*Supplementary Information of*

As(III) removal through catalytic oxidation and Fe(III) precipitation

Kazumasa Oshima, Hiromichi Kondo, Eriko Konishi, Tsuyoshi Yamamoto,

Yoshifumi Tsuge, Takayuki Watanabe, and Masahiro Kishida*

Department of Chemical Engineering, Graduate School of Engineering, Kyushu

University, Motooka 744, Nishi-ku, Fukuoka 819-0395, Japan

*Corresponding author: kishida@chem-eng.kyushu-u.ac.jp
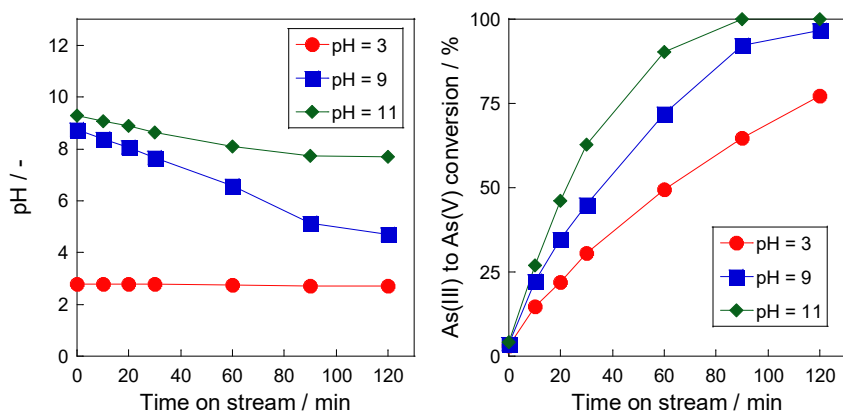
Fig. S1. Change in pH of the solution of the As oxidation over Pt/SiO$_2$ without Fe oxidant.

Experimental conditions: Initial As (III) concentration: 20 mg L^{-1}, HCl, 80 $^{\circ}$C, catalyst: 1wt%Pt/TiO$_2$, catalyst weight: 30 mg, O$_2$ purge.

Initial pH of the As solution without acid was almost 11, and its pH was controlled by the addition of HCl. It is known that As(III) oxidation forms protons as following formula [1,2].

$$H_2AsO_3^- + 1/2O_2 \rightarrow H_2AsO_4^- \rightarrow HAsO_4^{2-} + H^+ \qquad pKa = 6.94$$
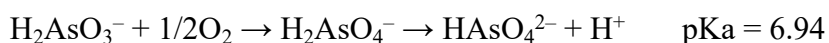
In basic solutions, the formation of protons significantly affected pH of the solution, resulting the decrease of pH with the progress of the reaction. Since it is difficult to evaluate the reactivity of the catalyst under such conditions, the pH was adjusted before the oxidation test.
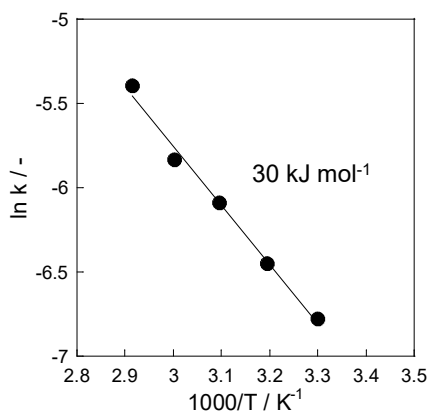
Fig. S2. Arrhenius plot of the As oxidation over Pt/SiO$_2$.

Experimental conditions: Initial As (III) concentration: 30 mg L^{-1}, pH = 3, catalyst: 1wt%Pt/TiO$_2$, catalyst weight: 100 mg, air purge.

From Fig. 3 in main text, a rate constant k was derived from the initial slope of As(III) conversion assuming that the oxidation was a first-order reaction.

References

1. D. H. Kim, A. D. Bokare, M. Koo and W. Choi, *Environ. Sci. Technol.*, 2015, **49**, 3506-3513.

2. C. Wu, H. Mahandra and A. Ghahreman, *Ind. Eng. Chem. Res*., 2020, **59**, 9882-9889.