Improve Deinking Flotation of Water-Based Inks from Fundamental Studies

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Abstract

Deinking flotation plays a critical role in paper recycling, where small ink particles are removed from paper pulp by air bubbles. While oil-based inks can be easily eliminated, water-based inks remain a significant challenge due to their inherent hydrophilicity and small particle size. This limitation has become a major barrier to increasing the paper recycling rate in the U.S. In the present work, we performed a series of fundamental studies to address the challenges of deinking flotation of water-based inks. *First*, pigment particles (carbon black) from water-based inks were characterized using different methods. Surface hydrophobicity and surface charge of the pigment were determined using contact angle measurement and zeta potential measurement, respectively. The surface free energy of pigment was also determined using van Oss-Chaudhury-Good (vOCG) equation. *Second*, surface force measurements were conducted between a model-ink surface and an air bubble in water using a Force Apparatus for Deformable Surfaces (FADS). The role of different surface forces in deinking flotation was investigated. *Finally*, various hydrophobicity enhancing reagents and surfactants were tested to improve the performance of deinking flotation of water-based inks. The findings in this work provide new insights into the fundamental mechanisms governing the poor flotation response of water-based inks and demonstrate promising strategies to enhance their removal efficiency.

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