

Methyl Ester Sulfonate The Next Generation Surfactant

Presented to

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Linear Alkylbenzene Sulfonate

- Historically the workhorse anionic surfactant
- Good surfactant properties, but...
 - Cost of raw material is increasing
 - Petroleum derived, non-renewable
 - Recent environmental concerns about biodegradation of production of aromatics



Search for Replacements

- Alternative surfactants require
 - Developed processing technology
 - Equivalent surfactant properties
 - Adequate volume to supply the industry
 - Developed formulation technology
 - Lower cost



Methyl Ester Sulfonates (MES)



One New Surfactant That Can Meet These Conditions

- Methyl Ester Sulfonates (MES)
 - Inexpensive raw material
 - Good surfactant properties
 - Process available that can be used in existing sulfonation plants



Methyl Ester Sulfonates

- Derived from renewable resources
 - Natural fats and oils
 - Supply of palm oil steadily increasing
 - Current price for ME is about US\$1200/MT
- High detergency and calcium ion stability
 - Less MES for equivalent washing power
 - Good blending partner with soap, LAS
- Attractive biological properties
 - Low toxicity
 - Biodegrades similar to FAS and soap
 - Biodegrades quicker than LAS

Chemithon MES Process is Versatile

- Chemithon MES process uses either lower or higher MW ME feeds
- Chemithon MES process uses higher iodine value feeds thus saving hydrogenation costs



MES Product Specifications

- Color of MES:
< 100 (5% Klett) usually is adequate, <10 is possible
- Extractable oils in MES:
Includes some byproducts, <4±1% AMB
- Volatile oils in MES:
Mostly methyl ester, <2±1% AMB
- By-product di-salt:
Less than 6% AMB
- Actives concentration:
25% to 85% (alcohol-free)
- Undetectable residual peroxides
- Residual alcohol to required specification



ME Carbon Chain Determines MES Quality

- Lower molecular weight (shorter carbon chain length) ME is easier to process
- Lower molecular weight ME gives lower disalt and color
- Laundry applications require higher molecular weight ME
- Only acid bleaching gives low disalt and low color long chain MES

Need MES in Dry Form

- Laundry powder formulations
 - Use MES in dry form
 - Agglomerate / blend to final product
- Detergent bar formulation
 - Co-mix molten or powder dry MES
 - Co-extrude / form final product
- Liquid formulations – dilute to desired concentration



BioDiesel Changes Everything

- BioDiesel is Methyl Ester
- Huge worldwide increase in BioDiesel production
- Huge potential increase in ME availability



Palm-Based BioDiesel

- Need to separate C₁₆
- C₁₆ has low IV number
 - Most double bonds on C₁₈ fraction
 - C₁₆ fraction IV before hydrogenation ~5
- Easy to hydrogenate to make sulfonation quality ME



C₁₆ MES Product Quality

- Active/disalt ratio: 17/1
- MES total active: 88.7%
- Disalt (100% AI basis): 5.6%
- Color (5% Klett): 10 to 20
- PEE (100% AI basis): 2.00
- Water (%): 2.3%
- Methanol (%): <0.1%



MES in Commercial Detergents

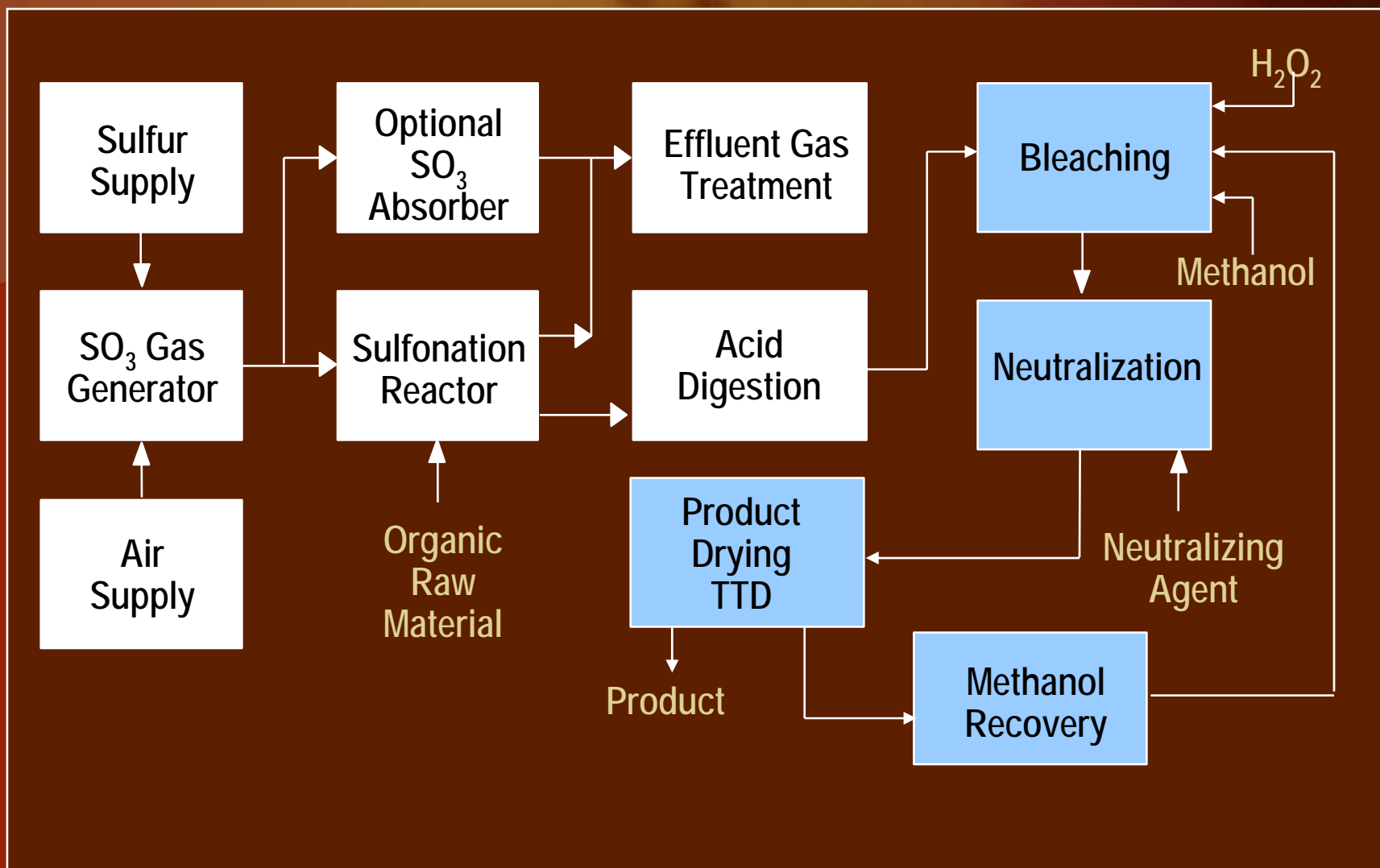
- Analysis of commercial laundry powder
 - Safeway Select Ultra II
 - 23.5% MES
 - 40 wash loads/box US\$0.125 per load
- Sun Liquid Detergent
 - 4% MES
 - 4% non-ionic



MES Used In Commercial Product



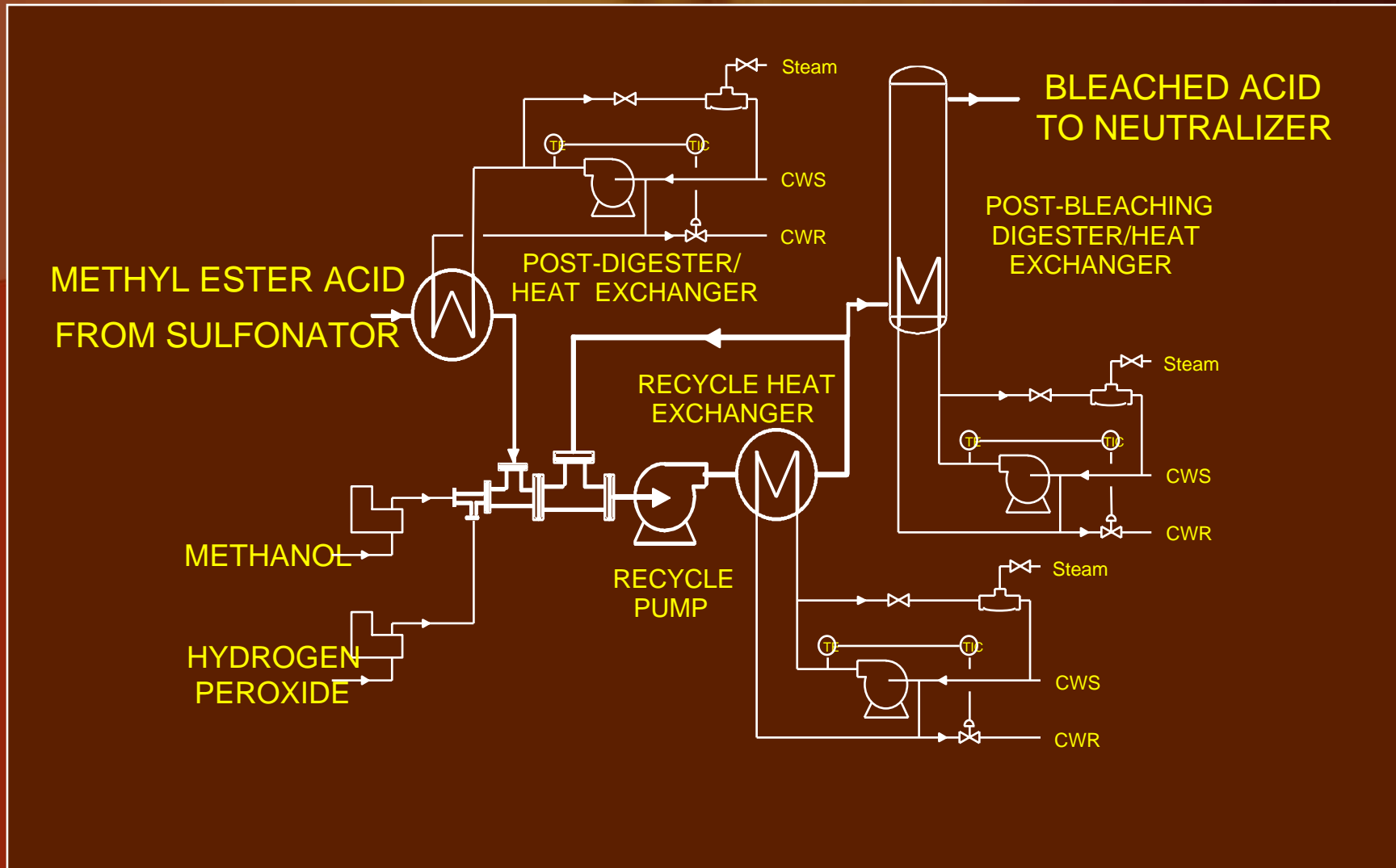
Continuous Air/SO₃ Sulfonation





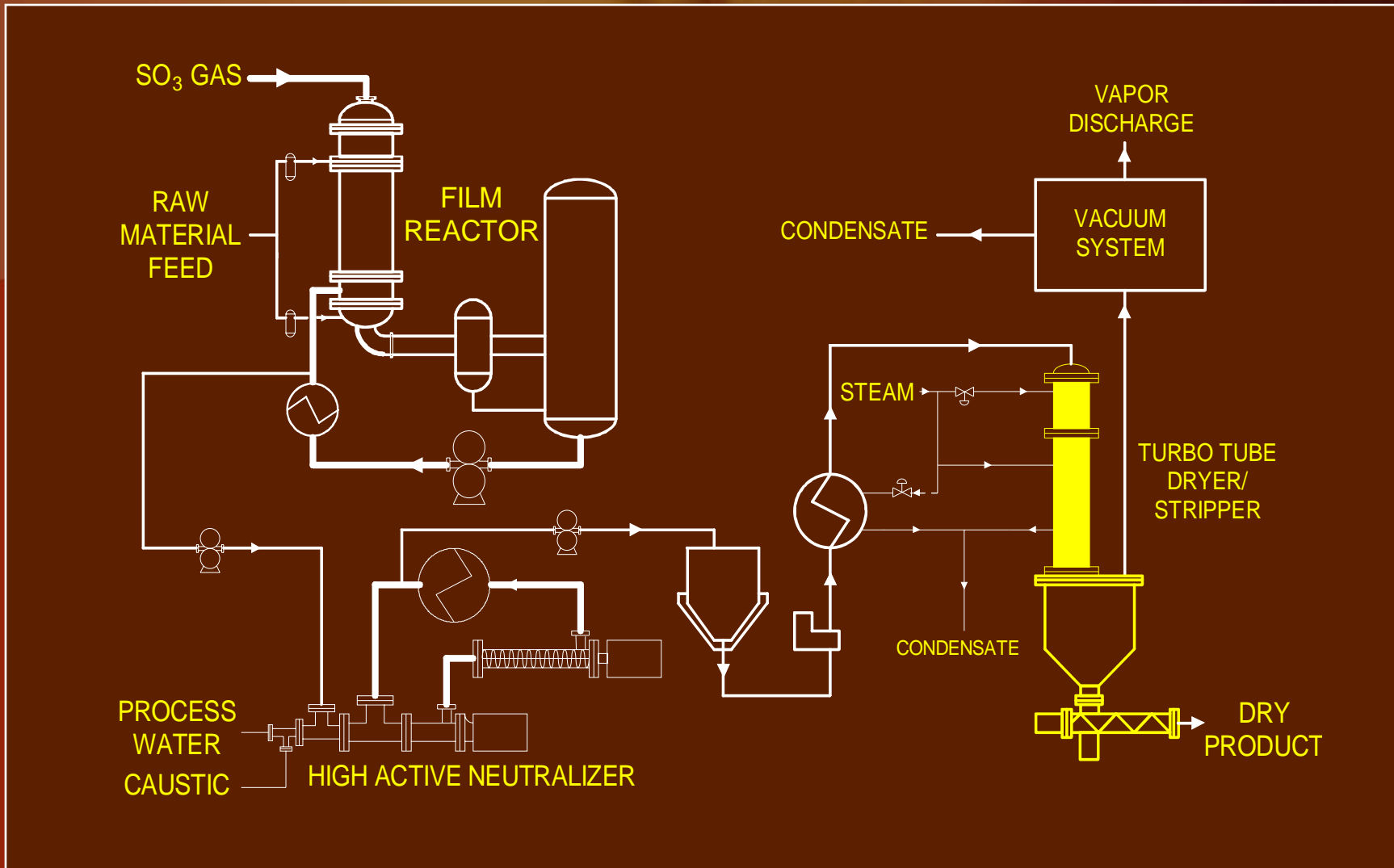


Methyl Ester Acid Bleach System






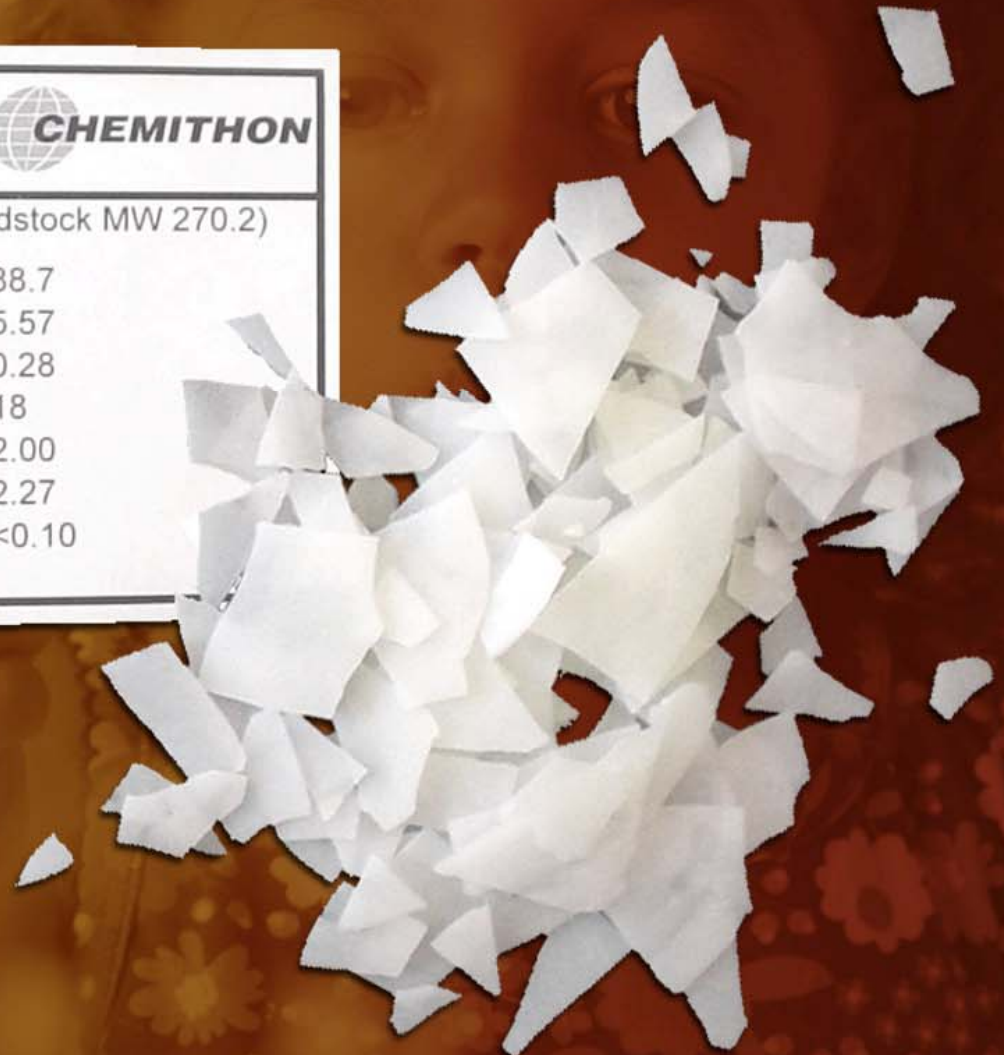
Dry Detergent Active Manufacturing



C₁₆ MES Product



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C16 Sodium Methylene Sulfonate (Feedstock MW 270.2)	
% Active	88.7
Disalt (100% AI)	5.57
wt % Soap	0.28
5% Active Klett	18
% Pet Ether Extractable (100% AI)	2.00
wt % H ₂ O	2.27
wt % Methanol	<0.10
Condition 764; dried Feb. 5, 2003	



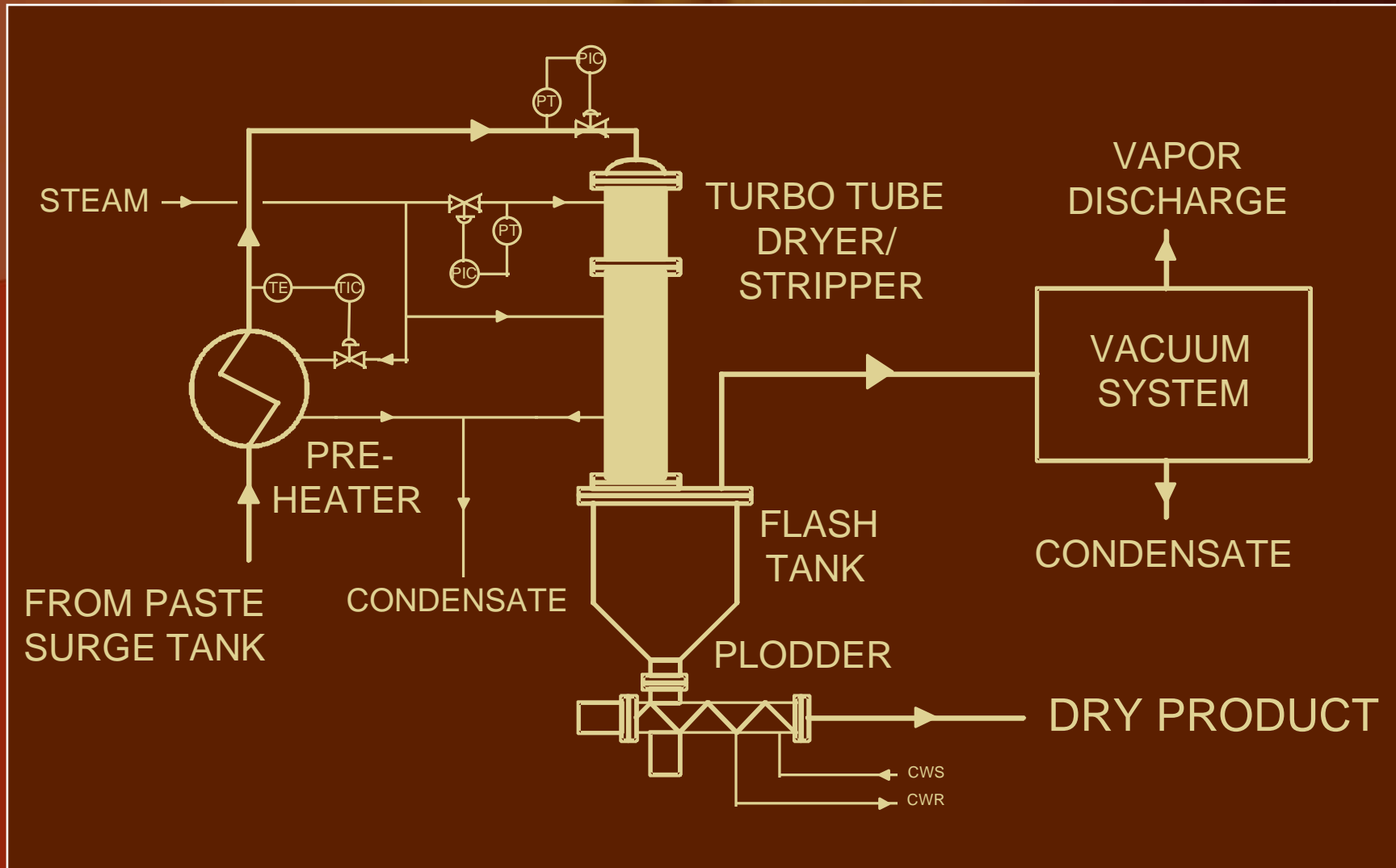
Drying of MES with Spray Towers

- Form of product critical for MES
 - MES hydrolytically unstable
 - Will hydrolyze rapidly if formulation is aqueous and basic
- Example – spray drying

Time	Initial	After Spray Dry	After 1 month	After 2 months
Di-Salt	4.40%	33%	89%	98%

Takashi Imamura, et al., French Patent 2,571,368, "Method for the Preparation of Salts of Alpha-Sulfonated Fatty Acid Esters"

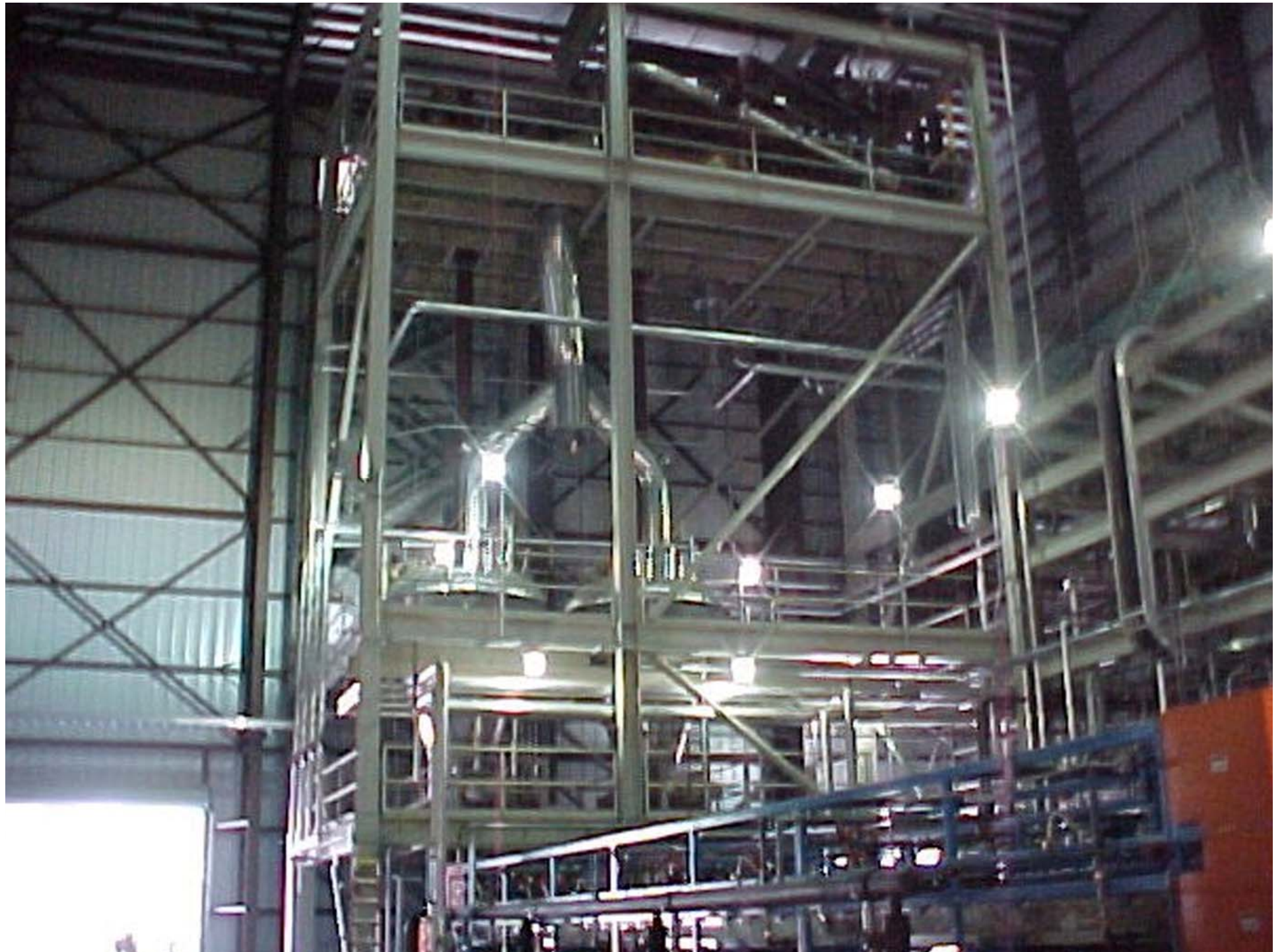
An Alternative to Spray Drying Turbo Tube™ Dryer System



Turbo Tube[®] Dryer System

■ Advantages

- Lower capital and operating costs
- No product degradation during processing
- Compact, self cleaning & energy efficient
- No moving parts
- No fire explosion hazards
- No plume or particle emissions
- Enhances spray tower and agglomerator capacities and efficiencies
- And more...



Conclusion

- MES is a desirable alternative surfactant
 - Demonstrated processing technology
 - Lower cost production
 - Hundreds of thousands of metric tons have been produced and used in detergent formulations
 - Successful in detergent market for the last 5 years
 - Adequate availability
 - New Chemithon MES plants coming on stream