Lean Manufacturing Project to Increase Efficiency and Reduce Energy Firmenich

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Company Overview



- Started in 1895
- World's largest private company in the flavors & fragrances business
- Producer of liquid, dry, and encapsulated flavors
- 64 countries, 54 operational facilities, 26 manufacturing sites
- New Ulm, MN location is one of five in the US
 - Spray-dried, dry-blended, paste, and liquid flavors



Incentives for Change

- Lean manufacturing
- Continuous improvement
- Corporate sustainability





Reasons for MnTAP Assistance

- 40% of all products are spray-dried powders
 - Increase efficiency of spray drying operation (increase up-time)
 - Increase production capacity (continue expansion and leadership in market)
- Continue march towards sustainability goals
 - Constantly strive to be a good neighbor to the community
 - Utilize less energy, water, and discharge less waste
- MnTAP intern brought in as a fresh set of eyes & engineering expertise on these projects



Approach

- Spoke to operators & upper management about operations
- Reviewed SOPs, and documented details of conversations
- Worked hands-on to gain understanding of potential opportunities
- Utilized chemical engineering background to:
 - Develop mathematical models of spray dryer performance
 - Identify trends, plan tests, and evaluate results



Opportunity 1: Time Reduction

Location	Process & Details	Reason for Desired Change
Small Dryer	 Cleaning-in-place (CIP), 1 operator 7 hours: downtime 	Production: 1-2 hoursDowntime reduction increases efficiency

Proposed Solution: Add an additional operator 7 hours \rightarrow 4 hours

Income	Expenditure	
 Production Rate: 75 KG/HR Product Retail Price: \$ 10/KG 	 Labor costs: \$ 25/HR Energy Costs: 3 HR additional operation 	



Opportunity 1: Financial Evaluation



Time Gained/YR	Annual Production Increase	Net financial benefit
320	24,000 KG	US \$ 100,000



Opportunity 2: Water Usage Reduction

Background: 3 Rinses – first rinse, chemical cleaner, final rinse Current: Visual or timing based control of water & chemical usage Proposed Solution: Use conductivity and turbidity sensors to monitor discharge

• Aids operators, save water & chemicals, gives additional time for production





Baseline (Water) TDS: 860 ± 10 ppm

Flow rate = 40 gpm Time saved = 5 min Water saved = 200 gal

Opportunity 2: Financial Evaluation

Location	Annual Savings @ 400 washups/YR	Annual Production Time Gain	Production Increase @ 75 KG/HR	Net Annual Profit
Small Dryer	80,000 gallons	22 HR	1,650 KG	\$ 15,200

• Possibility exists to reuse last rinse (or part) as first rinse of next wash-up (needs further evaluation)

Adding sensory equipment to manage this:

Expenditure	Profits	Payback Period
Approximately US \$ 6,500 Including PLC programming	\$ 15,200	5.5 months



Opportunity 3: Production Rate Increase

- Different spray-dry products have feeds with different solids content
- Higher solids content in feed:
 - Increases production rate
 - Saves time
 - Increases flavor retention
 - Reduces energy consumption
 - Reduces amount of water used
- Pumping & quality constraints

Production Rate @ 20% Solids: 126 KG/HR Production Rate @ 30% Solids: 217 KG/HR 72% increase





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Evaporating 1000 KG Feed Cost @ 20% Solids: \$ 174 Cost @ 30% Solids: \$ 102 41 % decrease in cost for this step



Opportunity 3: Production Rate Increase

- Identified most heavily used carriers
- Modified SOPs to minimize dilution
 - Formula instructed ingredients to be added in certain solids ratio
 - SOPs suggested adding additional water to dilute

Annual Capacity Increase	Annual Energy Savings	Annual Water Usage Reduction	Net Annual Profit
17,000 KG	\$ 2,600 (240,000 lb. steam)	30,000 gallons	\$ 170,000



Opportunity 4: Waste Reduction

- Product deposits are difficult to remove (dryer & screw conveyor)
 - **Benefit:** Pig Save on TSS & BOD discharge Product flow Even better company image Pipeline Deposits **Two Pronged Approach** https://en.wiki2.org/wiki/Hydraulically activated pipeline pigging Capture solids Capture solids Solids **TSS & BOD Investment &** before washing while washing **Payback Period** Captured Savings \$ 9,500 32,000 lb. **Needs Evaluation** Vacuuming Filter socks Pigging (currently being evaluated) (solubility an issue)

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Other/Future Opportunities

- Spray-head optimization on all dryers & nozzle addition on Box Dryer
 - Increased moisture content, particle size, and capacity
 - Mass & energy balances
 - Needs time for testing
- Waste heat recovery/reuse from exhaust air





Summary

Recommendation	Benefits	Annual Savings	Status
Add an Operator	320 hours	\$ 100,000	Testing
Add Sensory Controls	80,000 gallons 22 hours	\$ 15,200	Recommended
Increase Feed Solids	37,500 lb. product 2,400 therms 30,000 gallons	\$ 170,000	Testing
Product Recovery	32,000 lb. solids	\$ 9,500	Recommended



Personal Benefits

- Exposure to lean manufacturing
- Applied concepts to practical settings
- Learned from operators
- Project management skills
- Communications skills
- Real-world experience





Questions?

