

# Production Scale-Up of New Thermoplastic Composite Resin Formulations:

Demonstrating that the Calculated Savings Are Real



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# Composites

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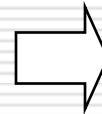
- Nylon
- PP
- ABS
- PC
- PET



- Glass
- Mica
- Talc
- Magnetite



- UV Stabilization
- Heat Stabilization
- Flame Retardant
- Custom Color



**SUPER  
RESIN!**



# Why Develop a New Product?

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- Driven by:
  - New application requirements
  - Cost down pressures
  - Creative scientific desires
- Real World Issues with a New Product
  - Automotive approval processes – number and length of time for approval
  - Only formulation ingredients are examined to determine if the new product is a “cost down” candidate
  - Incorporation of raw materials that are impractical for use in a manufacturing facility



# Current Product Optimization or New Product Development?

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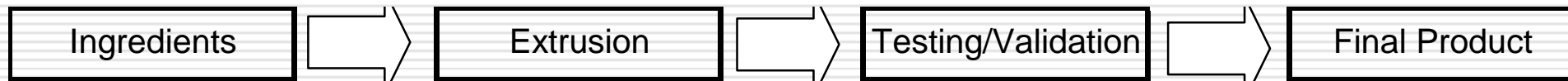
- ❑ Review ingredient selection & options versus equipment available
- ❑ Review key indicators in the manufacturing process that can “make or break” your product’s profitability
- ❑ Purpose: Use Total Cost to determine “whether it’s worth it (\$\$\$)” to develop a new product.



# Composite Production Process

## The 10 Million Pound Challenge

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- Prime
- Recycled
- Regrind
- Additive Packages

- Yield
- Line Rate
- PPE
- Waste Generation

- Number
- Frequency
- Laboratory Qualification

- Packaging



# Ingredient Options

Base Formulation	%
PP Homopolymer	54.60%
PP Homopolymer	11.00%
Maleic Anydride Coupled PP	0.30%
Black Color Concentrate	2.00%
Antioxidant Stabilizer - Secondary	0.50%
Antioxidant Stabilizer - Primary	0.30%
Heat Stabilizer	0.30%
Fiberglass	31.00%
Ingredient Cost/lb	\$0.89

Cost Down Formulation #1	%
PP Homopolymer	54.60%
PP Recycled	11.00%
Maleic Anydride Coupled PP	0.30%
Black Color Concentrate	2.00%
Antioxidant Stabilizer - Secondary	0.50%
Antioxidant Stabilizer - Primary	0.30%
Heat Stabilizer	0.30%
Fiberglass	31.00%
Ingredient Cost/lb	\$0.86

Cost Down Formulation #2	%
PP Recycled	54.60%
PP Recycled	11.00%
Maleic Anydride Coupled PP	0.30%
Black Color Concentrate	2.00%
Antioxidant Stabilizer - Secondary	0.50%
Antioxidant Stabilizer - Primary	0.30%
Heat Stabilizer	0.30%
Fiberglass	31.00%
Ingredient Cost/lb	\$0.69

Quality & Cost Down Formulation #3	%
PP Recycled	54.60%
PP Recycled	11.00%
Maleic Anydride Coupled PP	0.30%
Black Color Concentrate	2.00%
Stabilizer Package	1.10%
Fiberglass	31.00%
Ingredient Cost/lb	\$0.68

**10 Million Pounds: \$300,000 savings!**

**10 Million Pounds: \$2,000,000 savings!**

**10 Million Pounds: \$2,100,000 savings!**



# Extrusion – Yield Impacts on Total Cost

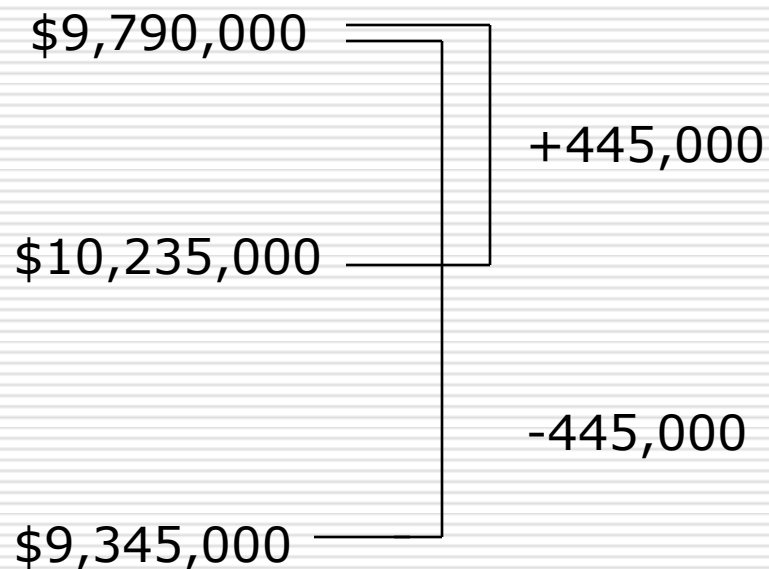
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Experimental Yield	
Base Formulation Cost:	\$0.89
Laboratory Scale Yield	90%
Total Ingredient Cost/lb	\$0.979

Yield Example #1	
Base Formulation Cost:	\$0.89
Actual Yield	85%
Total Ingredient Cost/lb	\$1.0235

Yield Example #2	
Base Formulation Cost:	\$0.89
Actual Yield	95%
Total Ingredient Cost/lb	\$0.9345

## 10 Million Pound Comparison



# Extrusion – Line Rate Impacts on Total Cost

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Line Rate	Processing Cost/lb	10 Million Pound Total	Δ
2,500 pounds/hour	\$0.28	\$2,800,000	Base
3,000 pounds/hour	\$0.23	\$2,300,000	-\$500,000
3,500 pounds/hour	\$0.20	\$2,000,000	-\$800,000

## Line Rate:

- Electricity
- Cooling Water
- Vacuum Trap Waste
- Mixer/Operator/Boxer Time
- Capital Equipment





## Testing/ Validation – Frequency Impacts on Total Cost

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### Lot Size Impacts Total Cost

Lot Size (lbs)	Tests/Year	Cost/Test	10 Million Pound Total	Δ
40,000	250	\$1,000	\$250,000	Base
80,000	125	\$1,000	\$125,000	-\$125,000
120,000	83	\$1,000	\$83,333	-\$166,667

Can your company “right size” testing frequency?



# Testing/Validation – Scope Impacts on Total Cost

Base Testing	Cost Down #1	Cost Down #2
Melt Flow	Melt Flow	Melt Flow
Filler	Filler	Filler
Moisture	Moisture	Moisture
Density	Density	
Tensile Strength at Break	Tensile Strength at Break	
Tensile Chord Modulus		
Flex Strength	Flex Strength	
Flex Modulus	Flex Modulus	
Izod Impact		
\$1,000/test	\$800/test	\$500/test

Test Program	Tests/Year	Cost/Test	10 Million Pound Total	Δ
Base Testing	250	\$1,000	\$250,000	Base
Cost Down #1	250	\$800	\$200,000	-\$50,000
Cost Down #2	250	\$500	\$125,000	-\$125,000



# Packaging – Impacts on Total Cost

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Box Weight (lbs)	Packaging Cost/lb	Number of Boxes	10 Million Pound Total Box Cost
1,200	\$0.025	8,333	\$208
1,700	\$0.018	5,882	\$106

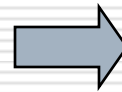


# Putting It All Together For Results

- We need to reduce the cost of this resin by 10% to maintain our profit margin!

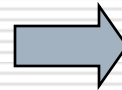
Current State	Cost/lb
Ingredient Cost/lb	\$0.8900
Yield Loss (95% Yield)	\$0.0445
Line Rate (2,500 lbs/hour)	\$0.2800
Full Scope Lot (40,000 lb) Testing	\$0.0250
Packaging (1,200 lbs)	\$0.0250
<b>Total Cost</b>	<b>\$1.2645</b>

- 7.4%



Your Idea # 1	Cost/lb
Ingredient Cost/lb	\$0.8900
Yield Loss (98%)	\$0.0178
Line Rate (3,000 lbs/hour)	\$0.2300
Full Scope Lot (120,000 lb) Testing	\$0.0083
Packaging (1,200 lbs)	\$0.0250
<b>Total Cost</b>	<b>\$1.1711</b>

- 10.8%



Your Idea #2	Cost/lb
Ingredient Cost/lb	\$0.8900
Yield Loss (98.5%)	\$0.0134
Line Rate (3,500 lbs/hour)	\$0.2000
Limited Scope Lot (120,000 lb) Testing	\$0.0067
Packaging (1,700 lbs)	\$0.0180
<b>Total Cost</b>	<b>\$1.1281</b>

• **NO PPAP/Formulation Changes!**

• **Immediate Results!**



# Being Your Company's Hero The Longer Term Plan

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Current State	Cost/lb
Ingredient Cost/lb	\$0.8900
Yield Loss (95% Yield)	\$0.0445
Line Rate (2,500 lbs/hour)	\$0.2800
Full Scope Lot (40,000 lb) Testing	\$0.0250
Packaging (1,200 lbs)	\$0.0250
Total Cost	\$1.2645

- 27%

Your BIG IDEA	Cost/lb
Ingredient Cost/lb	\$0.6800
Yield Loss (98.5%)	\$0.0134
Line Rate (3,500 lbs/hour)	\$0.2000
Limited Scope Lot (120,000 lb) Testing	\$0.0067
Packaging (1,700 lbs)	\$0.0180
Total Cost	\$0.9181



## Following Up: Optimize or New Development

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- Now –
  - Is there a current product that meets specifications and is approved? If yes, small changes in the ingredients (that do not compromise) quality can lead to BIG savings
  - Is the current product over designed? If you exceed minimum specifications by 20 – 30%, is that necessary and cost effective?
  - Examine production line rates to ensure that they are meeting or exceeding your original design criteria
  - Examine current production yield to ensure that it is meeting or exceeding your original design criteria
  - Review current certification testing scheme – Do you have enough historical data to reduce frequency or parameters?
- Follow-up -
  - Yield summary & line rate reports for each production run
    - Demonstrate the savings to Your Management
    - What is measured will improve!
- If a new product is necessary – specify all of the above and calculate total cost during design - to make sure that the calculated cost savings are real!



# Question & Answer

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