ICCDU XVI
27-30 August, 2018
Rio de Janeiro, Brazil

16th INTERNATIONAL CONFERENCE ON CARBON DIOXIDE UTILIZATION

Removal of Ammonium Perfluorooctanoate From Fluoropolymer Under $scCO_2$

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Keywords: $scCO_2$ process; APFO removal; intermolecular interaction; entrainer; solubility

Ammonium perfluorooctanoate (APFO) can improve the stability of particles in polymer solution and obtain the fluorinated monomer to form micelles which subsequently forms polymer with higher molecular weight. Therefore, it is usually used as an additive in the synthesis of fluoropolymer. However, previous researches showed that APFO had a global distribution, and existed in a wide range of environmental media such as surface waters, freshwaters, marine organisms and even in human body. Therefore, it has become an urgent problem that how to deal with residual APFO in the process of fluoropolymer production and reduce its harm to the environment and human beings.

APFO is an additive used in synthesis of fluoropolymer and subsequently resided in product. An enhancement in solubility of APFO in supercritical carbon dioxide ($scCO_2$) is definitively accomplished via intermolecular interaction[1,2]. The strength of intermolecular interaction of the APFO+CO_2 and APFO+entrainer+CO_2 is represented using transition pressure (P_T) of perfluorooctanoic acid (PFOA) and the solubility of APFO containing in sample (m). P_T of PFOA+CO_2 increases from 12.4 to 20.2 MPa when temperature changes from 60 to 100 °C. Besides, when different entrainers are used in the process, the m changes and the maximum one reaches 0.002 g•g-1CO_2, which is corresponding to the removal efficiency of 92.3%. In the present work, a method is developed for removal of APFO from fluoropolymer in $scCO_2$. Methanol, acetone, ethyl acetate and n-hexane are used to enhance the removal efficiency of APFO under the optimized conditions.

This present work proposed a novel method for the removal of APFO in fluoropolymer, and is expected to be a new process for reducing the emission of perfluorinated compounds and decreasing the environmental risk of persistent organic pollutants.

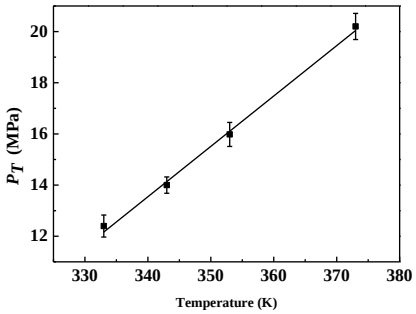

Figure 1. Relationship between P_T and temperature in the PFOA +CO_2 system.

Table 1. Removal efficiency of APFO in $scCO_2$

***T*(K)**	***E*%**						
	8MPa	**10**	**12**	**14**	**16**	**18**	**20**
333	86.8	89.7	92.3	91.6	91.8	91.9	92.1
343	85.7	87.8	89.1	90.8	90.1	90.3	90.3
353	84.6	86.7	87.5	88.9	89.7	89.6	89.7
373	82.3	83.4	84.3	86.3	87.8	88.9	89.5

Acknowledgments

We acknowledge the financial support from the National Natural Science Foundation of China (21776170, 21327011).

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