

**REMOVAL OF SOLVENT-BASED INK FROM HDPE SURFACES BY
ALKYLTRIMETHYLAMMONIUM BROMIDES**

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ABSTRACT

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Use of three different alkyltrimethylammonium bromides (i.e. dodecyl-, tetradecyl-, and cetyl-trimethylammonium bromide or DTAB, TTAB, and CTAB, respectively) for removal of solvent-based ink from printed high-density polyethylene (HDPE) surfaces was investigated. An increase in either the alkyl chain length or the concentration of the surfactant solutions increased the deinking efficiency at 30°C. The pH level was found to have a strong effect on ink removal of each surfactant, with deinking efficiency being found to increase with increasing pH level in the range 11-12. Over the temperature range investigated, 30-50 °C, the deinking efficiency decreased substantially with increasing temperature. The optimal conditions for ink removal were pH 12 and 30°C. The zeta potential of ink powder in different surfactant media and the wettability of different surfactant solutions on ink surface were investigated to study the adsorption of C_nTAB in CMC range and found to relate to the deinking efficiency to some extent. Similar to the deinking efficiency, the ability for the detached ink components to be solubilized into micelles in C_nTAB solutions increased with increasing the alkyl chain length and C_nTAB concentration, but it decreased with increasing temperature in the range 30-45°C. The results imply significance of the solubilization on the deinking efficiency when the surfactant concentrations exceed the corresponding CMCs. Addition of inorganic salt to the surfactant solutions enhanced deinking efficiency and helped increase solubilize capacity when comparing with those of the pure surfactant solutions.

บทคัดย่อ

อรุบล โชติพงษ์ : การกำจัดหมึกที่มีน้ำมันเป็นตัวทำละลายบนพื้นผิวพลาสติกโพลีเอทิลีนชนิดความหนาแน่นสูงโดยอัลคิลไตรเมทิลแอมโมเนียมโบรไมด์ (Removal of Solvent-based Ink from HDPE Surfaces by Alkyltrimethylammonium Bromides) อ. ที่ปรึกษา: รองศาสตราจารย์ ดร. ชีรศักดิ์ ฤกษ์สมบูรณ์ ศาสตราจารย์ ดร. จอห์น เอฟ สกีมอร์น และ รองศาสตราจารย์ ดร. พิชญ์ สุภผล 78หน้า ISBN 974-9990-17-X

การกำจัดหมึกบนพื้นผิวพลาสติกโพลีเอทิลีนชนิดความหนาแน่นสูง ทำโดยใช้สารลดแรงตึงผิวประเภทอัลคิลไตรเมทิลแอมโมเนียมโบรไมด์ 3 ชนิด คือ โดเดซิล-เตตระเดซิล-และเฮกซะเดซิล-ไตรเมทิลแอมโมเนียมโบรไมด์ (DTAB TTAB และ CTAB) พบว่าการเพิ่มจำนวนอะตอมในหมู่อัลคิลและความเข้มข้นของสารลดแรงตึงผิวมีผลในการเพิ่มประสิทธิภาพในการกำจัดหมึกที่อุณหภูมิ 30 องศาเซลเซียส ค่าความเป็นกรด-ด่างก็เป็นปัจจัยหนึ่งที่มีผลกระทบอย่างมาก พบว่าการกำจัดหมึกมีค่าเพิ่มขึ้นเมื่อค่าความเป็นกรด-ด่างสูงขึ้นในช่วง 11-12. นอกจากนี้การเพิ่มอุณหภูมิของกระบวนการกำจัดหมึกก็ส่งผลทำให้ค่าการกำจัดหมึกลดลงในช่วง 30-45 องศาเซลเซียส สภาพแวดล้อมที่เหมาะสมในการกำจัดหมึกคือ ความเป็นกรด-ด่างที่ระดับ 12 และอุณหภูมิ 30 องศาเซลเซียส เมื่อพิจารณาการดูดซับสารลดแรงตึงผิว 3 ชนิดบนแผ่นพลาสติกสีผ่านค่าซีต้าโพเทนเชียลของหมึก และความสามารถในการเปียกของสารลดแรงตึงผิวบนแผ่นพลาสติกในช่วงซีเอ็มซีพบว่า มีความสัมพันธ์ในทำนองเดียวกันกับค่าการกำจัดหมึกของทุกสาร ส่วนการละลายของหมึกพิมพ์ในสารลดแรงตึงผิว 3 ชนิดมีแนวโน้มในทำนองเดียวกันประสิทธิภาพในการกำจัดหมึก นั่นคือมีค่าเพิ่มขึ้นเมื่อจำนวนอะตอมในหมู่อัลคิลและความเข้มข้นของสารลดแรงตึงผิวเพิ่มขึ้นแต่มีค่าลดลงเมื่ออุณหภูมิของกระบวนการกำจัดหมึกเพิ่มขึ้นในช่วง 30-45 องศาเซลเซียส ซึ่งชี้ให้เห็นว่าการละลายเป็นกระบวนการที่สำคัญของการกำจัดหมึกเมื่อสารลดแรงตึงผิวมีค่าความเข้มข้นสูงกว่าซีเอ็มซี นอกจากนี้ยังพบว่าประสิทธิภาพในการกำจัดหมึกและการละลายของหมึกในสารลดแรงตึงผิวทั้ง 3 ชนิดที่ผสมกับเกลือโซเดียมคลอไรด์มีค่าสูงกว่าสารลดแรงตึงผิวชนิดบริสุทธิ์

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