fig. S7 (A, B) FTIR, and (C, D) Raman spectra (a) RT, (b) NaF/RT, (c) Na_3PO_4/RT, (d) AT, (e) NaF/AT, and (f) Na_3PO_4/AT. The anion sample was prepared by dark equilibrium of the suspension (1 g/L TiO_2 and 50 mM anions) overnight, followed by filtration and drying in a vacuum at 80 °C.

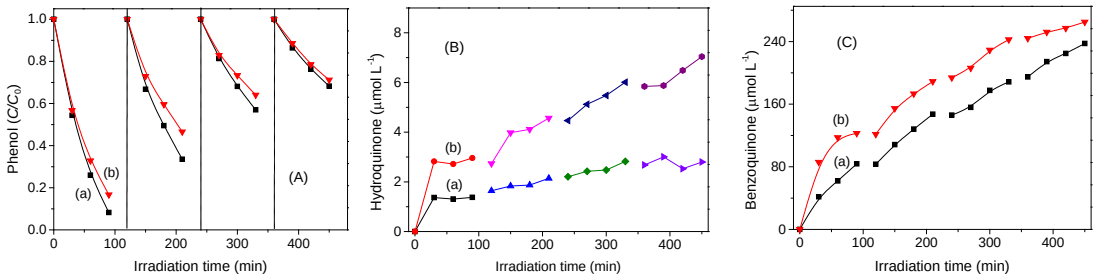

Fig S8. (A) Recycling test of phenol degradation on Pt/RT with (a) 5 mM NaF and (b) Na_3PO_4. The corresponding formation of (B) hydroquinone, and (C) benzoquinone. After each run, only drops of fresh phenol solution was supplemented, to restore its initial concentration around 0.43 mM.

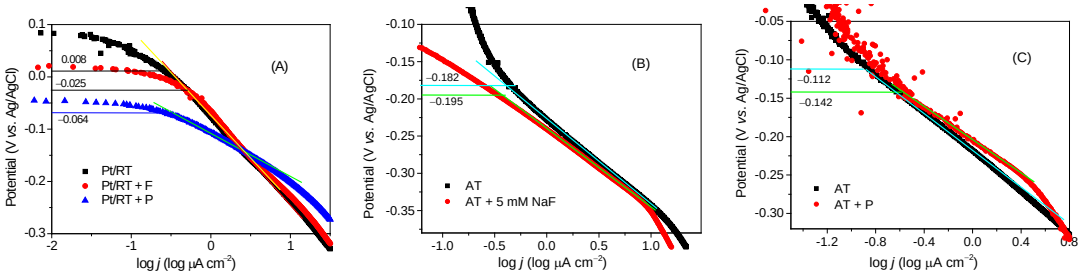

Fig. S9. Reduction of O_2 on a film electrode in 0.5 M $NaClO_4$ pH 5.2. (A) Pt/RT, with or without 1 mM anions. (B) AT, with or without 5 mM NaF. (C) AT with or without 5 mM Na_3PO_4.

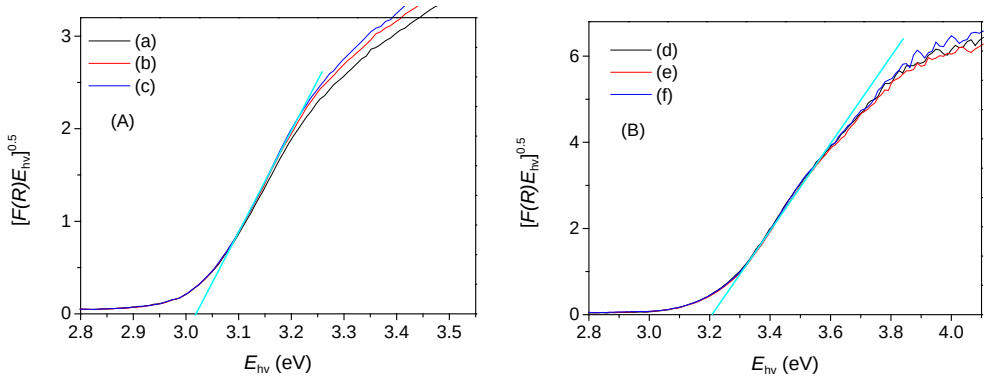

Fig. S10 Tauc plots for indirect transition, where R is reflectance, F_R is $(1 - R)^2/(2R)$, and E_{hv} is light energy. (Samples were (a) RT, (b) NaF/RT, (c) Na_3PO_4/RT, (d) AT, (e) NaF/AT, and (f) Na_3PO_4/AT.

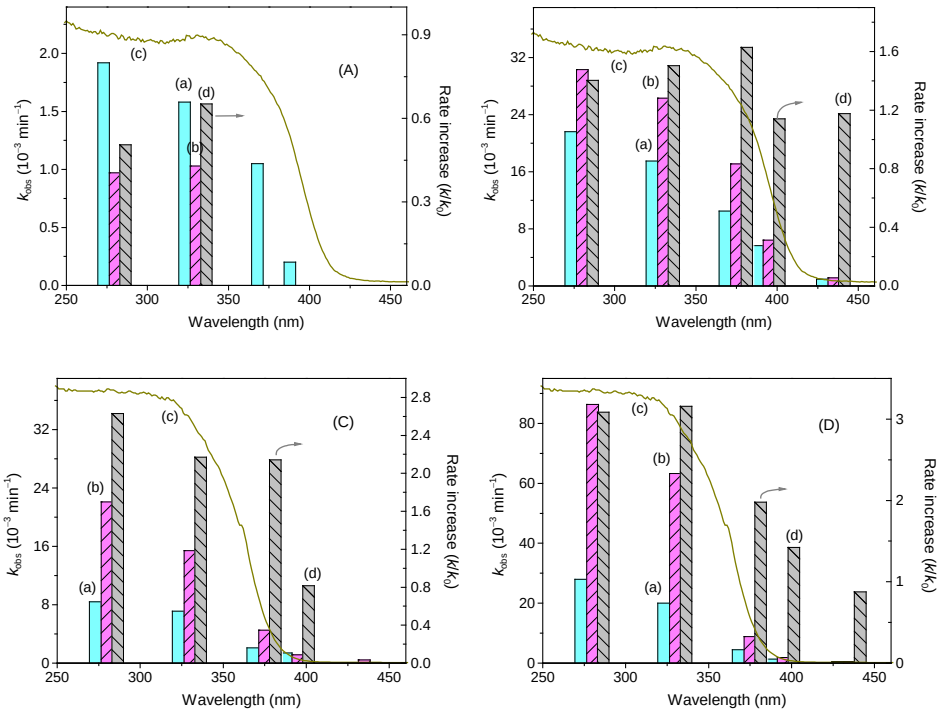

Fig. S11 Apparent rate constants of phenol degradation on (A) RT, (B) Pt/RT, (C) AT, and (D) Pt/AT, (a) in absence, and (b) in presence of 5 mM NaF, measured on a 500 We Xenon lamp with a cut-off filter at 280, 330, 375, 395, and 435 nm. Curve (c) is the absorption spectra of rutile for (A,

B), and anatase for (C, D). The bars (d) is k/k_0, the ratio of k_{obs} with anions to k_{obs} without anions.