

LEPAGE, JAMES^{1*}, PATRICK KINCAID¹ and JAN SEETZ², AkzoNobel Functional Chemicals, ¹ USA: 525 West Van Buren St, Chicago, IL 60607, ² Europe: Stationsstraat 77, P.O. Box 247, 3800 AE Amersfoort, The Netherlands. **Removal of calcium based scales in sugar juice evaporators using EDTA.**

ABSTRACT

Sugar scale is a complex mixture of various components that forms on evaporator heat exchangers during the concentration of sugar juice. Depending on the sugar juice source – cane vs. beet – and processing conditions, the amount of scale formed can vary significantly from mill to mill. In general – scale formation from sugar beet processing is almost always significantly less than is found in cane juice mills due to efficient carbonation plus cation exchange of the weak juice removing scale forming Ca^{2+} ions. However scale thicknesses of even a few tenths of a millimeter can dramatically reduce evaporator efficiency and thick juice throughput. To ensure efficient mill operation this scale requires periodic removal, either by mechanical cleaning or with chemical treatments with NaOH and / or acid. Mechanical cleaning is highly labor intensive and comes with safety concerns, while chemical treatments may not always be effective especially on Ca based scales. Additionally acid cleaning can be corrosive to equipment.

Chelating agents like EDTA have been known for 60 + years to dissolve numerous organic and inorganic metal ion based scales and is used in many descaling applications – such as in removing Fe and Ca based scale deposits in boiler cleaning and removal of ‘milk stone’ – Ca hydroxyapatite (HAP) in dairy processing plants. Depending on the scale to be removed optimum use of EDTA may require a particular pH or salt type of EDTA.

We have determined that EDTA at high pH readily dissolves Ca sulphate, oxalate, carbonate and many other scale types typically found in sugar juice evaporators. In contrast, the dissolution of HAP based Ca scale is best done with a solution of EDTA at a pH 9 or below. Besides pH, the concentration of the EDTA solution and temperature will also impact the extent of scale removal. Since each evaporator may have a different scale composition – the optimal application and use of EDTA requires knowledge of the scale(s) present in each evaporator. Examples of the application of EDTA to remove a range of scales found in cane sugar juice evaporators will be presented as with possible application to sugar beet juice scale. Successful cleaning typically requires just ~ 3 hours of boiling with EDTA. Monitoring of pH and free EDTA content using a simple titration procedure during the cleaning is critical to ensuring the proper amount of EDTA is used.