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APPLICATION NOTES

UV/EB INKS AND FOOD PACKAGING

Introduction

A noticeable trend in the printing and packaging fields in the recent years has been the tendency to print and prepare packaging ever closer to the point in time by which it is needed ("Just-in-time").

Unfortunately, printing with oleoresinous oxidation inks usually requires 24-48 hours standing before the print surface is sufficiently hard to accept cutting and folding processes without smudging. For food packaging applications, some fourteen days may be required to ensure that all oxidation curing of the ink is completed and that volatile reaction products are fully dissipated with appropriate stack-turning procedures.

In contrast UV or EB cured inks are essentially completely cured "off the press", and with the use of appropriate raw materials, it is possible to produce print with minimal off flavour without the need for stack turning or winding.

UV and EB inks are currently being used by many of the world's largest web-converters of food packaging (e.g. Tetrapak, J. Gadsden) because of this advantage of instantaneous cure and low volatile residuals.

Organoleptic considerations

The organoleptic features of a chemical are those features which are concerned with its ability to impart a smell or taste. Thus contamination of food by exposure to volatile chemicals from the packaging materials may produce off-odour or off-taste

It is possible for the packaging material to continuously exude volatiles at levels just at or below the threshold for odour detection. Nevertheless certain foodstuffs, of which those containing dairy fats (e.g. milk) are prime examples, will over a period of time absorb sufficient of the contaminating species to give a detectable off flavour.

The favourable organoleptic features of UV systems can be demonstrated in laboratory experiments. Figure I illustrates the detectability of off-flavour in packaging for conventional and UV cured systems over a period of several weeks.

The conventional inks used in the study were specially formulated to give minimal odour. Similarly the UV inks and varnish have been formulated to ensure that the resins and diluents in the UV ink and varnish have low intrinsic odours and that the photoinitiators are selected for low odour and volatility.

Other points of this study are relevant:

* Equal areas of printed samples are placed in sealed containers with a number of pieces of chocolate. No surface contact is allowed between the chocolate and the printed samples.

* UV ink and varnish samples are tested immediately after printing

* Conventional printing materials are allowed seven days to "air" prior to testing.

* At the time intervals noted, chocolate samples are removed and submitted to a tasting panel. Each panel member is provided with a sample of an exposed (to air) chocolate with similar ageing to the test material as a control reference.

The results demonstrate unequivocally the superior performance of UV cured ink and varnish.

It should be noted however that the laboratory tests are indicative only of what is achievable under ideal conditions. In particular, optimum cure conditions were chosen, and the possibility of reverse set-off contamination was avoided.

Rules for Use

The needs and requirements of the food packager will ultimately determine the degree of stringency to be adopted by the converter. Some or all of the following rules will have to be adopted.

1. Ensure adequate levels of cure are achieved.

In UV , avoid heavy ink films, particularly of hard-to-cure colours. Therefore, use maximum number of lamps and lowest practical line speed.

In EB curing avoid doses in excess of 4 Mrads to minimise paper degradation effects.

2. Use high-purity benzophenone-free inks, particularly where low density plastics are involved and taint is critical.

3. Avoid printing on porous substrates when using UV curing - excessive ink penetration results in uncured ink and therefore odour and taint.

4. Take appropriate care to avoid reverse set-off. "Winding" of the cured sheets is recommended to minimize post-cure odour levels in the sheets.

5. No contact is to occur between foodstuff and ink (or varnish system)

6. Immediate food wrapping must form a barrier between any ink/varnish system and the food. Note that paperboard substrates are not a sufficient barrier

7. Immediate food wrappers must be of sufficiently low permeability to prevent migration and must be printed in such a manner that set-off in the the printing process is avoided.

Benzophenone is one component of these inks which under certain circumstances may cause migration and taint problems. Low density Polyethylene and Polypropylene films are not impermeable barriers to benzophenone. Benzophenone free grades are available upon request for the most demanding applications.

8. The printer must make his own assessment of the suitability of any UV inks or varnish for food applications. It should be recognised that each print configuration has specific differences (e.g. number of lamps, interdeck drying etc.) to all others which will determine the most suitable choice of ink formulation for the equipment.

9. Ultimately it is the responsibility of the food packager to ensure that his packaging will cause no deterioration in the organoleptic characteristics of the contained food. The stringency of measures to be adopted is very much determined principally by the food itself and secondly by the nature of the packaging material to be adopted.