

**Titre:** Reactive extrusion recycling of polymethyl methacrylate to methyl methacrylate and methacrylic acid. Supplément  
Title:

**Auteurs:** Yanfa Zhuang, Tien Dat Nguyen, Mahdi Sharifian, Jean-Luc Dubois, Abdellah Aji, & Gregory Scott Patience  
Authors:

**Date:** 2025

**Type:** Article de revue / Article

**Référence:** Zhuang, Y., Nguyen, T. D., Sharifian, M., Dubois, J.-L., Aji, A., & Patience, G. S. (2025). Reactive extrusion recycling of polymethyl methacrylate to methyl methacrylate and methacrylic acid. Chemical Engineering Journal, 515, 162709 (12 pages). <https://doi.org/10.1016/j.cej.2025.162709>  
Citation:

 **Document en libre accès dans PolyPublie**  
Open Access document in PolyPublie

**URL de PolyPublie:** <https://publications.polymtl.ca/65936/>  
PolyPublie URL:

**Version:** Matériel supplémentaire / Supplementary material  
Révisé par les pairs / Refereed

**Conditions d'utilisation:** Creative Commons Attribution-Utilisation non commerciale 4.0  
Terms of Use: International / Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC)

 **Document publié chez l'éditeur officiel**  
Document issued by the official publisher

**Titre de la revue:** Chemical Engineering Journal (vol. 515)  
Journal Title:

**Maison d'édition:** Elsevier science sa  
Publisher:

**URL officiel:** <https://doi.org/10.1016/j.cej.2025.162709>  
Official URL:

**Mention légale:** © 2025 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).  
Legal notice:

# Reactive extrusion recycling of polymethyl methacrylate to methyl methacrylate and methacrylic acid

Yanfa Zhuang<sup>a</sup>, Tien Dat Nguyen<sup>a</sup>, Mahdi Sharifian<sup>a</sup>, Jean-Luc Dubois<sup>b</sup>,  
Abdellah Ajji<sup>a</sup>, Gregory Patience<sup>\*a</sup>

<sup>a</sup>*Polytechnique Montreal, Dept. Chemical Engineering, CP 6079, Succ CV, Montreal, Québec H3C 3A7, Canada*

<sup>b</sup>*Trinseo France SAS - Altuglas International SAS, Tour CB21, 16 place de l'Iris, Courbevoie, 92400, France*

---

---

## Appendix A. Supplementary information

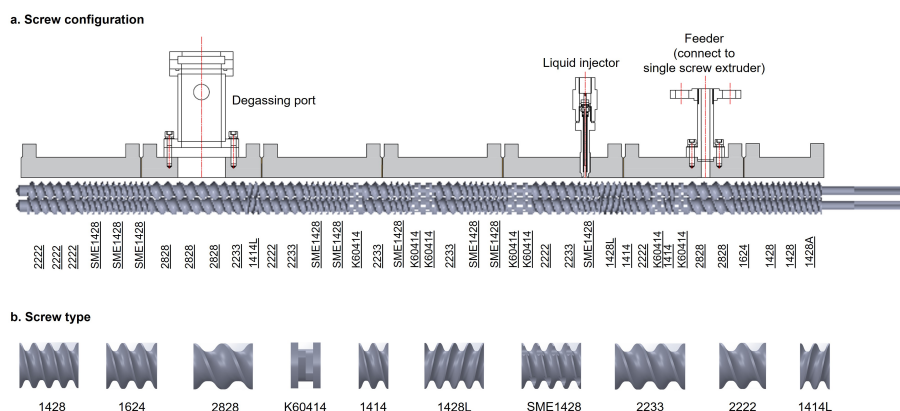
Supplementary Table A.1: Molecular weight of virgin PMMA and scraps

| PMMA type                     | $M_n$<br>g mol <sup>-1</sup> | $M_w$<br>g mol <sup>-1</sup> | Dispersity |
|-------------------------------|------------------------------|------------------------------|------------|
| Virgin PMMA (Altuglas)        | 99499                        | 116216                       | 1.2        |
| Injection grade scraps        | 53626                        | 103360                       | 1.93       |
| Extrusion grade scraps, white | 46341                        | 101434                       | 2.2        |
| Extrusion grade scraps, red   | 119423                       | 177626                       | 1.5        |

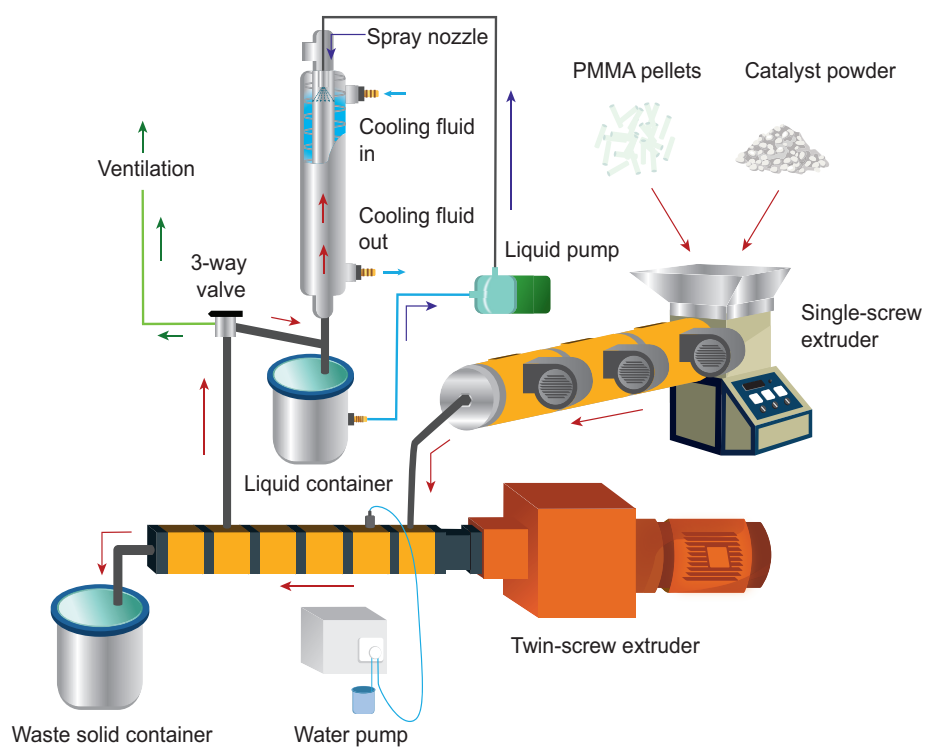
---

\*Corresponding author

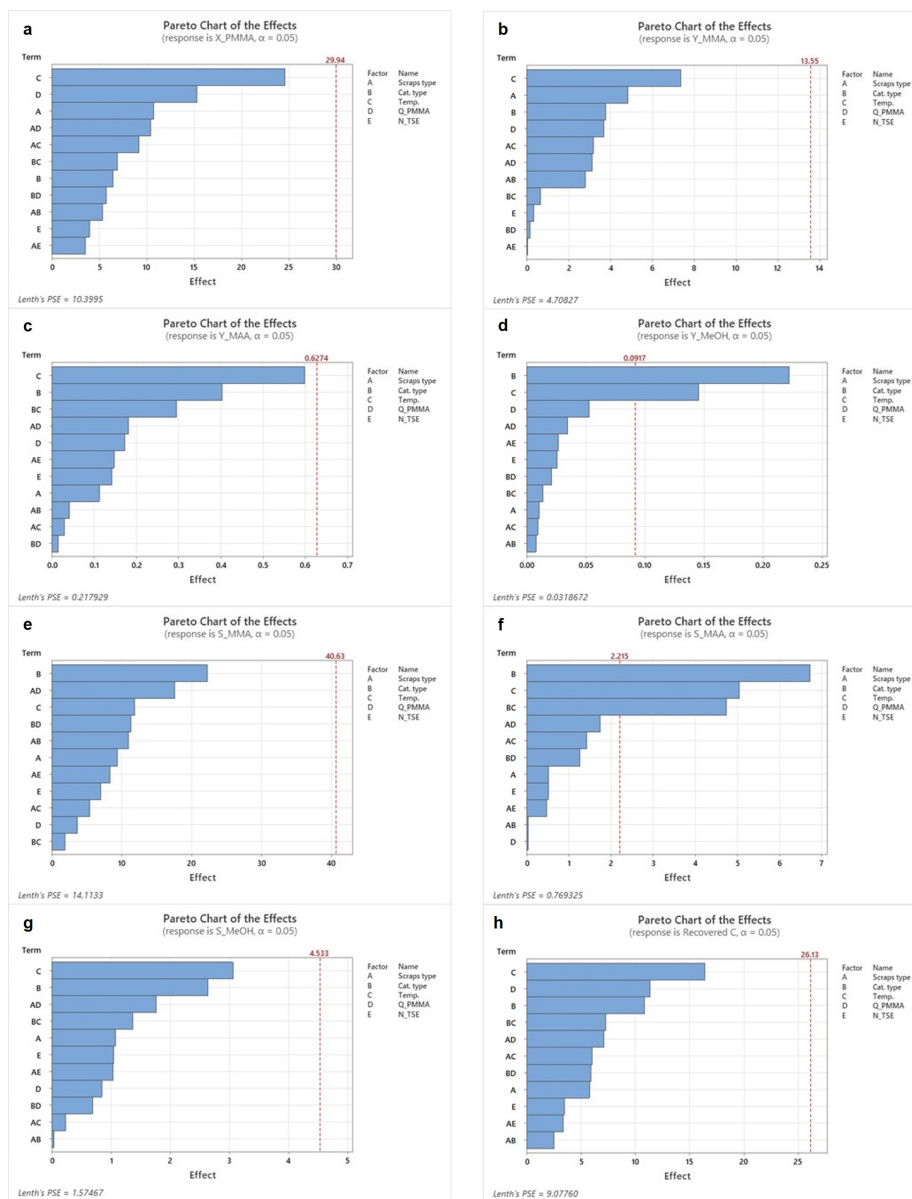
Email address: [gregory-s.patience@polymtl.ca](mailto:gregory-s.patience@polymtl.ca) (Gregory Patience\*)



Supplementary Fig. A.1: Screw configuration (a) and screw type (b) of the T20 twin-screw reactive extruder



Supplementary Fig. A.2: Scheme for a two-stage reactive extrusion hydrolysis system with atmospheric degassing design



Supplementary Fig. A.3: Pareto charts of the effects. Each factorial regression model includes terms up to the second order. Factor A-Scraps type; B-Catalyst type; C-Temperature; D- $Q_{PMMA}$ ; E- $N_{TSE}$

Supplementary Table A.2: Physico-chemical properties and particle size of commercial Al<sub>2</sub>O<sub>3</sub>

| Sample                         | $S_{\text{BET}}$           | $V_{\text{tot}}$            | Average $D_v$ | $V_{\text{micro}}$          | $S_{\text{micro}}$         | $S_{\text{meso}}$          | $d_p^a$       |               |                             |
|--------------------------------|----------------------------|-----------------------------|---------------|-----------------------------|----------------------------|----------------------------|---------------|---------------|-----------------------------|
|                                |                            |                             |               |                             |                            |                            | Medium size   | Mean size     | $D[10]$ $D[90]$             |
|                                | $\text{m}^2 \text{g}^{-1}$ | $\text{cm}^3 \text{g}^{-1}$ | $\text{\AA}$  | $\text{cm}^3 \text{g}^{-1}$ | $\text{m}^2 \text{g}^{-1}$ | $\text{m}^2 \text{g}^{-1}$ | $\mu\text{m}$ | $\mu\text{m}$ | $\mu\text{m}$ $\mu\text{m}$ |
| Al <sub>2</sub> O <sub>3</sub> | 197                        | 0.53                        | 48            | 0.001                       | 4                          | 192                        | 72.66         | 74.65         | 56.78 93.17                 |

Note:  $d_p$ -particle size; a-measured by PSD