DuPont™ Zonyl® NF Paper Fluoro-Protectant

Technical Information

Description

Zonyl® NF is an anionic, water-based, low foaming fluoro-protectant that imparts oil and grease repellency to a wide variety of paper and paperboard products. Application of 0.2 lb of Zonyl® NF as received per 1,000 ft^2 usually provides sufficient oil and grease repellency. The versatility of Zonyl® NF, along with compatibility to many other anionic or nonionic paper chemicals, allows application by most papermaking, treating, and converting operations.

Food Packaging Status

Zonyl® NF is listed in the Code of Federal Regulations, Food and Drugs, 21 CFR 176.170, components of paper and paperboard in contact with nonalcoholic aqueous and fatty foods, Conditions of Use B though H. The limitations and Conditions of Use are defined as:

- A maximum treatment level of 0.17 lb Zonyl® NF solids per 1,000 ft^2 of paper or paperboard. (Zonyl® NF contains 19.5% solids.)
- Conditions of Use B through H of 21 CFR 176.170 are shown below:
  - B – Boiling water sterilized
  - C – Hot filled or pasteurized above 66°C (150°F)
  - D – Hot filled or pasteurized below 66°C (150°F)
  - E – Room temperature filled and stored (no thermal treatment in the container)
  - F – Refrigerated storage (no thermal treatment in the container)
  - G – Frozen storage (no thermal treatment in the container)
  - H – Frozen or refrigerated storage (ready prepared foods intended to be reheated in the container at time of use):
    - Aqueous or oil-in-water emulsion of high or low fat
    - Aqueous, high or low free oil or fat

* Federal regulations specify total fluorine content. Broke, secondary fiber containing fluorochemical and small amounts of fluorides in pulp and water can contribute to total fluorine content.

Application

Equipment

Zonyl® NF can be applied on or off the paper machine. Convenient locations are at the size press, coating station, calender stack waterbox, gravure or flexographic press, wire wound rod, or trailing blade and roller coaters. In short, any equipment that can apply a uniform coating of a water solution to paper or board can usually apply Zonyl® NF successfully. Surface treatment is preferred, as it offers wide versatility in location and equipment while providing a less expensive and more easily controlled application than internal treatments.

Treatment Level

Treatments can be made to one side or both sides of the paper or paperboard. The concentration of Zonyl® NF required for a given degree of oil or grease holdout depends upon several factors:

- The oil or grease being held out
- Time and conditions for holdout
- Nature of the fiber finish
- Presence of other chemicals on the sheet
- Papermaking variables, such as stock freeness, density, and degree of calendering

In most cases, the greater the amount of fluorochemical on the surface of the treated paper or paperboard, the greater the oil and grease repellency. Variations in alum, filler, size, starch, and other sheet or treatment parameters may affect holdout. For an initial trial, the recommended rate is 0.2 lb Zonyl® NF as received per 1,000 ft^2.

Solution pH

The treating solution pH has little effect on Zonyl® NF over a pH range of 6–10. Performance is slightly better for solutions of pH 9–10.

Water Hardness

Water used to make the treating solution must be soft (less than 50 ppm hardness) or have sufficient chelating agent added (according to the manufacturer's recommendation) to control hard water ions. Failure to soften the water will reduce repellency by precipitating product. Softening agents such as Versene® Powder or Versene® 100 (Dow Chemical Co.) are recommended. The level of Versene® will vary with water hardness, but, generally, 0.1% Versene® 100 is sufficient.

Sizing Agents and Alum

Internal sizing, such as rosin and alum, can reduce penetration of the Zonyl® NF treating solution, resulting in a nonuniform, shallow treatment. Therefore, internal size should be avoided or minimized. Alum can cause precipitation of the fluoridizer at the surface of the sheet. Alum should be eliminated or minimized using a chelating agent (Versene® Powder or Versene® 100). Where lower pH is required, sulfuric acid can be substituted for alum.

Mineral Fillers

Mineral fillers in the sheet also reduce the effectiveness of Zonyl® NF. Fillers increase the surface area and require more fluorochemical to provide repellency.

Thickeners and Film Formers

Zonyl® NF is compatible in solution with most thickeners and film formers, such as unmodified starch, acid-hydrolyzed or enzyme-converted starch, ethylated starch, Elvanol® polyvinyl alcohol, sodium alginate, casein, protein, and sodium CMC. These products can also be added to Zonyl® NF to minimize sheet penetration, if resistance to scoring or folding is unimportant. Chlorinated or oxidized starches should be avoided.

Preparation of Zonyl® NF Treating Solution

- Heat the water to 70°C (160°F) to facilitate mixing.
- Zonyl® NF is specifically formulated as a low-foaming product. Avoid the use of excessive chelating agents (Versene®). If a chemical antifoam is required, one of the following, or an equivalent product, is suggested:
  - Antifoam FG-10 (Dow Corning)
  - Defoamer 831 (Hercules, Inc.)
- Add all other required materials (starch, sodium CMC, PVA, wetting agent, etc.) to the solution. **Ensure all additives are compatible with Zonyl® NF prior to application.**
- Zonyl® NF is thixotropic and needs to be thoroughly mixed to ensure uniform application on the paper or paperboard. Avoid unnecessary aeration of the Zonyl® NF by using low shear mixing equipment and eliminating solution free fall.
- Lastly, add sufficient Zonyl® NF to obtain repellency. Zonyl® NF can be added at full strength and should be uniformly distributed in the solution by gentle but complete mixing. Uneven application generally results in reduced oil repellency.

Testing

Determining the amount applied is generally done by controlling wet pickup or, if greater accuracy is needed, by fluorine analysis. The presence of Zonyl® NF can be qualitatively detected by placing a drop of oil on the surface of the paper or paperboard. Fluorochemical will cause the oil drop to "bead," whereas a film coating such as polyethylene will allow the oil to "flow" or lay flat. The more fluorochemical present, the greater the contact angle. To minimize treatment cost and avoid unnecessary expense, it is important to keep in mind the intended use of the paper or paperboard and design testing around end-use conditions.

Personal Safety, First Aid, and Storage and Handling

Zonyl® NF should be stored above 5°C (41°F) to avoid freezing. Zonyl® NF is stable to aging and can be stored for prolonged periods with little or no loss in effectiveness. Again, Zonyl® NF is thixotropic and needs to be thoroughly mixed to ensure uniform application on the paper or paperboard. Avoid unnecessary aeration of the Zonyl® NF by using low shear mixing equipment.

Do not apply Zonyl® NF using aerosol application or by atomization. Inhalation of spray or mist may cause nasal, throat, or lung irritation. Inhalation of large amounts of respirable particles may be toxic to the lungs. Symptoms may be modest initially, followed in hours by severe shortness of breath requiring prompt medical attention. See the Material Safety Data Sheet (MSDS) for further information.

Technical Assistance

For help in evaluating this product in your application, please call DuPont Technical Service at (800) 255-4596.

Ordering Information—Product, Literature, or Samples

To order samples or literature, please call (800) 255-4596. For commercial quantities, please call (800) 441-9504. For locations outside the United States, contact the local DuPont representative in your country.

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