ANGUS® CHEMICAL COMPANY

Key Performance Advantages

- Improves the quality in solvent-based rotogravure and flexographic printing
- Increases press output
- Enhances pigment dispersion and color development

Paints and Coatings

AVANTANE® PA 4000

Performance-Enhancing Specialty Ink Additive

AVANTANE® PA 4000 is an additive specifically designed to meet the performance requirements encountered in solvent-based rotogravure and flexographic printing. It is a versatile component for formulating inks and thinners, and makes possible impressive quality-related improvements to many of the frequently encountered problems during printing operations. When AVANTANE PA 4000 is used either as a component of the press-side thinner or in the ink formulation, press output can be increased, which results in even further operational economies.

The advantages to be achieved by using AVANTANE PA 4000 in the rotogravure or flexographic processes are the result of its unique properties, which contribute benefits to the following elements in the printing process:

- Improves color development of ink through enhanced pigment dispersion
- Promotes excellent print definition
- Improves quality issues associated with less than optimal solvent release
- Enhances adhesion to substrates

Selected Formulating Properties

The following are selected formulating properties of AVANTANE PA 4000. They are not to be considered product specifications.

Specific Gravity @ 20/20°C	~1.02
Weight per U.S. Gallon @ 20°C, lb	~8.5
Vapor Pressure @ 20°C, mm Hg	~11
Evaporation Rate, by Volume (n-butyl acetate = 100)	101
Flash point, Tag Closed Cup, °C/F	34/94
Distillation Range @ 760 mm Hg (90% min.)°C	112-133
Solubility in Water @ 20°C, % by Weight	2.6

Improves Pigment Dispersion and Color Development

Wetting is one of the most important aspects of ink manufacture. Without proper wetting, pigment dispersion and color development in the ink will be inadequate. The excellent wetting properties of AVANTANE PA 4000 can be used to best advantage in the manufacture of inks by allowing the AVANTANE PA 4000 to aid in the dispersion of the pigments. Ink vehicles have difficulty in thoroughly wetting the pigment particles because of the monomolecular film of moisture that is strongly adsorbed on their surface. This element often accounts for the higher costs associated with long pigment dispersion times and the associated quality variances from having less than full development of color value during the ink manufacture. For proper wetting to occur, this monomolecular film must be displaced by the vehicle. The strong affinity of the hydrophilic surface for this water layer makes such displacement difficult. AVANTANE PA 4000 will displace the monomolecular film of water on the surface because it has a higher energy of adsorption than does water. When incorporating AVANTANE PA 4000 to achieve this function, it is suggested that dosages of surfactants in the formulation be reviewed, as it is often possible to reduce their levels, since elimination of the water layer improves their efficiency. No other additive has energy of adsorption of sufficient magnitude to displace water from pigment surfaces. By elimination of the water layer from the pigment surface, both dispersion and color development are maximized.

Displacing Monomolecular Moisture Promotes Excellent Print Definition

Print quality is the ultimate criterion in customer acceptance of a job. To produce good, clean printing, the ink must have proper flow properties. Poor flow properties are, therefore, one of the causes of the poor print definition. Inks that do not flow and transfer properly due to their build-up on the plate or in the cylinder will produce low print quality. This condition results from the fact that the vehicle does not coat the pigment surface, and it is gradually picking up solvent from the system during aging to satisfy the wetting needs. As the pigment surface withdraws this solvent from the system, it depletes the available solvent used to solubilize the polymer. When this occurs, the viscosity will increase, and the flow characteristics of the ink are diminished. The application of AVANTANE PA 4000 is particularly useful since it will allow the pigment surface to be fully coated by the vehicle, and will eliminate the variances that result from a solvent deprived system. Thus, during the printing process, the transfer of the ink from the plate or cylinder will remain within the proper design range, and ink build-up will not occur to decrease fine-line definition. In addition, ink based on AVANTANE PA 4000 will allow the same improved performance stability in rework inks, making their reuse a very simple procedure. In the end, inks containing AVANTANE PA 4000 will provide for improved quality of work while offering the opportunity to enhance the operational economics for the printer.

Improves Quality Issues Associated With Solvent Release Properties

Good solvent-release properties in an ink are usually thought of in terms of ability to operate a press at high speed with no tendency toward blocking, odor, or blushing. AVANTANE PA 4000, when included in inks at the press, aids in the prevention of the specific press problems listed because of its ability to improve overall solvent release.

Blocking

Blocking is usually caused by poor solvent release, causing the ink to stick to the unprinted side of the printed material. The resins used in most inks have a powerful attraction for most of the solvents used in these inks. This attraction delays drying far longer than would be predicted by evaporation-rate values for the solvents alone. Unlike typical solvents or additives, AVANTANE PA 4000 is not strongly attracted to the resin, so ink systems containing AVANTANE PA 4000 will aid in the solvent release, and the inks will dry promptly after application. Additionally, because of this good solvent release, the ink film will properly release all of the solvents, and will avoid a tacky condition on the ink surface, which is conducive to smudging. With these solvent-release issues being eliminated, it is possible to run the presses at higher speeds to permit improved productivity.

Odor

Problems involving residual odor in printed materials are basically the result of inefficient solvent release, as discussed under blocking. It is advantageous in the end-use if the printer has used components that completely evaporate and are not retained in the final ink film. The AVANTANE PA 4000 has a midrange evaporation rate to control the through-dry of the ink film, and allows the other solvents and additives to leave more efficiently. In the final analysis, the incorporation of AVANTANE PA 4000 reduces the level of residual components which contribute to odor in the finished product.

Blushing

Blushing is a condition that develops from the rapid evaporation of solvent at the ink surface while in the presence of moisture from the air. The condensation of moisture on the ink surface contributes to precipitation of the resin in the ink, producing a blush. It is evidenced by reduced gloss or transparency of the ink.

In order to overcome this situation, slow-evaporating (retarder) solvents are incorporated into the ink. While this can reduce blushing, it often creates other problems such as blocking and odor, or a reduction in press speeds to allow elimination of the slow-evaporating material. The beneficial vapor pressure of AVANTANE PA 4000 eliminates the blushing problems because it can be formulated into the solvent blends to provide uniform solvent-release rates which control the release of the very rapid evaporating solvents that cause the blushing. When AVANTANE PA 4000 is incorporated into the system, retarder components can often be reduced or eliminated, thus alleviating their use problems.

Enhances Adhesion to Substrates

Specific resins used in inks may have good adhesion to certain substrates but not to all. Since inks cannot be designed solely for only a specific use, adhesion must be controlled by variation in formulation. As with pigment surfaces, a monomolecular film of moisture is usually present on the surface of substrates that will have printing ink applied. Inks and thinners containing AVANTANE PA 4000 can be used for printing on all types of substrates because the AVANTANE PA 4000 promotes wetting of the substrates (particularly nonporous surfaces such as aluminum foil or polyethylene). In comparison to inks without AVANTANE PA 4000, most inks containing AVANTANE PA 4000 will displace the moisture from the substrate and allow the surface to be wetted more readily by the ink. As a result, adhesion of the ink will be improved.

A. Gravure-Process Ink Thinners

Vinyl Ink	% by wt.
Methyl ethyl ketone	40
Methyl isobutyl ketone	2
Toluene	45
AVANTANE™ PA 4000	10
RS-Nitrocellulose Ink	**% by wt.**
Ethyl acetate	30
Ethyl alcohol	30
Toluene	30
AVANTANE™ PA 4000	10
Chlorinated Rubber Ink	**% by wt.**
Isopropyl acetate	18
Toluene	74
AVANTANE™ PA 4000	8
Acrylic Ink	**% by wt.**
Isopropyl acetate	80
AVANTANE™ PA 4000	20

B. Flexographic-Process Ink Thinners

Co-solvent Polyamide Ink	% by wt.
Isopropyl alcohol	63
Aliphatic hydrocarbon	27
AVANTANE™ PA 4000	10
Acrylic Ink	**% by wt.**
n-Propyl acetate	32
Ethyl alcohol	48
AVANTANE™ PA 4000	20
Alcohol-Soluble Polyamide Ink	**% by wt.**
Ethyl alcohol	60
n-Propyl acetate	15
Aliphatic hydrocarbon	10
AVANTANE™ PA 4000	15

C. SS-nitrocellulose Ink Thinner for Either Gravure or Flexography

Co-solvent Polyamide Ink	% by wt.
Isopropyl acetate	5
Ethyl alcohol (anhydrous)	75
Aliphatic hydrocarbon	10
AVANTANE™ PA 4000	10

Use In Press-Side Thinners

AVANTANE PA 4000 can be used in either formulation of the inks or introduced into the thinner. The formulary above contains several typical examples of starting formulations for solvent systems to be used with various ink vehicles.

Formulation Considerations

The dosages of AVANTANE PA 4000 (as a portion of the total solvent) which are required to maximize its benefits will vary from one system to another, and are usually dependent on the vehicle, solvents, and pigmentation or application of the ink. A general recommended starting point to fully receive the benefits of AVANTANE PA 4000 is in the range of 8-15% replacement of the total solvent system. Levels within this range have proven effective in providing substantial performance improvements to both ink and thinner formulations.

Health and Safety Considerations

AVANTANE PA 4000 is not considered toxic by the dermal route of exposure and is not irritating to the skin or eyes by contact.

AVANTANE PA 4000 should be considered as moderately toxic by oral ingestion. The chief industrial hazard of AVANTANE PA 4000 is vapor inhalation. Vapor concentrations are attainable which could be hazardous with a single excessive exposure. As with any chemical, proper precautions must be taken to ensure its safe and effective use.

Before using this product, refer to the most recent Material Safety Data Sheet from ANGUS Chemical Company, which provides information on its properties and handling.

AVANTANE PA 4000 is a flammable liquid by definition of U.S. Occupational Safety and Health Administration (OSHA) and the U.S. Department of Transportation. It should be handled and stored only in the manner prescribed for Class IC flammable liquids.

Environmental and Disposal Information

Do not dump into any sewers, on the ground, or into any body of water. Disposal methods must be in compliance with all Federal, State, Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

For unused and uncontaminated product, the preferred options include sending to a licensed, permitted: recycler, reclaimer, incinerator or other thermal-destruction device. The same management options are available for used or contaminated materials, although additional evaluation is required (see, for example, U.S. Environmental Protection Agency, 49 CFR Part 261, "Identification and Listing of Hazardous Waste"). Any disposal practice must be in compliance with all Federal, State, Provincial and local laws and regulations. Check with appropriate agencies for your location.

We can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums.

Product Stewardship

ANGUS encourages its customers to review their applications of ANGUS products from the standpoint of human health and environmental quality. To help ensure that ANGUS products are not used in ways for which they are not intended, ANGUS personnel will assist customers in dealing with environmental and product safety considerations. For assistance, Safety Data Sheets, or other information, please contact your ANGUS representative at the numbers provided in this document. When considering the use of any ANGUS product in a particular application, review the latest Safety Data Sheet to ensure that the intended use is within the scope of approved uses and can be accomplished safely. Before handling any of the products, obtain available product safety information including the Safety Data Sheet(s) and take the necessary steps to ensure safety of use.

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