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ChemScan® Method Summary #149 Synthetic Polymers for Potable, Cooling and Boiler Water Treatment

Background

Water soluble polymers are used primarily to disperse, suspend or stabilize particulate matter in water. There are three basic categories of water soluble polymers:

Synthetic, which are produced by polymerization of petroleum or natural gas products.

Semi-synthetic (sometimes called organic polymers), manufactured from natural organic or microbial materials, using chemical or fermentation techniques.

Natural, including plant and animal materials such as lignin, tannins and sugars. (See Method Summary #68, Natural Organic Matter).

All water soluble polymers perform similar functions, but synthetic polymers are preferred in many applications because of their greater efficiency and versatility.

Synthetic polymers include polyacrylates, polymethacrylates, polymaliecs, polystyrenes and sulfonated polystyrenes. (Organic phosphonates are considered to be a separate category of corrosion inhibitors and are addressed in a separate ChemScan Application Summary). Manufacturers of synthetic polymers include BASF, B F Goodrich, Celanese, Cytec, Ciba, Dow/Hampshire, FMC, Johnston, Nippon Shokubai, Rohm & Haas, Stockhausen and others.

Standard Analysis Techniques

Standard free polymer analysis techniques available to the water treatment industry include the ferric complexation method and the quaternary surfactant turbidity method. The ferric complexation method adds a surplus concentration of dissolved iron into the sample for reaction with free polymer. The remaining dissolved iron is measured and the free polymer concentration is calculated from the result. The quaternary surfactant turbidity test is used for analysis of anionic polymers by measuring the turbidity caused by introduction of a cationic compound (typically Hyamine®) into the sample.

Several methods are also available to measure tags or tracer compounds that are either attached to the polymer or introduced as a proportionate component of the water treatment product formulation. These tracers may require proprietary detection systems and may concentrate in recirculating water systems in a manner that is not proportionate to the available fraction of active treatment chemicals.

ChemScan Analysis Method

Synthetic (and some semi-synthetic) polymers tend to have unique absorbance signatures in the ultraviolet wavelength range. In pure media and in high concentration, many polymers would be good candidates for primary analysis, (without reagents) using ChemScan. In typical recirculating cooling water and boiler blow-down, however, the concentration of free polymer is relatively small compared to other dissolved chemicals and particulates in the sample. Therefore, direct analysis using uv absorbance may not be possible for these applications.

ChemScan has developed automated secondary methods for polymer analysis based on the two most common analysis techniques used by the water treatment industry. The ChemScan ferric complex method establishes a baseline in the sample to eliminate interference from any dissolved minerals, complexed polymer or background turbidity prior to introduction of ferric reagent. The ChemScan quaternary surfactant turbidity test also starts with a baseline adjustment for background turbidity, prior to introduction of the quaternary compound.

Either of the ChemScan methods are suitable for analysis of the so called “tagged” polymers, although, it is the polymeric reactions that are measured, not the tag itself. ChemScan can also detect other water treatment components typically used as tracers. Such products include tolytriazole (see Method Summary #120) and sodium molybdate (see Method Summary #123). Full uv spectrum analysis assures stable, accurate results for either method.

Free polymer can be detected as a stand alone parameter or can be detected as one of a suite of parameters by a multiple parameter ChemScan analyzer. ChemScan analyzers can also monitor single or multiple sample points, depending on the specific model selected for the application. Results can be output in serial or analog (4-20 mA) format as either ppm of the specific treatment chemical or as ppm of equivalent product concentration.