Effect of different preparation methods on the scale inhibition properties of polyaspartic acid

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Abstract Scale adheres to the surfaces of pipelines or cooling water system equipment, impeding heat transfer and accelerating pipeline corrosion. This obstruction not only impacts equipment operation but also leads to significant economic losses. Calcium carbonate ($CaCO_3$) constitutes the primary component of scale. However, current commercial-scale inhibitors, such as organophosphates, contribute to water pollution. Therefore, the environmentally friendly scale inhibitor polyaspartic acid (PASP) has garnered considerable attention. This study explores three synthetic methods for PASP production: acid-PASP, ammonia-PASP, and alcohol-PASP. Liquid chromatography analysis revealed that alcohol-PASP synthesis produced no by-products. At a dosage of 10 mg/L, the scale inhibition efficiency of alcohol-PASP reached 44%, surpassing that of commercial PASP (10%). The enhanced performance of alcohol-PASP can be attributed to its ability to transform the crystalline phase of $CaCO_3$ from aragonite to a less precipitable form, aragonite, upon introduction.

Keywords Green Scale Inhibitor, PASP, Crystalline Phase Shift