

5th International Nitrocellulose Symposium

Denitration of Nitrocellulose (NC) in Acid Recovery Centrifuge

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2010 – Yield loss realized in ATK’s commercial propellant manufacturing line

- Simultaneously, Grade B NC nitrogen content trending lower

Failure investigation identified two processing issues in NC Nitration process

- Elevated reaction temperature
- Elevated acid recovery centrifuge temperature vs. historical

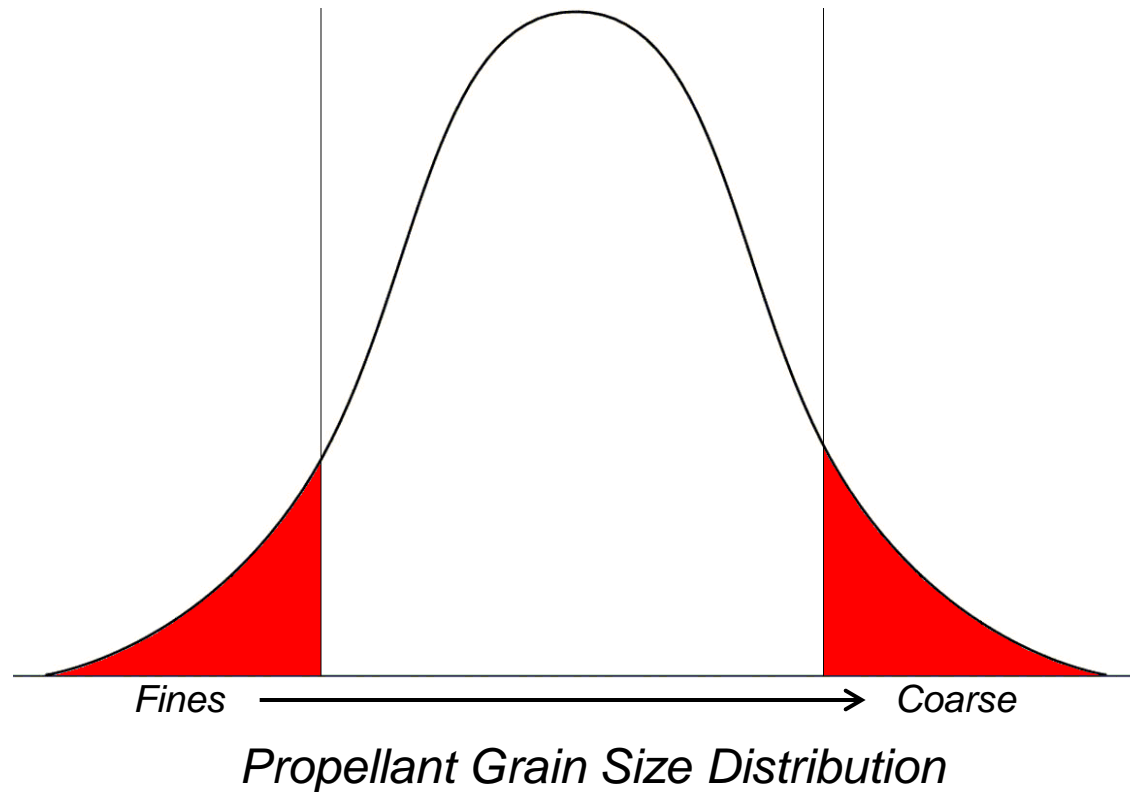
Failure mode validated on laboratory scale nitrocellulose manufacturing process

Cooperation with customer to install process water chiller

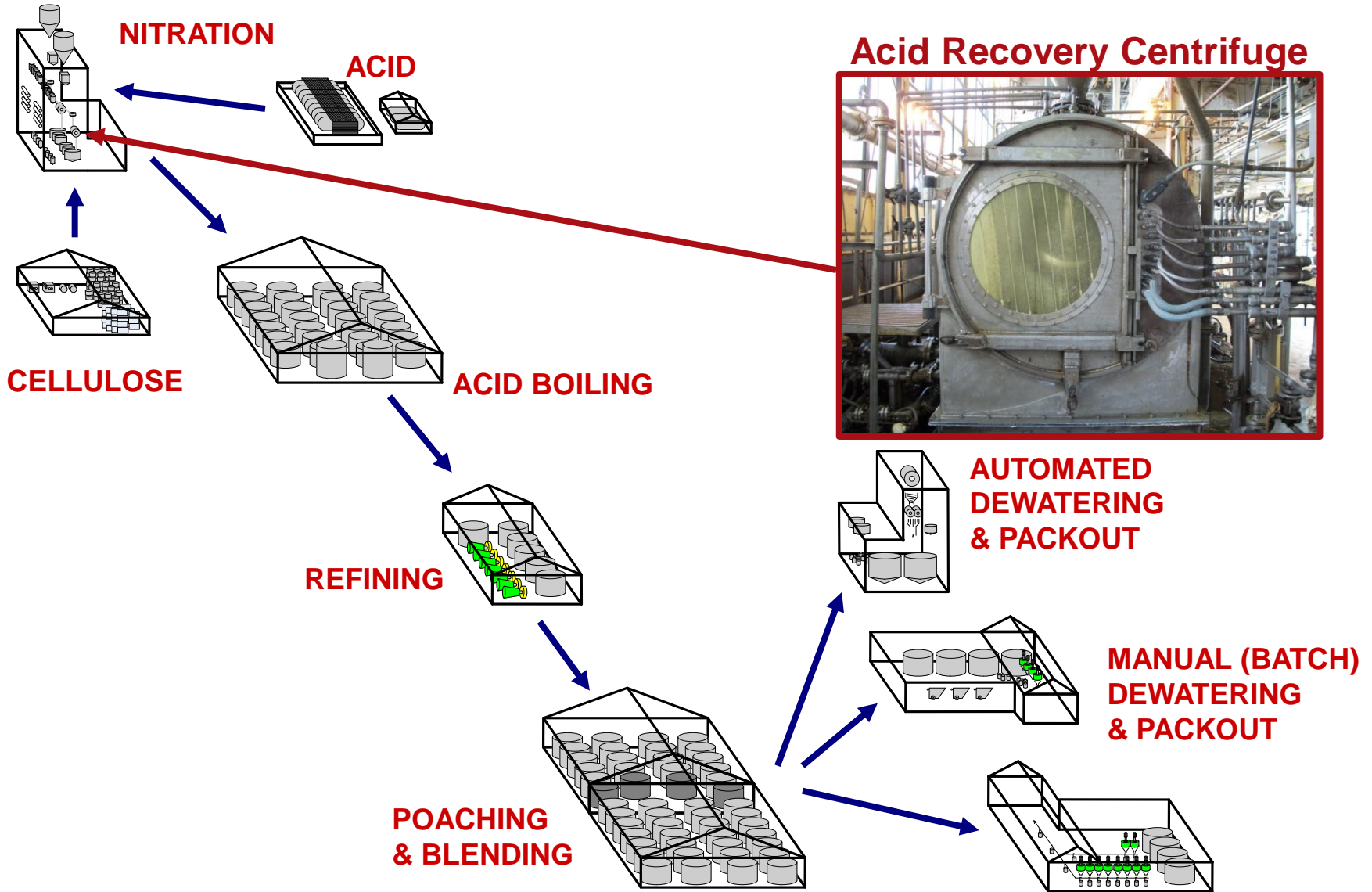
- Return reaction temperature and acid recovery centrifuge temperature to normal levels

Commercial propellant manufacturing line realized losses at screening process

- Excessive coarse and fines fractions in screened propellant
- Decreased yield increased product rework above expected levels



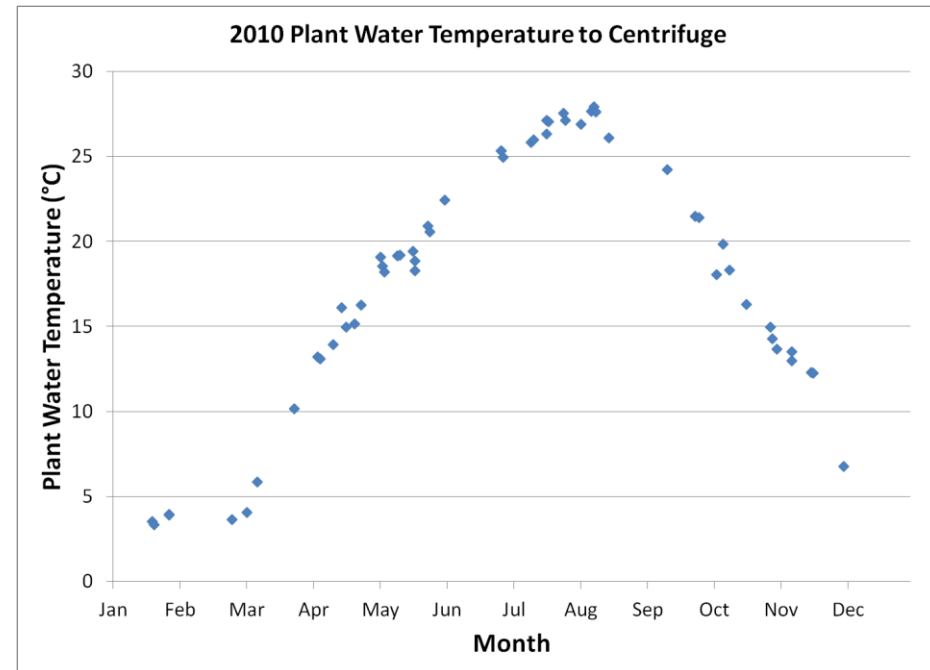
Radford NC Manufacturing Process



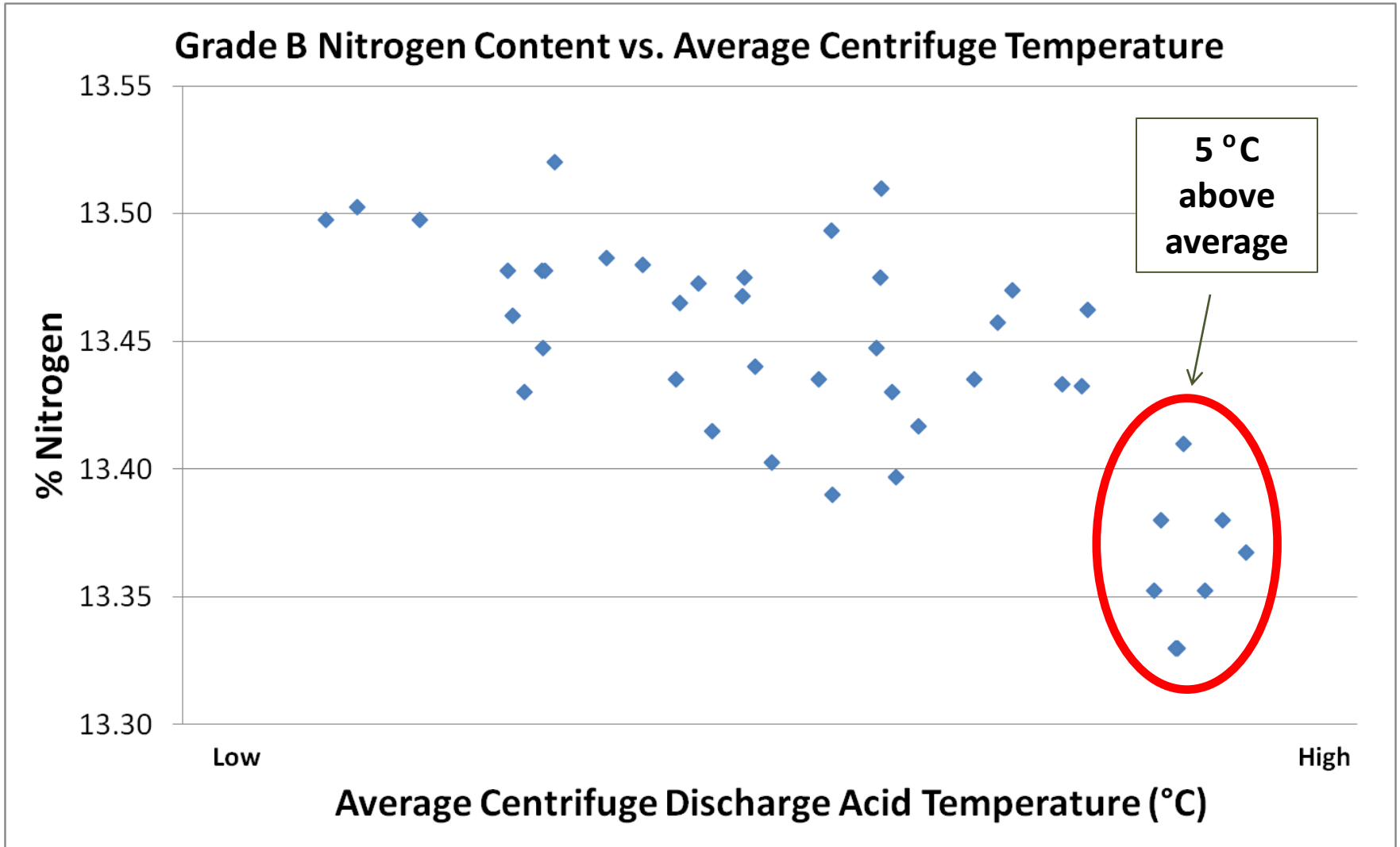
Acid Recovery Centrifuge after Nitration

Acid/NC slurry flow into pusher plate style acid recovery centrifuge

- Acid recovered from NC using plant water and recycled acid washes
- Two of six washes are temperature controlled
- Plant water temperature historically uncontrolled



% Nitrogen vs. Centrifuge Temperature



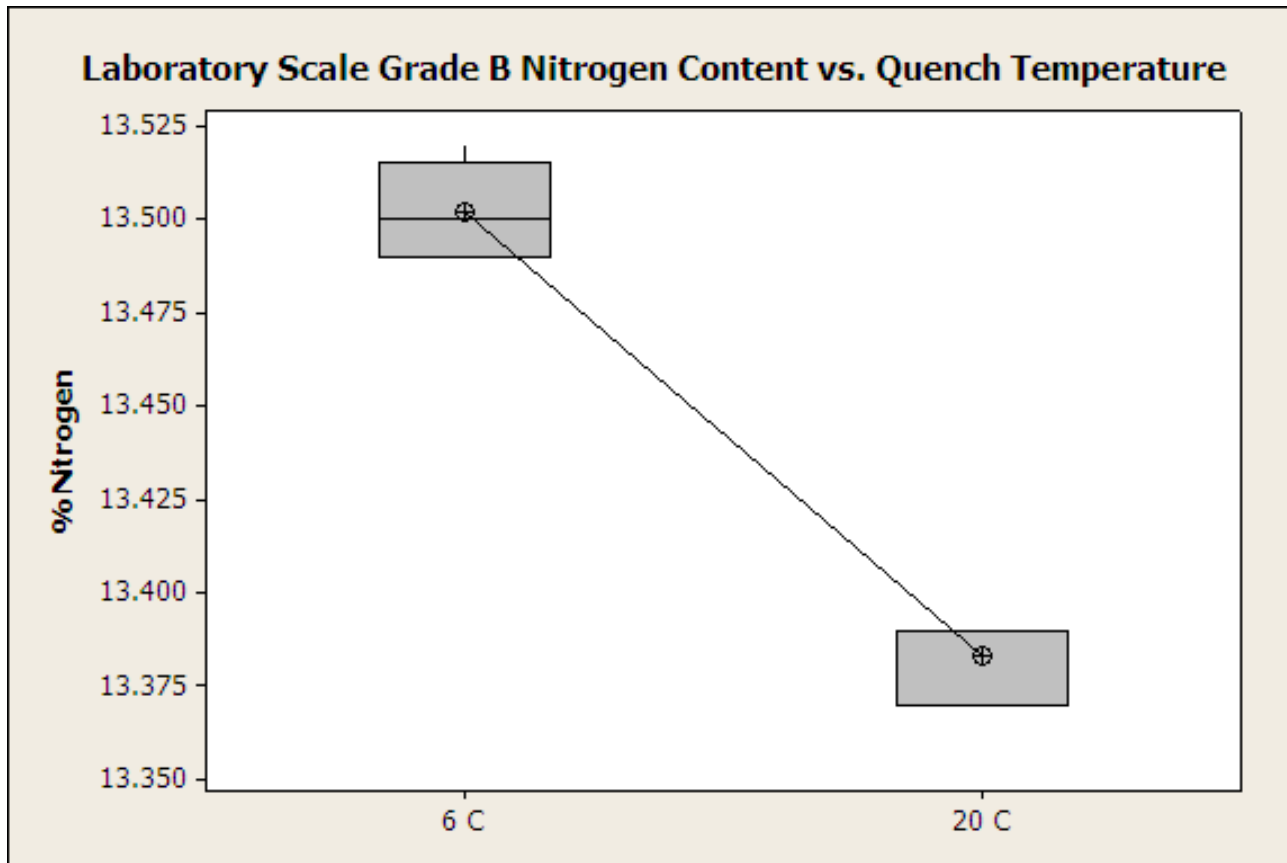
Denitration likely occurring at high centrifuge quench temperatures

Laboratory Scale Quench Temperature Experiment



Grade B nitrated on laboratory scale process quenched at different conditions

- Quench water temperature = 6 C
- Quench water temperature = 20 C





Chiller Installation

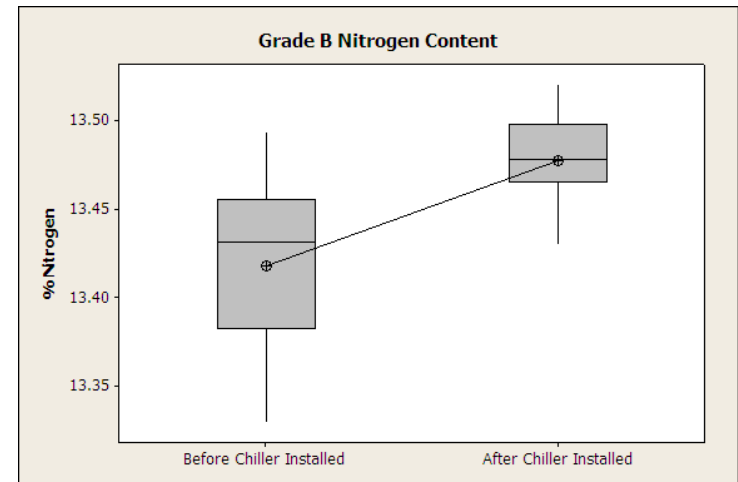
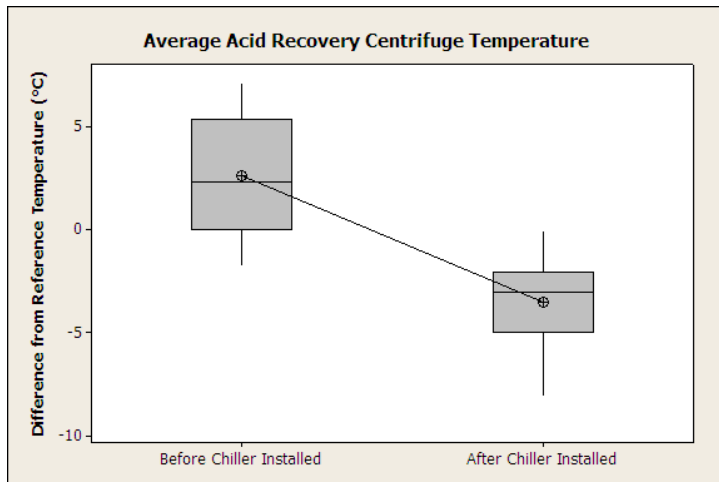
Chill Plant Water

- Plant water to centrifuge
- Plant water to nitrating acid heat exchanger

Results

Lower centrifuge temperatures

Higher nitrogen Grade B NC



Yield losses experienced in commercial propellant manufacturing line correlated with lower % nitrogen Grade B produced under high temperature centrifuge conditions.

Consistent with literature and experiments performed on ATK's laboratory scale nitrocellulose manufacturing process, high centrifuge temperatures were determined to be the root cause for the propellant processing issues.

Through close collaboration with the customer, a plant water chiller was installed to lower the centrifuge temperature and produce a more uniform and higher quality final product.