Advances In Sulfonation and Sulfation Technologies

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for

2nd International Conference on Soaps, Detergents & Cosmetics
Trends

- Plants becoming larger, regional facilities
- Increased emphasis on operational economics
- More multi-product capability
- High solids production
  - lower shipping costs
  - Increased formulation flexibility
Trends

20MT Multi-Product Facility in North America
**Trends**

- Partial Iso for 20MT Multi-Product Facility
Trends

- Green products
  - methyl ester sulfonates
  - alcohol and ethoxylate sulfates
- Markets are demanding -
  - wider range of higher quality products
  - higher yields
  - greater plant reliability
  - more automation
  - lower waste stream volumes
  - higher efficiencies
Improving Productivity

- Multiple reactors
- Gas flow splitting arrangements
  - Symmetrical
  - Asymmetrical
- Variable gas concentrations
Improving Productivity

- Can use both AFFR and MTR reactors in a single plant to promote flexibility
- Can install inline spare equipment
Improving Productivity

- “Micro” mole ratio control means
  - Lower free oils
  - Reduced carryover
  - Better “on stream” factors
- Reactor distribution design improvements
- Post reaction systems
Improving Productivity

- MTR with reaction distribution cartridge and “post-reaction” contactor section
Energy Efficiency

- Reducing energy consumption by
  - Waste heat recovery systems
  - More efficient rotary equipment
  - Longer running/lower maintenance pumps and blowers
  - Turbo Tube® & other drying techniques

- Energy vs. Yield and Quality
Energy Efficiency

Waste Heat Recovery Boilers
Energy Efficiency

- Use of more efficient drying methods such as
  - Drum Dryer – a “direct contact” type
  - Wiped Film Evaporator – an “indirect” type
  - Flash Evaporator – an “indirect” type
  - Turbulent Convective Evaporation – an “indirect” type
1,4-Dioxane Reduction

- Upgrading sulfation plants to reduce 1,4-dioxane levels
  - Basic types for 3:1 reduction
  - Enhanced types for up to 9:1 reduction
- Replacing older generation reactor designs
- Upgrading piping design to reduce 1,4-dioxane formation
1,4-Dioxane Reduction

- One of the latest type DRS systems
- Can approach a 9:1 reduction ratio
Process Control

- Upgrading to more modern PLC standards, such as the Allen-Bradley CompactLogix and ControlLogix
  - Faster response
  - Greater reliability
  - Additional system variables
- Integration with plant-wide DCS systems
Process Control

- Premium program architectures, such as the Profibus-PA or –DP
  - Single cable/buss type
  - Multi-task capability
  - Layered communications protocol
Process Control

- Schematic for a Siemens Profibus-PA Multi-System Type
Co-Actives

- Active mixtures with synergistic detergent properties superior to a single active
  - Such as detergency + foaming
- Often found in LAS and MES mixtures
Pilot Plant Studies

- Commercially scalable systems from 5 to 20 kg/hr to develop processes and formulation technologies
- Statistical designed experiments for process modeling and optimization
Pilot Plants

5 kg Research Pilot Plant

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