

Evaluation of vegetable-based biosolvents for use as cleaning agents in the printing industry

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Many organic hydrocarbon solvents traditionally used in the printing industry contain high levels of volatile organic compounds (VOC's) that are associated with ozone depletion. As such there is legislative pressure to curb their use and reduce emissions in the workplace. The European Commission introduced a Solvent Directive, which came into force on 11 March 1999 *European Directive 1999/13/EC (Directive on the limitation of emissions of VOCs due to use of organic solvents in certain activities and installations)*. The Directive aims to reduce the emissions of VOC's from industrial processes by approximately 66% in 2007 (from a baseline of VOC emissions in 1990).

The UK printing industry is the second largest user of solvents in the UK. As a result of this legislative pressure the printing industry is currently looking for alternative low VOC, low-hazard solvents as replacements for conventional petroleum-based solvents such as isopropyl alcohol and the alkyl-aromatics.

In its first annual report (2002), the UK Government-Industry Forum on Non-Food Uses of Crops (GIFNFC) highlighted the potential for use of vegetable oils as biosolvents in the printing industry. Vegetable oils including rapeseed, soya and coconut and their derivatives have excellent solvent properties that match the technical requirements of the printing sector. More recently, work funded by HGCA¹ highlighted a range of technical opportunities for the use of vegetable-based esters as solvents. One key area of potential highlighted by the review was that of using vegetable-based esters in the printing industry as print washes for removing ink and debris from offset printing presses. This work built on earlier EU funded work in the SUBSPRINT and VOFAPRO projects.

The UK printing industry employs approximately 160,000 people in over 12,000 companies; which reflects a high proportion of companies with small workforces (only 500 employers have more than 50 people in their work force).

As the UK printing industry is characterised by small printing companies, the fragmented and small scale of individual operators in the UK industry presents challenges to information dispersal and in encouraging change to existing tried and tested methods.

A recent 3-month demonstration project led by the Agricultural & Rural Strategy Group of the Central Science Laboratory assessed the performance and cost effectiveness of vegetable-based cleaning solvents in the UK printing industry, and potential hazards and risks associated with their use. A key objective was to provide printers with information to assist them in decision-making when purchasing blanket and roller washes, by providing an independent appraisal of cost, performance and hazards associated with vegetable-based solvents supplied as alternatives to current commercial print washes marketed in the UK.

¹ Turley, Areal & Copeland (2004). The opportunities for use of esters of rapeseed oil as bio-renewable solvents. Home-Grown Cereals Authority, London.

The project was undertaken in collaboration with two printers, DocQwise Business Services Ltd and BestPrint & Design Ltd.

“The demonstration project was an excellent opportunity for DocQwise to take the lead nationally in this particular area.” Jans Eskildsen, DocQwise Business Services Ltd.

“We were pleased to help in the trials of vegetable-based solutions and would seriously consider using them in the future.” Peter Best, BestPrint & Design Ltd.

Two predominantly vegetable-based print wash solutions from European suppliers were used. Preference in selection was for blanket and roller wash solvents derived from rape (as the UK could supply raw materials for such products), rather than those based on coconut, soya or palm oils.

The solutions were tested on commercial lithographic sheet offset printing presses, the first manually cleaned, the second using an automatic cleaning system. Product A - vegetable-based, water miscible cleaning agent suitable for automatic rubber blanket washers and for washing by hand. Product B - a graphic cleaner for rubber rollers and blankets. Results were compared with conventional Group AII and Group AIII blanket and roller wash solvents.

The vegetable-based solutions were as effective as conventional solvents in removing ink and debris. Product A required the lowest volume (83 ml/day), with no significant difference between Product B (140 ml/day) and Group AIII solvent (140 ml/day). The Group AII solvent required the highest volume (200 ml/day). Re-inking ability of the rollers and make-ready times were unaffected. Drying times were different and some required more time.

Prices of the vegetable-based solutions are currently higher than conventional products. After taking into consideration the initial price of the solvent, and the quantities used, two distinct groups were identified relating to the total cost of using each solvent. The first group (Product A at £24.07/year and Group AII solvent at £32.69/year) were found to cost less per year than group two (Product B at £ 63.55/year and Group AIII solvent at £57.46/year).

Vegetable-based solutions have a much lower risk to operators, when compared with conventional solvents. Adoption of vegetable-based solutions would help the printing industry to meet the European Directive on VOC emissions. In addition, vegetable-based solutions have significantly less odour, improving the working environment.

Both printers working in this project found that the vegetable-based solutions required different application and cleaning methods compared with conventional solvents. For example, wiping the blanket and rollers with a dry or damp wipe to remove any excess oily residues. It is important to consider the initial purchase cost for alternative solvents, and to balance it with performance and health and environmental risks. Clearly rapeseed derivatives have potential.

Figure 1: Average volume of solvent used per day (ml)

