

Tall Oil Soap Recovery and CTO Plant Fundamentals

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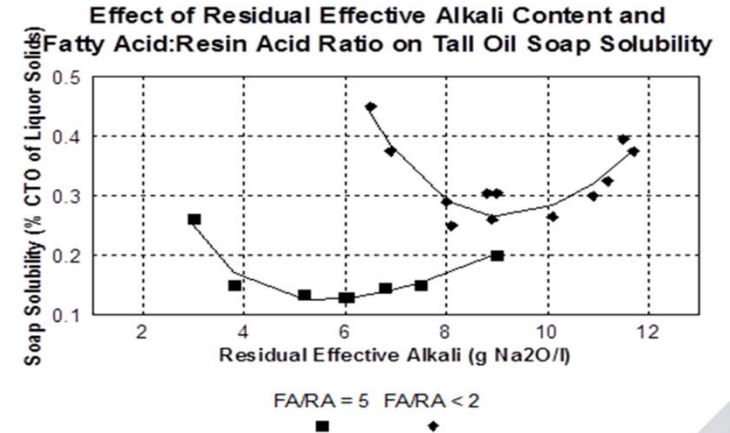
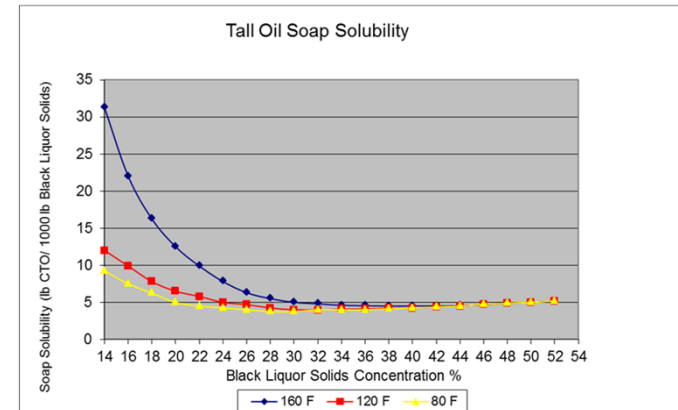
Optimizing Soap Recovery

Liquor Temperature (175 – 205 F.)

Liquor Concentration (17-30%)

Liquor REA (5-8 g/l Na₂O)

These conditions enhance instability in the liquor/soap colloidal system and the soap particles “salt out” to the surface rendering them recoverable.



Soap Recovery Best Practices

Weak liquor tank soap bed depth (4-6 feet)

Soap skimmer soap bed depth (2-4 feet) **What is your mill's SOP?**

Soap density (7.8 – 8.2 lbs./gallon) – must minimize air entrainment

Soap entrained liquor content (8-12%)

Tall oil residual in liquor after skimming (<0.6% of BLS)

Air injection (~1SCFM/1000 gpm liquor flow)

Liquor superficial velocity (< 5 feet/hr.)

Excellent soap recovery won't happen unless soap pumps are maintained properly.



CTO Plant Fundamentals – Comparison of Major Design Types

Attribute	Batch	Decantation	Centrifuge
Footprint	Large – basically a tank farm	Medium – similar to the batch but without the large reactor	Small – because of the relatively small size of a centrifuge
Ease of Operation	Very simple – requires minimal testing	More difficult – requires more testing to minimize oil losses in the spent acid; control of interface is critical	More difficult – working with high speed, precision equipment requires attention to details
Solid Waste	Minimal – no routine landfilling	May require routine landfilling of waste	May require routine landfilling of waste
Efficiency	85-88% best practices and contingent on well-defined lignin layer	88-94% best practices with minimal losses from fiber separation	95-96% best practices contingent on "shoot" frequency
Production Rate	Flexible; excellent turndown capability; practical throughput limit ~50,000 – 60,000 tons/year tall oil soap	Around the clock operation required for peak performance; turndown capability good; consider for throughputs between 40,000 – 75,000 tons year tall oil soap	Around the clock operation required for peak performance; turndown capability good; consider for throughputs > 50,000 tons/year tall oil soap
Spent Acid Generation	Lowest because plant can run at high spent acid concentrations ~24%	Highest because plant must run at spent acid concentration ~15% to reduce plugging	Highest because plant must run at spent acid concentration ~15% to reduce plugging
Maintenance Costs	Less maintenance but depends on whether reactor is brick-lined or high alloy	Comparable to batch	Requires the most maintenance because of the high speed, precision, close tolerance equipment
Process Testing	Minimal – pH and separation check primarily	Intensive – mainly because interface detection is difficult; can be simplified with large sight glasses	Minimal – lends itself well to instrumentation and DCS operation



CTO Plant Fundamentals – Comparison of Major Design Types

Basis:	1 ton CTO			
		Decanter	Batch	Centrifuge
Sulfuric Acid Usage	lbs H ₂ SO ₄	420-450	420-450	360-400
Caustic Usage	lbs Na ₂ O	55-70	55-70	50-65
Conversion Yield	%	52-54	52-54	54-57
Brine Generation	gallons	420-460	275-285	420-460
Brine Concentration	%	15-16	22-23	15-16
Theoretical Yield	%	58	58	58
Separation Efficiency	%	92-94	92-94	94-98

Brine Properties		
	Continuous Plant	Batch Plant
Concentration (%)	15-16	21-25
pH	11 to 12	11 to 12
CTO Content (%)	1 to 3	1 to 3
Lignin Content (%)	1 to 3	1 to 3
Calcium sulfate (%)	0.7 to 1.5	0.7 to 1.5
Heating Value (BTU/lb. solids)	750 to 4000	750 to 4000
Brine volume (gallons/ton soap)	220-250	140-155
Brine specific gravity	1.08 - 1.13	1.15 - 1.20



Tall Oil Soap and CTO Plant Safety

Slip Hazards – Wash up any spills

Thermal Hazards – Watch out for un-insulated piping

Caustic Soda – Watch out for flange leaks

Sulfuric Acid – Watch out for flange leaks

Spent Acid – thermal and chemical hazard

Hydrogen Sulfide – Personal monitor is essential

*Ensure sampling points for catching samples are designed with safety in mind. Use PPE.
Ensure acids and liquors are properly segregated to avoid H₂S generation.*

