

OPTIMIZE BUTTER PRODUCTION BY CONTROLLING CONSTITUENTS CLOSER TO TARGETS

In-line analysis of butter to control the levels of fat, moisture and salt

Introduction

Butter is manufactured from cream with a fat level at approximately 40%. The cream is added to the churn and tumbled or churned until a curd is formed. This curd is then kneaded to produce a smooth texture. During the kneading process water, or brine in the case of salted butter, is added to adjust the product to the legally required minimum of 80% fat.

With most butter production facilities now using continuous churns, the capacity has increased toward 30,000 lb. of butter per hour, producing a great amount of butter over a shorter period. To take advantage of this higher volume, tighter controls of production must be maintained.



ProSpect real time in-line analysis of butter

Challenge

The churn operator or butter maker has the task to maintain the levels of fat and moisture and in salted butter, salt. The quality manager has responsibilities to maintain product uniformity and quality of the product. With large amount of butter being produced by the continuous churns, a large amount of loss can occur very rapidly if the fat level falls below 80%. On the other hand, there can be a great amount of product "give-away" by overcompensating the level of fat to ensure its minimum of 80% i.e., running high at 81-82%. The challenge is to maintain the fat level at 80%+ without going below or being too high and losing money by giving fat away.

In salted butter, the salt level must also be maintained at approximately 1.5% depending on the butter type and manufacturer. If too high or too low the taste is affected.

OPTIMIZED BUTTER PRODUCTION IN-LINE MEASUREMENT

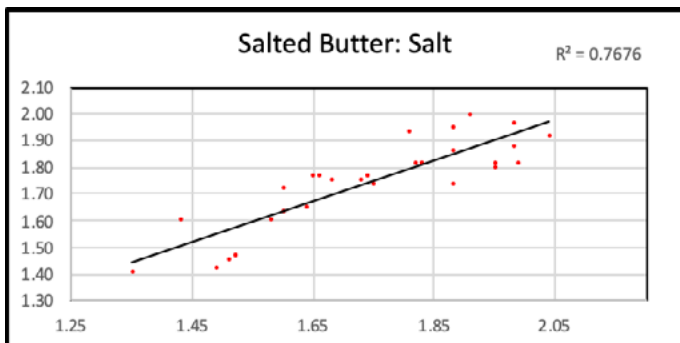
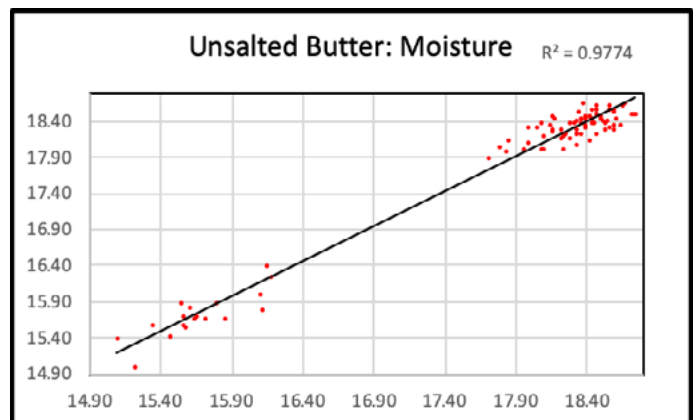
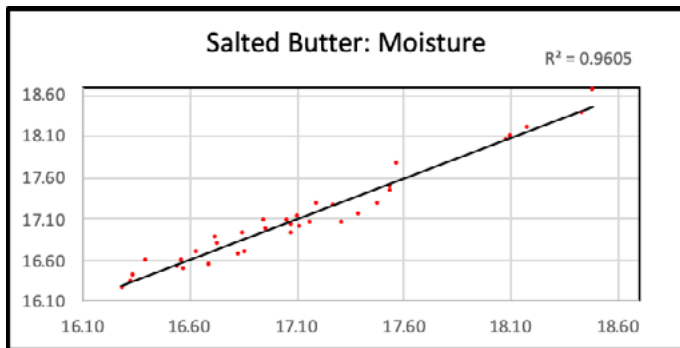
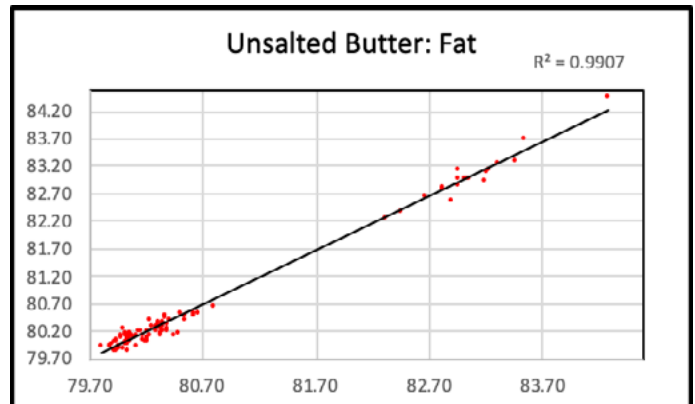
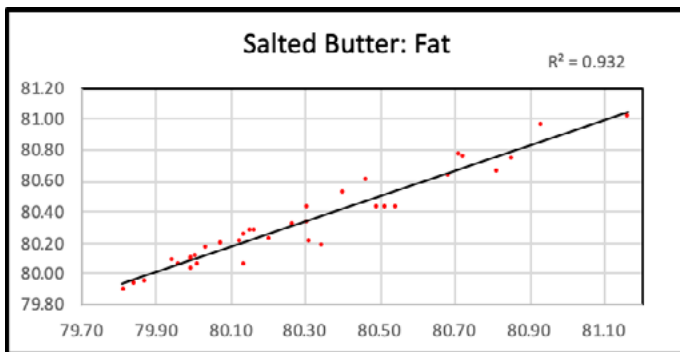
Solution

The ProSpect In-line Process NIR simultaneously measures the levels of fat, moisture and salt in butter at the outlet of the working section of the continuous churn. This data is displayed on the main terminal as well as the trends for each of the constituents. It also outputs the results via plant Ethernet (or 4-20mA analogue) to the churn process control.

SALTED BUTTER ANALYSIS STATISTICS			
	Range	SEP	R ²
Fat	79.8 - 81.2%	0.11	0.9320
Moisture	16.1 - 18.7%	0.12	0.9605
Salt	1.3 - 2.1%	0.09	0.7676

UNSALTED BUTTER ANALYSIS STATISTICS			
	Range	SEP	R ²
Fat	79.7 - 84.6%	0.12	0.9907
Moisture	14.9 - 18.8%	0.16	0.9774

- R² = The correlation between the lab reference value and the ProSpect predicted value
- SEP = Standard Error of Prediction or Performance. This is the Standard Error of differences between ProSpect Predicted and Lab Reference Value



OPTIMIZED BUTTER PRODUCTION BENEFITS

Benefits

The ProSpect in-line butter analyzer's proven performance demonstrates the advantage of real time analysis for quality process control. With this performance, the operator has the ability to move the product constituents closer to specification. The customer can then realize a rapid return on investment, typically < 12 months and continuing overall profit.

- Based on an hourly production of 8,000 lb./hr, 10 hours per day, 250 operating days per year, the yearly production = 20,000,000 lb.
- The control of the process using the ProSpect's continuous result output can be used to bring the average fat content from 80.45% to 80.15%. This is based on accuracy and repeatability of the measurements.
- At \$2.00/lb. this would result in a cost savings of \$120,000 per year which includes 60,000 lb. additional yield.

Production anomalies can be immediately detected resulting in timely corrective action. This greatly reduces the amount of product rework and/or waste.

The ProSpect is a fully integrated system with:

- Built-in process computer with touch screen interface
- Built-in PLC which includes bi-lateral communication to the plant PLC.
- Output of analytical results to the plant PLC via ethernet or analogue
- Input of production signal from the plant PLC to automatically select the product that is in production
- Built-in power conditioning
- Built-in air-conditioned temperature control
- Insensitive to vibration
- Ethernet ready
- Self-diagnostics
- All housed in a NEMA 4X environmental enclosure
- Wash down ready
- 3A compliant CIP measurement flow cell with NIR energy transmitted through fiber-optic bundles.

*ProSpect In-line Process
NIR for measurement of
Fat, Moisture, Salt and
SNF in butter*

