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Treatment of Acetonitrile by Catalytic Supercritical Water Oxidation in Compact-Sized Reactor

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Author(s)

Benjaporn Youngprasert, Kunakorn Poochinda, Somkiat Ngamprasertsith

ABSTRACT

The objective of this research was to study the treatment of acetonitrile by catalytic supercritical water oxi-dation in a compact-sized tubular reactor, with an internal volume of 4.71 mL. Manganese dioxide was used as the catalyst and H2O2 was used as the oxidant. The oxidation of acetonitrile in supercritical water was studied at 400-500 oC, 25-35 MPa, the flow rate of 2-4 mL/min, the initial concentration of acetonitrile 0.077-0.121 M and the %excess O2 of 50-200%. As a result, the products were mainly N2, CO2 and CO and acetonitrile can be decomposed > 93 % within a very short contact time (1.45-6.19 s). The oxidation process was carried out with respect to the conversion of acetonitrile by 25 factorial design. Regression models were obtained for correlating the conversion of acetonitrile with temperature and flow rate. The complete oxida-tion can be achieved at a condition as moderate as 400 oC, 25 MPa with the flow rate of 2 mL/min.

KEYWORDS

Acetonitrile, Supercritical Water Oxidation, Compact-Sized Reactor

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References

[1] P. E. Savage, "Organic chemical reactions in supercritical water," Chemical Reviews, Vol. 99, pp. 603–621, Febru- ary 1999.

[2] M. Watanabe, T. Sato, H. Inomata, R. L. J. Smith, K. Arai, A. Kruse, and E. Dinjus, "Chemical reactions of C1 compounds in near-critical and supercritical water," Chemical Reviews, Vol. 104, pp. 5803–5821, December 2004.

[3] Y. Arai, T. Sato, and Y. Takebayashi, "Supercritical fluids: Molecular interaction, physical properties, and new applications," Springer-Verlag, Berlin, 2002.

[4] Z. Y. Ding, M. A. Frisch, L. Li, and E. F. Gloyna, "Catalytic oxidation in supercritical water," Industrial and Engineering Chemistry Research, Vol. 35, pp. 3257–3279, October 1996.

[5] http://www.michigan.gov/documents/MDCH_Acetonitrile_fast_sheet_approved_4–19–05_122749_7.pdf.

[6] T. Li, J. Liu, R. Bai, and F. S. Wong, "Membrane-aerated biofilm reactor for the treatment of acetonitrile wastewater," Environmental Science and Technology, Vol. 42, pp. 2099–2104, March 2008.

[7] P. Braos-García, D. Durán-Martín, A. Infantes-Molina, D. Eliche-Quesada, E. Rodríguez-Castellón, and A. Jiménez- López, "The effect of thermal treatment under different atmospheric conditions on the catalytic performance of nickel supported on porous silica in the gas-phase hydro- genation of acetonitrile," Adsorption Science and Tech- nology, Vol. 25, pp. 185–198, April 2007.

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[8] E. Kohyama, A. Yoshimura, D. Aoshima, T. Yoshida, H. Kawamoto, and T. Nagasawa, "Convenient treatment of acetonitrile-containing wastes using the tandem combination of nitrile hydratase and amidase-producing microorganisms," Applied Microbiology and Biotechnology, Vol. 72, pp. 600–606, September 2006.

[9] W. R. Killilea, K. C. Swallow, and G. T. Hong, "The fate of nitrogen in supercritical-water oxidation," The Journal of Supercritical Fluids, Vol. 5, pp. 72–78, March 1992.

[10] T. Ruamchat, R. Hayashi, S. Ngamprasertsith, and Y. Oshima, "A novel on-site system for the treatment of pharmaceutical laboratory wastewater by supercritical water oxidation," Environmental Sciences, Vol. 13, pp. 297–304, 2006.

[11] B. D. Phenix, J. L. Dinaro, J. W. Tester, J. B. Howard, and K. A. Smith, "The effects of mixing and oxidant choice on laboratory-scale measurements of supercritical water oxidation kinetics,"