

Ink Consumption and Cost Modelling for Polypropylene (PP) Films in Flexographic Printing

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Abstract:

Flexographic printing on polypropylene (PP) films is widely used in flexible packaging, yet accurate estimation of ink and solvent consumption remains challenging due to reliance on empirical thumb rules. This study proposes an artwork-driven framework for quantifying colour-wise ink usage and consumable cost in polypropylene flexographic printing. The methodology integrates digital artwork coverage extraction, print-area geometry, dry ink laydown modelling, solids-based wet ink conversion, solvent mass estimation, and per-kilogram cost calculation within a standardized 27-step operating procedure. Validation using a commercial multi-colour packaging case demonstrates that artwork-based coverage analysis significantly improves estimation accuracy over conventional approaches. Results reveal that white underprint contributes disproportionately to total ink consumption due to full-area coverage and higher laydown requirements. The framework enables reliable mass-balance verification and realistic prediction of ink, solvent, and cost per kilogram of printed film. The proposed approach supports cost optimisation and is adaptable across substrates and flexographic press formats.

Keywords:

flexographic printing, ink consumption modelling, polypropylene packaging, artwork-based coverage, cost estimation.