

## Effect of stainless-steel corrosion products during hydrothermal dechlorination of polyvinyl chloride

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Hydrothermal dechlorination of polyvinyl chloride (PVC) is primarily performed in stainless steel reactors prone to chlorine-induced pitting corrosion, contaminating the reaction media with  $\text{Fe}^{2+}$ ,  $\text{Ni}^{2+}$ , and  $\text{Cr}^{2+}$  and possibly triggering shifts in degradation chemistry. This study investigated the single and synergistic influence of  $\text{Fe}^{2+}$  and  $\text{Ni}^{2+}$  on urea-assisted hydrothermal dechlorination of polyvinyl chloride under mild conditions. Significant improvement in dechlorination degree was observed at 210 °C when 5 mmol  $\text{Fe}^{2+}$  or 10 mmol  $\text{Ni}^{2+}$  was added. Furthermore, positive interaction between the cations was confirmed when the simultaneous use of 1 mmol  $\text{Fe}^{2+}$  and 0.25 mmol  $\text{Ni}^{2+}$  achieved the same catalytic performance. The presence of these ions prevented adhesive contact of PVC particles, thus limiting mass-transfer resistance and the autocatalytic effect of HCl. Combined central composite design (CCD) and response surface methodology (RSM) revealed that dechlorination and the improvement thereof were dependent on temperature ( $p < 0.0001$ ).  $\text{Ni}^{2+}$  and  $\text{Fe}^{2+}$  exerted a quadratic and linear effect on dechlorination, respectively. The highest catalytic activity occurred in the temperature range of 217.5 °C - 222.5°C. The results show that even very low concentrations of  $\text{Ni}^{2+}$  and  $\text{Fe}^{2+}$  accelerated dechlorination, indicating the inappropriateness of using steel reactors for determining intrinsic PVC degradation chemistry. Therefore, the use of stainless-steel reactors is discouraged, and at the same time, using Fe-Ni or scrap steel as cheap catalytic agents shows potential.