

ChemBrief



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NONIONIC ASSOCIATIVE THICKENERS FOR LOW VOC APPLICATIONS

Due in large part to the legislation of environmental regulations, the coatings market has seen a shift from traditional oil and solvent-based paints toward compliance technologies including water-based systems. Water based paints contain lower levels of VOC's (Volatile Organic Compounds) and are therefore more environmentally responsive. With the recent development of appropriate resins and additives, it is now possible to reach zero VOC with water based technology.

In zero and low VOC water-based products, the "additives" package is coming under increased scrutiny as a contributor to VOC levels even though additives are used at low levels in the coating. In response to this situation, Southern Clay Products, Inc. has developed our patented OPTIFLO® VF technology. All OPTIFLO® VF products contain no VOC's. Most nonionic associative thickeners contain some amount of solvent (VOC) to facilitate lower package viscosity. Lower package viscosity allows the nonionic associative thickeners to be supplied as liquids allowing for easy incorporation by pumping or pouring. Lower viscosity also allows these solutions to be as high in concentration of active ingredients (polymer solids) as possible. The three major factors that control the solution viscosity of a nonionic associative thickener are:

- 1) **molecular weight**
- 2) **hydrophobe selection**
- 3) **hydrophobe level**

Diagram 1 shows the impact that changes in hydrophobe selection and hydrophobe level have on solution viscosity. When using a low level of a "weak" hydrophobe the solution viscosity of a 20% active content can be supplied at a low viscosity which produces a pumpable liquid. However, when the strength of the hydrophobe is increased to a "medium" or "strong" hydrophobe, the solution viscosity increases significantly. This greatly impairs one's ability to provide a solution that is low enough in viscosity to pump or pour.

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Increasing the actual level of hydrophobe further compounds this increase in viscosity, greatly reducing the ability to handle the nonionic associative thickener. This increase in solution viscosity is caused by the stronger hydrophobes interacting or “associating” with each other. This causes a network to form as shown in Diagram 2, which then causes a drastic increase in viscosity. With low levels of a weak hydrophobe this “association” is not strong enough to form a network which will generate a lower solution viscosity. This lack of association allows some products such as OPTIFLO® L100 to be supplied as high as 20% active ingredient in water with no VOC or viscosity suppressant.

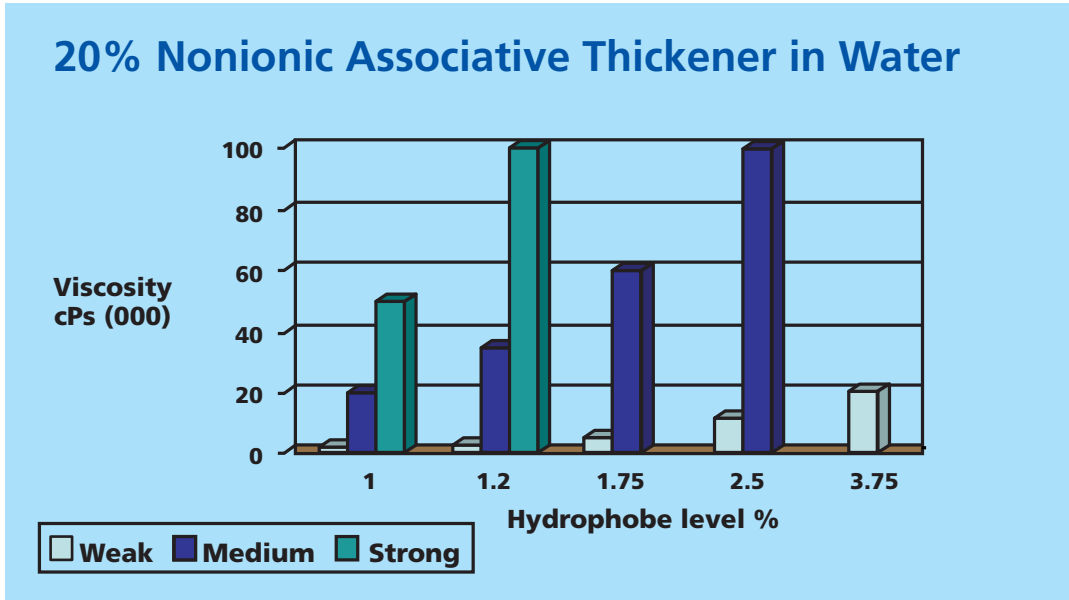


DIAGRAM 1

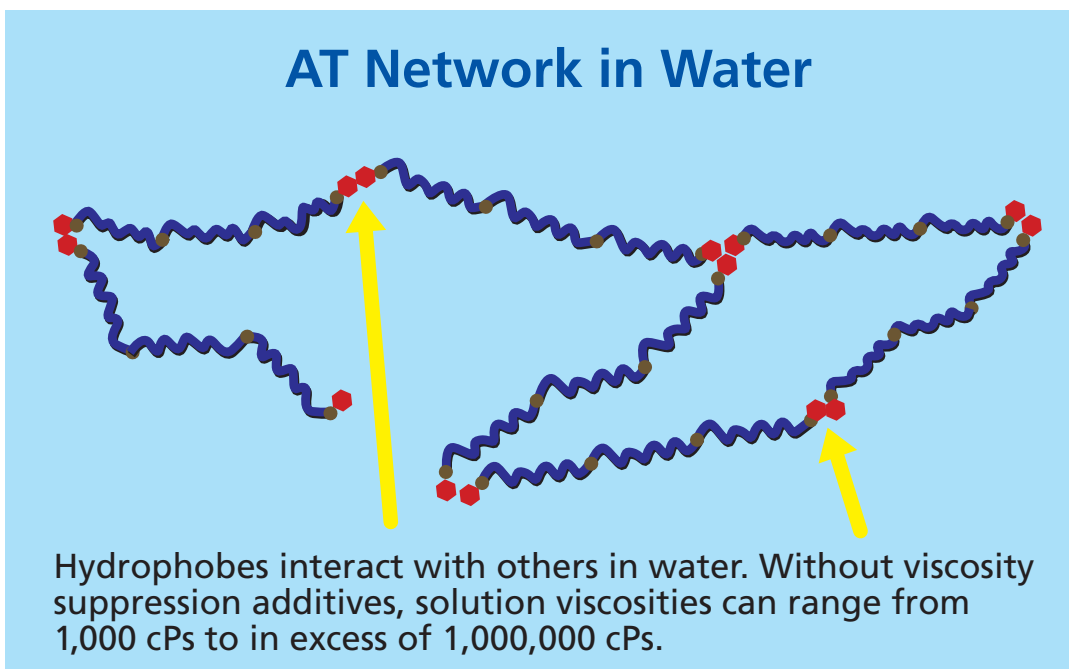


DIAGRAM 2



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Decreasing solution viscosity to allow higher solids in a product that could be pumped and poured posed a significant technical challenge particularly in systems containing significant amounts of strong hydrophobes. These products with high levels of strong hydrophobes are typically referred to as low shear viscosity builders or KU drivers. Many technical answers are available to address this issue, but many have undesirable side effects. Our goal is to supply a product at the highest possible level of active ingredient while maintaining the lowest possible solution viscosity. Three obvious methods were available which would accomplish this task, however each has limiting factors which disqualified them from consideration. These methods which were eliminated from consideration were:

1) Inclusion of Coupling Solvents

Coupling solvents can be used to reduce the viscosity of high solids nonionic associative thickener solutions. Unfortunately, coupling solvents contribute to increased levels of VOC's. In some cases an abrupt increase in viscosity upon dilution can be experienced, which can cause difficulty in incorporation into the product.

2) Inclusion of Surfactants

Surfactants can be used to effectively suppress the viscosity of high solids nonionic associate thickener solutions. It is even possible to create a zero VOC high solids dispersion by using surfactants to suppress viscosity. However, the disadvantage of using surfactants is that they can contribute to water sensitivity and interfere with the previously formulated surfactant package in paint formulas.

3) Use of Cyclodextrin

Cyclodextrin can be used to suppress viscosity and achieve zero VOC. Cyclo-dextrin functions through the use of a hydrophobic cavity which serves as a quest cavity for the hydrophobe. This prevents the "association" of one hydrophobe with another. However, releasing the hydrophobe in the final paint systems can be difficult at times in low surfactant formulations.

To achieve zero VOC in a product that remains pourable and can be pumped, a patented technology was developed and used in OPTIFLO® VF products. Amphiphilic polymers are used to suppress viscosity, allowing high solids in a product that has low solution viscosity. Through this revolutionary development, Southern Clay Products, Inc. provides formulators with a series of high solids nonionic associative thickeners that contain no VOC's. They also have predictable formulation behavior and can be easily handled in production. OPTIFLO® VF products retain the same high efficiency as their standard OPTIFLO® additive counterparts. This means that low VOCs can be achieved without a decrease in thickener efficiency.

Let Southern Clay Products, Inc. help you create your low VOC coatings in the future!



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ROCKWOOD
ADDITIVES

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