



Ultrafiltration: Temperature Affects

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ABSTRACT

One of key processes at Sensus for creating very high clarity tea is an ultra-filtration system. In order to better understand the process, a series of tests were performed using various processing parameters and teas of varying origins. The single most critical parameter is temperature. The process has to be temperature controlled to a low level (<20°C) otherwise compounds are solubilized through the membrane and then precipitate upon dilution to create "tea cream".

INTRODUCTION

One of the quality aspects of tea is its clarity. Often, higher clarity tea is desirable for ready to drink (RTD) applications. As Sensus, there are a number of processing procedures available for varying levels of clarity. The highest clarity product is processed using an ultra filtration system. This system provides exceptional clarity and is ideal for some customers. In order to optimize the ultra filtration unit, the affect of temperature and of tea origin were evaluated.

MATERIALS AND METHODS

An ultra filtration system (equipment and processing details not listed for confidentiality) was used to filter pre-concentrated tea concentrate. Two types of tea were used at two different temperatures (14-16°C and 21-24°C).

RESULTS AND DISCUSSION

It is fairly clear from Figure 1 that a heavy precipitate forms in the teas that are processed at a higher temperature through the ultra filtration membrane. Both the types of teas (2nd from left and far right) show a strong precipitate at ~7°B when processed at 21-24°C. There appears that there might also be a difference between the teas with one having more precipitate, but could be other factors. There is no doubt that processing temperature plays a major role. Comparing 14-16°C as compared to 21-24°C, there is a dramatic difference.

Figure 2 is the same samples further diluted to approximately 0.7°B. While the same comparisons are still accurate, the amount of precipitate is harder to discern. It can be seen as a dark area at the bottom of the cups in the picture. Once again, the major difference is by far the processing temperature.

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Figures 1 and 2 clearly show the affect of temperature on the tea #1 and suggest a similar affect would be found in the tea #2. Figure 3 is a direct comparison of the tea #3 tea at high and low temperatures. The same results are seen.

Another affect of the processing temperature is on the °Brix of the permeate. Typically the °Brix of the permeate is 3.0-3.1 when processed above 20°C and less than 2.5°B when processed below 10°C. It is most likely that at the higher temperatures, some material is being solubilized and is passing through the membrane only to precipitate later.

Research is currently being performed to identify the components of the precipitate.

Conclusions

Clearly, processing temperature plays a critical and fundamental role in ultra filtration and it is imperative that the system be operated at a low temperature.

Figure 1. Tea concentrate diluted to approx. 7°B. From left to right: Tea #1 @ 14-16°C, Tea #1 @ 21-24°C, Tea #2 @ 16-19°C, and Tea #2@ 21-24°C.

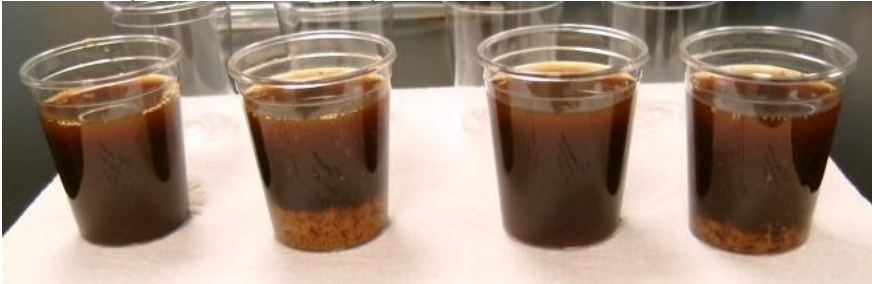


Figure 2. Tea concentrate diluted to approx. 0.7°B. From left to right: Tea #1 @ 14-16°C, Tea #1 @ 21-24°C, Tea #2 @ 16-19°C, and Tea #2@ 21-24°C.



Figure 3. Tea concentrate #3 diluted to approx 7°B. Teas filtered at 17-24°C (left) and at 5-12°C (right).

