# Rheology Modification with Avicel® in Personal Care Applications

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## Synopsis

Avicel® microcrystalline cellulose is manufactured by isolating the crystalline cellulose regions from wood pulp. It is an ideal solution for providing physical stability to formulations at low-to-medium viscosity. The physical network of insoluble particles formed by Avicel® is pseudoplastic, highly shear-thinning and thixotropic, making it ideal for suspensions, sprayable products and emulsions. The gel network is stable to shear and elevated temperatures and has a wide functional pH range. Because of its convenience of use, excellent toxicity profile and wide compatibility, Avicel® can be readily incorporated into a wide range of cosmetic formulations. Application examples include suncare sprays, cosmetic foams, low viscosity emulsions and decorative cosmetics.

## Introduction

Currently, the microcrystalline celluloses in the Avicel® product range are widely utilized as rheology agents in several industries, including food, pharmaceutical and household products. Several exciting applications for this product range are now emerging in the personal care industry due to its unique rheological properties, natural origin and excellent toxicity profile.

Microcrystalline cellulose is a purified form of cellulose derived from wood pulp of selected species of trees.Wood pulp cellulose consists of loosely structured para-crystalline regions and more ordered crystalline regions. During Avicel® manufacturing process, the para-crystalline regions are hydrolysed and removed leaving only the crystalline regions. These microcrystals, which are insoluble, rod-shaped particles of less than 1 micron in length, can be dried to form commercial products know collectively as non-colloidal grades. During the drying process, hydrogen bonding causes the cellulose microcrystals to form larger, tightly-bound particles that can not be redispersed later to recover the individual microcrystals. The properties of these non-colloidal grades are outline briefly below and in **Table 1** and will be dealt with in more detail in a future paper.

The main subject of the present paper is a second class of microcrystalline cellulose products that are commonly referred to as colloidal grades. These are manufactured by co-processing the microcrystals with a minor amount of a soluble gum that inhibits hydrogen bonding during the drying process. The products produced in this way can be readily redispersed in water using high shear. Dispersion results in the formation of a physical 'log-jam' network of individual microcrystals (**Figure 1**) that gives colloidal Avicel® its unique rheology.

**Table 1. A brief overview of the functional proplerties of colloidal and non-colloidal Avicel.**

| | *Colloidal Avicel* | *Non-colloidal Avicel* |
|---|---|---|
| Commercial form | White powder | White powder |
| Cosmetic Grades | PC 591,611,815 | PC 101, 102, 105 |
| Particle size | <1 micron | 20 to 200 microns |
| Particle shape | Rod-like | Approximately spherical, porous |
| Acivation | High shear dispersion | Blending or mixing |
| Co-processed with soluble hydrocolloid | Yes | No |
| Soluble | No | No |
| Absorb liquids | No | Yes |
| Compressible | No | Yes |
| Thixotropic dispersions | Yes | No |
| Suspends, stabilizes, foams or emulsions | Yes | No |