



## Simultaneous disposal of acrylic acid (ester) wastewater and residue with high efficiency and low energy consumption

Rongjie Chen<sup>a,b</sup>, Zhaoyang Fei<sup>b</sup>, Qing Liu<sup>a,\*</sup>, Xian Chen<sup>a</sup>, Zhuxiu Zhang<sup>a</sup>, Jihai Tang<sup>a,b,c</sup>, Mifen Cui<sup>a</sup>, Xu Qiao<sup>a,b,c,\*</sup>

<sup>a</sup>College of Chemical Engineering, Nanjing Tech University, Nanjing 210009, China, Tel. +86 25 83587168; Fax: +86 25 83587168; email: qing\_liu@njtech.edu.cn (Q. Liu), Tel. +86 25 83172298; Fax: +86 25 83172298; emails: qct@njtech.edu.cn (X. Qiao), RogerChan@njtech.edu.cn (R. Chen), chenxian@njtech.edu.cn (X. Chen), zhuxiu.zhang@njtech.edu.cn (Z. Zhang), jhtang@njtech.edu.cn (J. Tang), mfcui@njtech.edu.cn (M. Cui)

<sup>b</sup>State Key Laboratory of Materials-Oriented Chemical Engineering, Nanjing Tech University, Nanjing 210009, China, Tel. +86 25 83587168; Fax: +86 25 83587168; email: zhaoyangfei@njtech.edu.cn

<sup>c</sup>Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), Nanjing 210009, China

Received 7 October 2018; Accepted 5 June 2019

---

### ABSTRACT

The acrylic acid (ester) production wastewater and residue were simultaneously treated by a novel two-stage fluidized-bed/fixed-bed catalytic system. The effects of fluidized-bed temperature, flow rate of wastewater or residue, and oxygen excess rate (OER) on the disposal efficiency were investigated to certify the feasibility. The chemical oxygen demand of effluent was less than 100 mgO<sub>2</sub> L<sup>-1</sup> when the temperature exceeded 380°C, the OER was greater than 2, and the flow rate of distillation residue was less than 1.5 mL h<sup>-1</sup>. By utilizing the high calorific value of residue, the energy balance of the system can be achieved by regulating the flow rates of wastewater and residue with the guarantee of the treatment efficiency, which was verified by the theoretical simulation calculations. The technology employed in our research shows obvious advantages on purification of the acrylic acid (ester) production wastewater and residue for its high efficiency and can make the most use of the energy in wastes to reduce energy consumption.

**Keywords:** Acrylic wastewater; Residue; Fluidized-bed/fixed-bed; Energy balance

---

\* Corresponding authors.