
MOLECULAR SIEVE UNITS → THE BIG BLACK BOX?

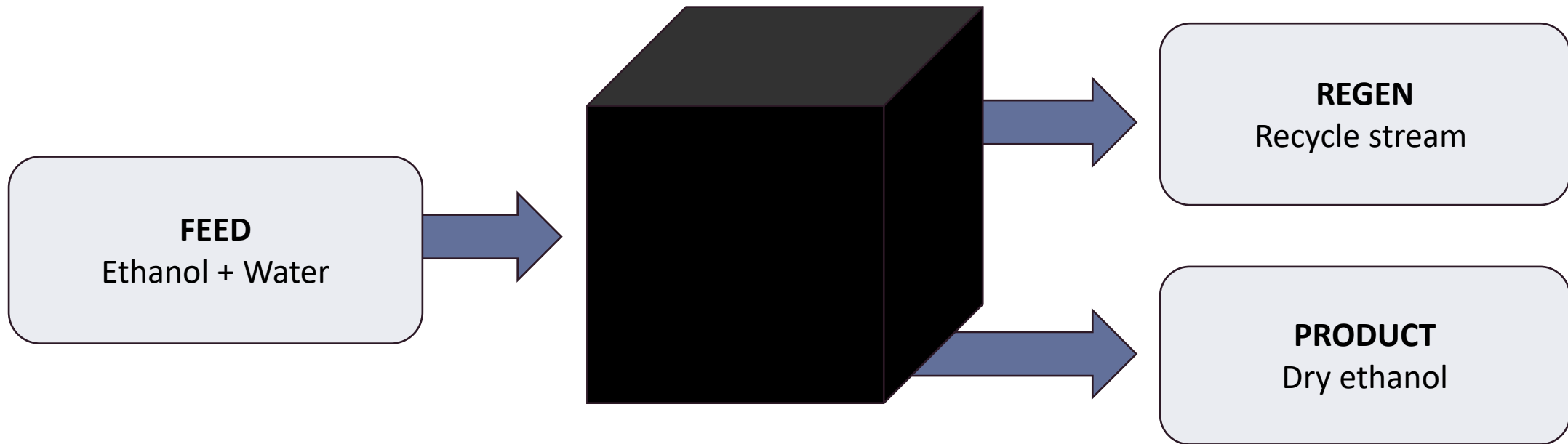
What can we learn and apply from the mass balance?



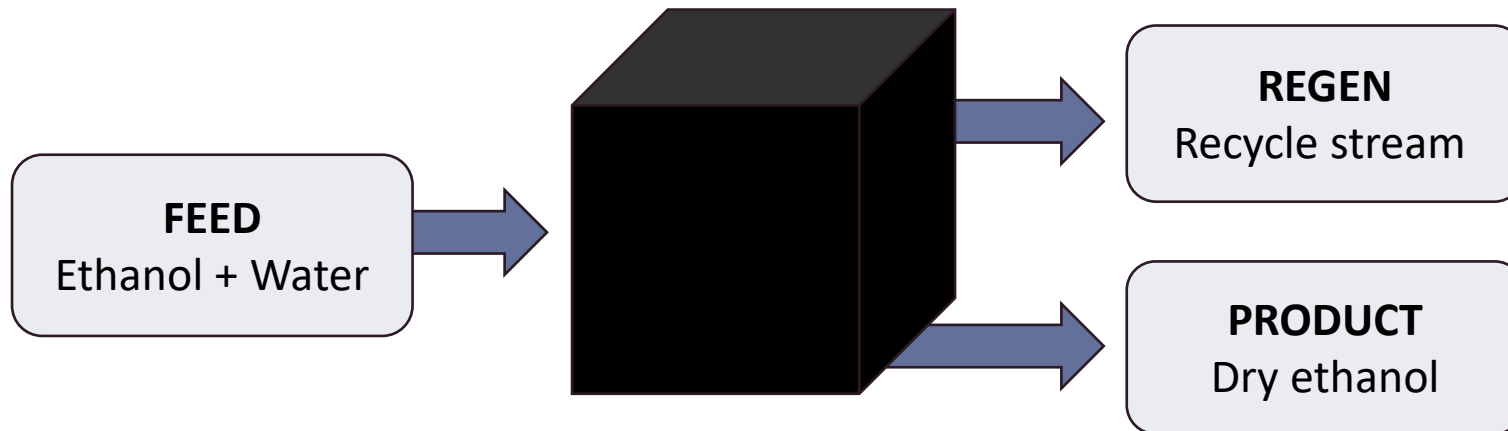
A Trusted Solution Provider
for Adsorbents & Catalysts Industry



THE BIG BLACK BOX?



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Operators monitor

- Proof
- Flow rate
- Energy
- Pressure

But overlooked

- Ethanol recycled in regen
- Regeneration inefficiency
- Hidden profitability losses

THE BIG BLACK BOX?

Operators monitor

- Proof
- Flow rate

Small inefficiencies inside the black box can create large operating costs.

Ethanol + water

PRODUCT
Dry ethanol

But overlooked

- Ethanol recycled in regen
- Regeneration inefficiency
- Hidden profitability losses

WHAT CAN WE LEARN FROM MASS BALANCE?

01 Where ethanol is being lost

Trace it across feed, product, and regen streams.

02 Why regeneration proof matters

How recycle composition drives operating cost.

03 What actually defines efficiency

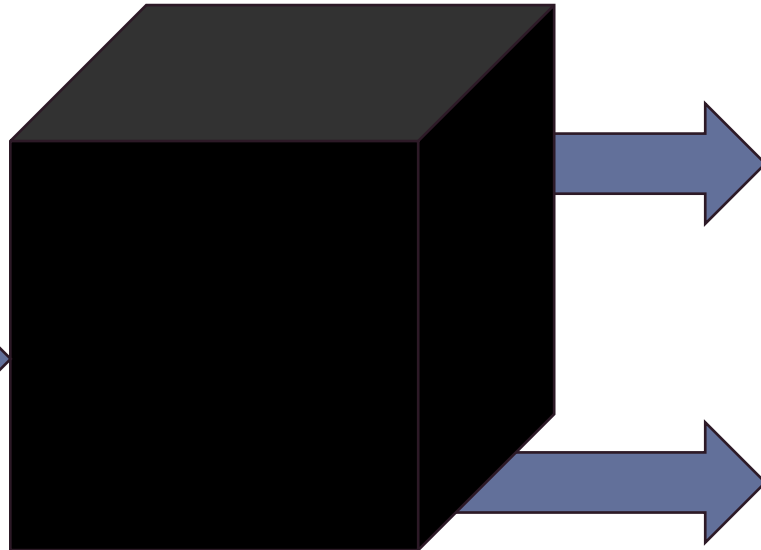
Water removed vs. ethanol retained.

04 How feed conditions set cycle

Water load is the real clock of the bed.

WHERE DOES ETHANOL ACTUALLY GO?

Mass Feed			
<i>Feed Proof</i>	<i>Feed GPM</i>	<i>Density lb/gal</i>	<i>lbs/min</i>
186.00	100.00		
Ethanol	93.00	6.58	<u>611.94</u>
Water	7.00	8.34	58.38
Total Mass In			670.32



Mass Regen			
<i>Regin Proof</i>	<i>regen flow GPM</i>	<i>Density lb/gal</i>	<i>lbs/min</i>
88.20	100.00		
Ethanol	0.47	6.58	<u>3.06</u>
Water	6.54	8.34	54.50
Total GPM & LPM		14.92	57.56

Mass Product			
<i>Product Proof</i>	<i>Product Flow GPM</i>		
199.00	93.00		
Ethanol	92.54	6.58	<u>608.88</u>
Water	0.47	8.34	3.88
Total Mass Product			612.76

MINIMIZING REGENERATION PROOF IS KEY

FROM THE MASS BALANCE

88 proof

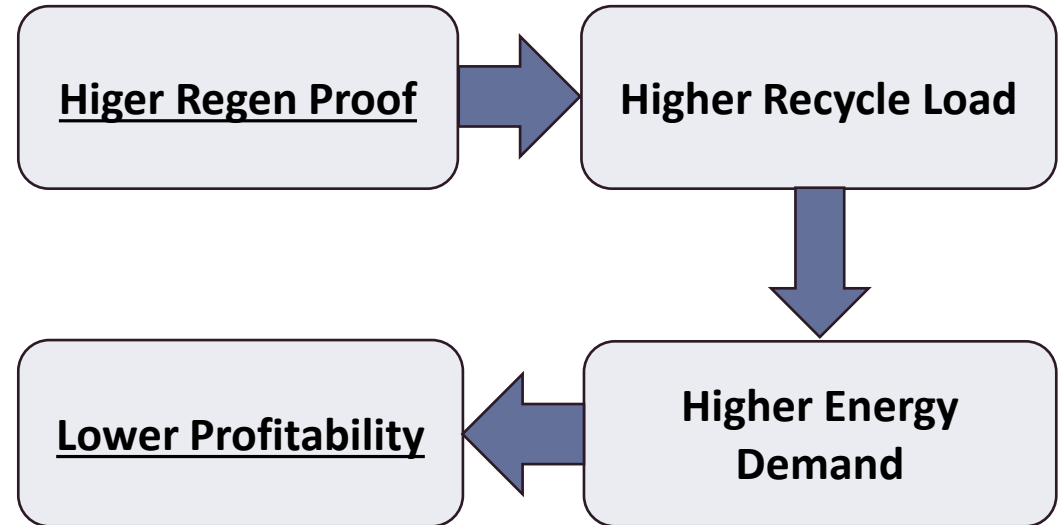
regeneration stream

3.06 lb/min

ethanol re-entering the system every minute

Typical target: 90 – 110 proof

Push toward the lower end — recycle drops, energy follows.



A DIFFERENT TAKE ON EFFICIENCY

$$\text{True Efficiency} = \text{Ethanol Out} / \text{Ethanol In}$$

TRADITIONAL VIEW

Water Removed

Measures how dry the product is.

- Easy to monitor
- Reported on every shift
- Says nothing about losses

Ethanol Efficiency

In	Out	% eff
611.94	608.88	99.5

OPERATIONAL VIEW

Ethanol Retained

Measures how much product you keep.

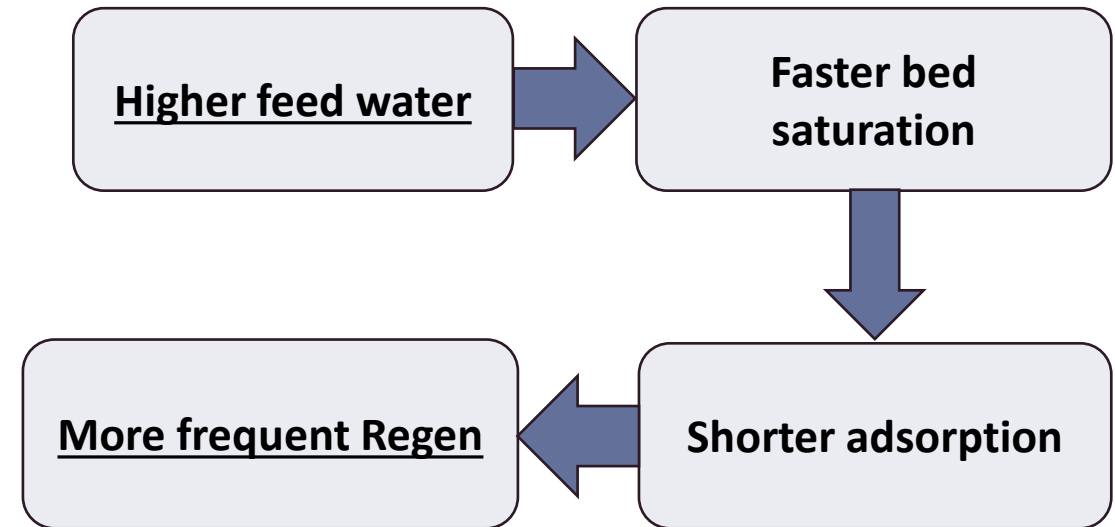
- Direct link to revenue
- Captures recycle losses
- Aligns with plant economics

WATER LOAD DETERMINES CYCLE TIME

$$\text{Adsorption time(min)} = \text{Working Capacity} / \text{Water Flow Rate}$$

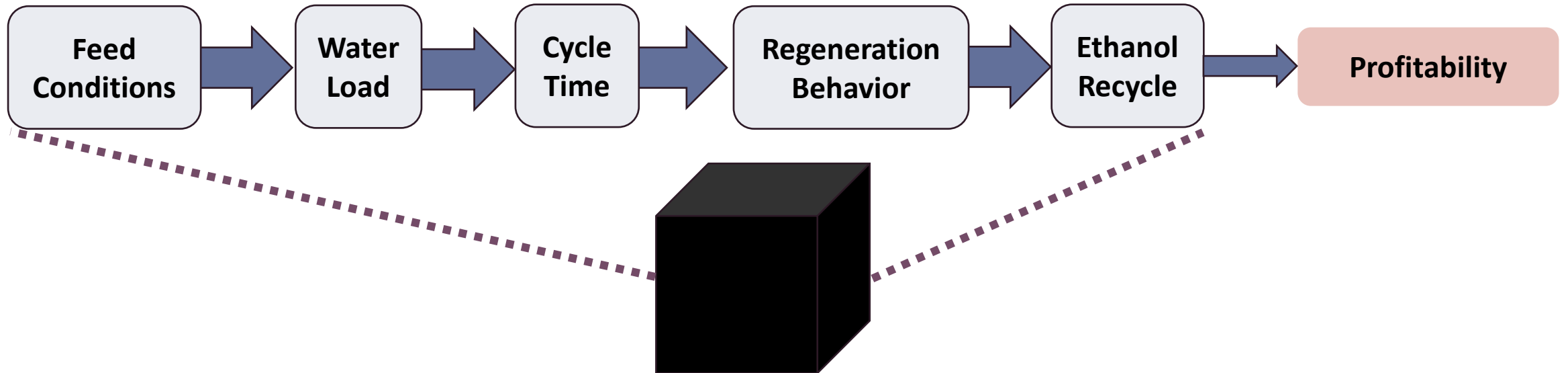
Typically 0.5-0.7

Mass Feed			
Feed Proof	Feed, GPM	Density, lb/gal	lbs/min
186	100		
Ethanol	93	6.58	611.94
Water	7	8.34	58.38
Total Mass In			670.32



Therefore Manage feed rate and working capacity — and you manage every downstream cycle parameter.

OPTIMIZE THE CHAIN, NOT THE DIAL



Operators don't need to instrument every variable.
They need to see how upstream choices about **feed water** and **regenproof** arrive downstream as recycle, energy, and lost margin.
Mass balance is the map.

KEY TAKEAWAYS

- Awareness of the importance of ***regeneration proof*** and the effect it has on profitability and energy by applying a strategy to minimize recycle of ethanol.
- ***Feed data defines adsorption time***, all other times, repress, depress are proportional to the adsorption time.
- A different way of looking an efficiency give us a better handle on what matters – ***The ethanol not the water.***

Every molecular sieve unit has optimization opportunities hidden inside the process

THANK YOU FOR YOUR TIME

Come visit us at **Booth 805** to continue the conversation.

We help plants uncover hidden inefficiencies, reduce recycle losses, and optimize molecular sieve performance.

Process Optimization

Molecular Sieve Systems

Performance Analysis



Technical Support

Regeneration Strategy

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Engineering

Troubleshooting