POSTER SUMMARY

FLOW BEHAVIOUR CHARACTERISTICS OF C-MASSECUITE

Moloi TM, Barker B and Walford SN

Sugar Milling Research Institute NPC, c/o University of KwaZulu-Natal, Howard College Campus, Durban, 4041 South Africa

tmoloi@smri.org, bbarker@smri.org, swalford@smri.org

Abstract

Knowledge of the flow behaviour characteristics of C-massecuite is important for sugar production, as it can affect the amount of sucrose that can be recovered from the mother liquor. Throughout the recovery process, the flow behaviour characteristics of C-massecuite has an impact on the boiling behaviour, the crystallisation rates and the separation of crystals from the mother liquor. A knowledge of the flow behaviour properties is also required for the correct design and sizing of sugar factory unit operations, piping, pumps and stirrers.

Due to their high impurity content, C-massecuite and the associated mother liquor exhibit non-Newtonian behaviour. In the past, viscosity or consistency has been used as an indicator of the flow behaviour of C-massecuite. These measurements cannot characterise non-Newtonian behaviour effectively and have also not shed any light on the reasons for the 'hard-to-boil' massecuite phenomenon, which has often caused processing and recovery problems in factories. The Sugar Milling Research Institute NPC (SMRI) has an Anton Paar rheometer that can perform accurate flow behaviour measurements of C-massecuite and the associated mother liquor, and it has both rotational and oscillation functions that can measure the viscoelastic properties of fluids. It is thus capable of characterising both C-massecuite and the associated mother liquor, in terms of their viscoelastic behaviour, a characteristic that is seldom measured for these streams, and it provides further insights into the physical properties that may be associated with its poor boiling behaviour.

This poster presents and compares the flow behaviour measurements performed on both the C-massecuite and the associated mother liquor (C-Nutsch) samples collected from different South African sugar factories during November and December 2022, by using the Anton Paar rheometer. The viscoelastic behaviour of the samples in terms of deformation energy (the ability of the sample to store and dissipate energy) is described. The storage modulus (elastic behaviour) and the loss modulus (viscous behaviour) of all the collected samples were measured. The ratio of the two moduli (the loss factor) ultimately describes the viscoelastic properties of the sample. This ratio was calculated for all the C-massecuite and C-Nutsch samples used in the study.

The information generated from these flow behaviour measurements will be used:

- to investigate the viscoelastic behaviour of C-massecuites and C-Nutsch during the 2023/2024 season and whether the technique can identify the reasons for the poor boiling behaviour of massecuite;
- to investigate the role that flow behaviour properties play in the recovery of sucrose (in terms of exhaustion);
- to create a library with reference data for future C-massecuite and C-molasses rheological studies; and
- to develop a method for measuring the effects of chemical modifiers on the flow behaviour of C-massecuites.

Keywords: C-massecuite, C-Nutsch, flow behaviour, viscoelasticity