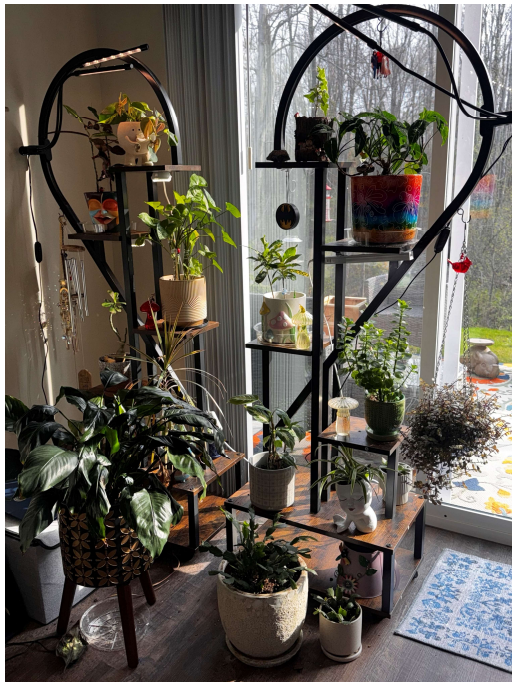
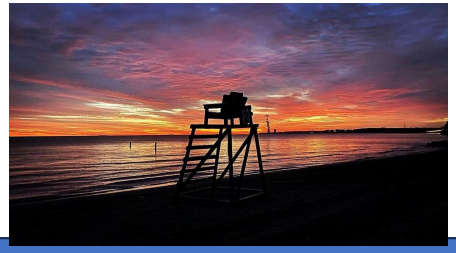
Microbial Contamination and Control Conference

A little bit about me…

- Hail from Cleveland, Ohio
- Plant mom in honor of my Dad
- Sunrise/sunset chaser
- PDA Member for 15 years
- Disinfectant residue enthusiast ☺





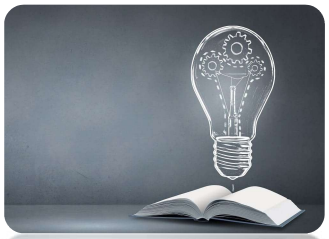
Disclaimer

The information presented today is intended for informational and educational purposes only. It reflects the speaker's personal experiences in the field and lessons learned.

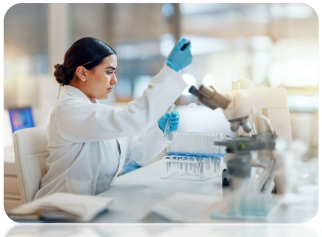
What's on the Agenda

Review of Residues

Tales from the Field



Lessons Learned



Study and Results

Final Thoughts

Disinfectant Residues

The houseguest that just doesn't leave.

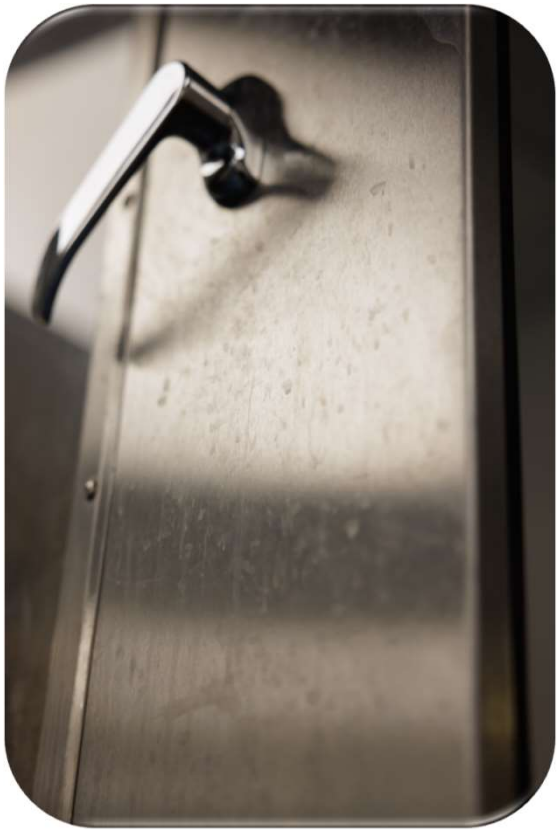
What are Disinfectant Residues?

- The chemical compounds or by-products that remain on a surface following the application and drying of a disinfectant.

- Accumulation from repeated use may result in:
  - Compromised surface integrity
  - Elevated safety risks
  - Reduced disinfection efficacy
  - Material compatibility degradation
  - Potential regulatory non-compliance

Understanding Disinfectant Residues

- ALL disinfectants leave residue, except for Hydrogen Peroxide (H_2O_2) and Isopropyl Alcohol (IPA)
- Cleaning frequency often determines when residue removal is required
- Some disinfectants leave different residue than others
- Residues look different on difference surfaces
- Cleaning protocols may not include a periodic residue removal step
- Regulatory and guidance documents (i.e. PDA, FDA, Annex I)



When cleaning doesn't show them the door, residues linger — just like an unwelcome guest.

Tales from the Field

We'll explore tales of disinfectant residues that challenged contamination control, revealed unexpected outcomes, and lessons learned.

Tale One: Blaming the Booties

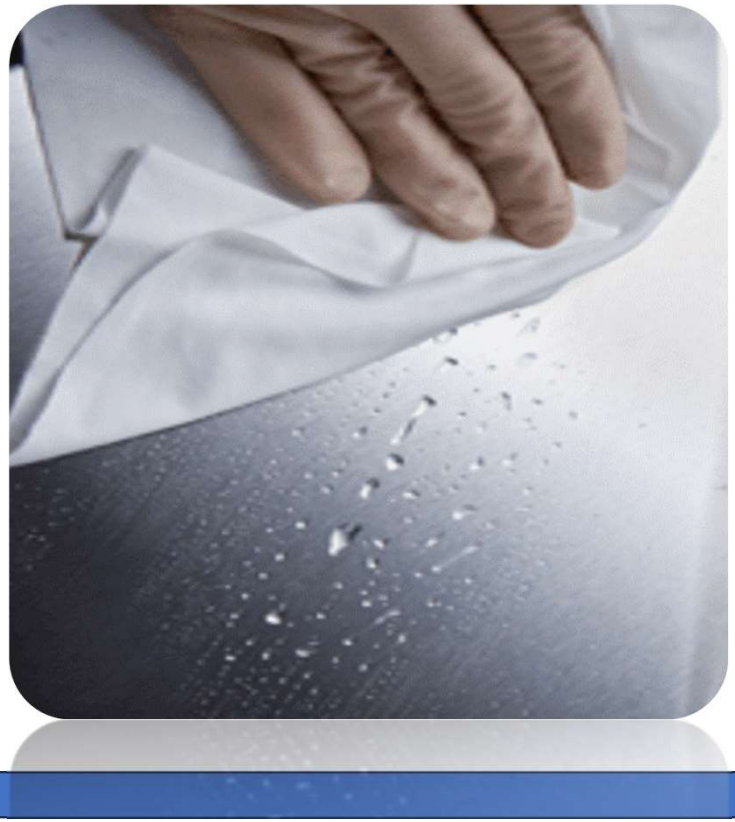
Problem:

- Over 60 slip-and-fall accidents in a short period.
- Assumed cause: faulty booties – tried over 10 different types
- Slip-and-fall incidents continued despite changes

Our Observations

- Operators walking from dirty to clean and clean to dirty while floors were wet
- Floors were sticky, causing booties to flake off and stick to the floor, leaving particles on the floor
- Staining on walls and floors indicating residue build up
- Disinfectant applied using garden sprayer, contact time – 10 minutes
  - Sprayed, after contact time was met, mopped

The Real Cause



Excessive disinfectant use and high frequency of cleaning compounded the build up rather than removing it

Cross-contamination from improper movement patterns (dirty to clean) worsened the problem

I almost slipped!

It wasn't the booties!

More disinfectant and cleaning isn't always better

Residue can mimic other problems

Movement and sequence matters

Always investigate beyond the obvious: Focused on booties, delayed identifying the root case

Tale Two: The Mops That Revealed the Truth

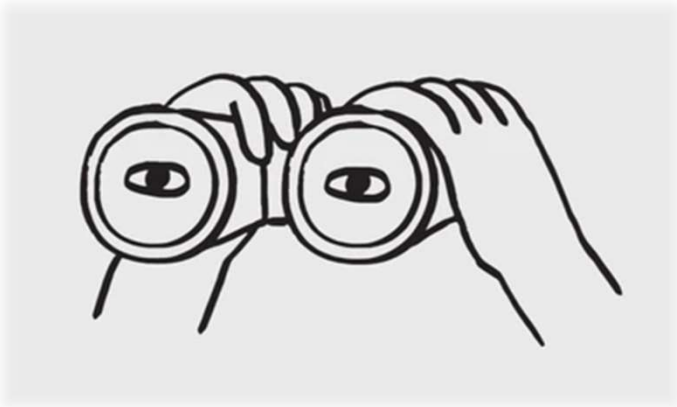
Problem:

- Operators complained that new mop heads and a different bucket system were causing streaking on walls

- The facility assumed the new mop were leaving residues, as no other cleaning protocols had changed – besides the mop, it was quickly blamed

Our Observations

- New mops did not leave visible streaks, but instead began to lift old, built-up residue from walls and floors
- The facility had no residue removal program in place, leading to years of accumulated build up
- Side-by-side testing compared different wringing methods
  - Down-press wringer (old system) vs. Sieve style bucket (new system)
  - Both methods left similar amounts of residue



Our Observations

- If both mops were applying same amount of solution, why would one mop causing streaking over the other?
  - Downpress wringer (old system): Should have removed excess solution of the mop, reducing excess, but in practice it did not eliminate residue effectively
  - Sieve (new system): Was not used properly – allowed the mop to be overly wet, leading to a slop and mop effect

The Real Cause

- The problem was not the new mop or equipment change, but the existing, embedded residue revealed for the first time
- The new mop was effective at loosening the old, embedded residues, giving the false impression of introducing a new residue and streaking

Key Takeaways

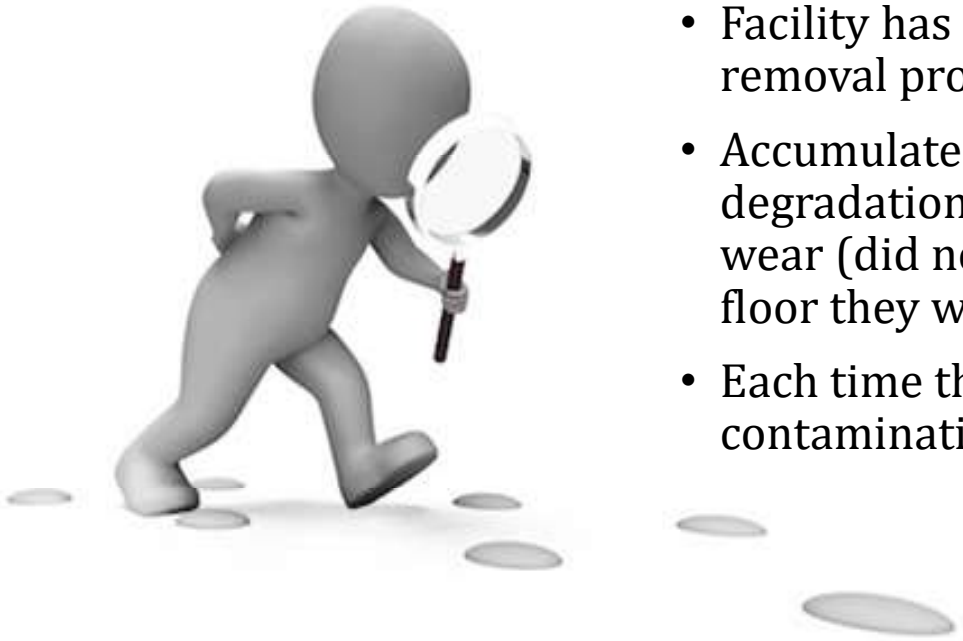
- It wasn't the mops!
- New mop revealed the problem
- The down-press wringer should have controlled the amount of solution being applied, but in practice, both methods left similar residue amounts
- Technique matters
- Don't blame the tool – investigate the entire process
- Routine residue removal is key

Tale 3: The Residue that Wrecked the Floors

Problem:

- A facility was experiencing significant floor damage
- Were persistently recovering microorganisms
- Despite following cleaning procedures, they continued to recover microorganisms
- Residues were never removed
- The team was uncertain whether the contamination was coming from- the floor material or the bleach residue itself, or maybe both?

Our Observations



- Sticky floors
- Facility has never implemented a residue removal program
- Accumulated residues were causing degradation of the flooring, leading to surface wear (did not know if it was concrete or the floor they were wiping/mopping up)
- Each time the floors were mopped, contamination spread throughout the facility

The Real Cause

- The issue was not just the damaged floors or contamination alone, but the combination of residue buildup

- Cleaning and disinfection process itself was spreading contamination, mopping redistributed the contaminated residues across the floor

- Disinfectant residues were not effectively removed leading to:
  - *Chemical damage to floor surfaces, creating crevices where organisms could thrive*
  - *Contamination within the residues, allowing organisms to persist*

Key Takeaways

- It wasn't just the floors! The REAL problem was the accumulation of disinfectant residues which damaged flooring and provided a breeding ground for contamination
- Improper residue management can backfire – Disinfecting without removing residues can spread contamination rather than eliminate it
- Proactive residue removal programs are essential in maintaining both surface integrity and contamination control
- Investigate contamination wholistically to find root cause

Three Tales, One Underlying Issue

Though each story presented a different challenge, the root cause in all three stories was due to the presence of disinfectant residues:

Tale One: Safety Concern

Tale Two: Cosmetic Concern

Tale Three: Contamination Concern

Now What? Turning Lessons Into Action

Understanding the…

- The impact of solution/solvent used to remove the residue
- The impact the fabric can have on removal
- Surface specific approaches

Disinfectant Residue Removal Study

Disinfectant Residue Removal Study

Evaluated the impact of:

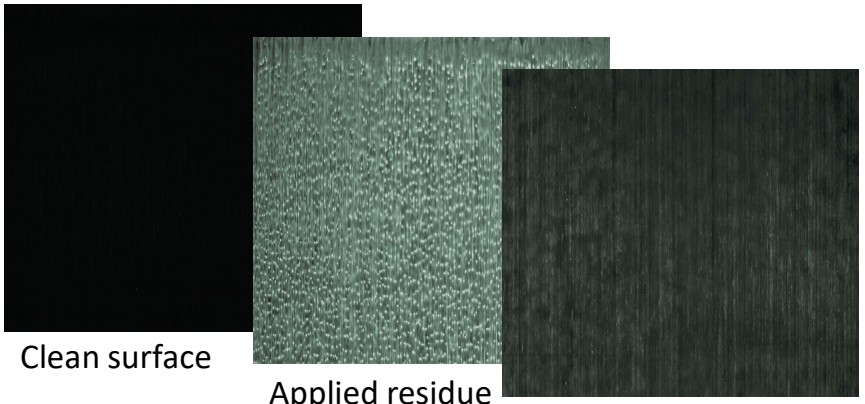
Type of Disinfectant

Removal Agent – IPA or DI

Fabric

Residue Design Study and Parameters

- Fluorescent tracer dye added to disinfectant
- Pixel analysis to measure surface residue
- Disinfectant solution applied by wiping
- Solvents for residue removal applied by wiping
  - Wipes/Mops saturated to 60% of their respective sorbent capacity
- 18 camera sampling locations per replicate
- A total of five replicates per approach
- Applied one layer



Clean surface | Applied residue | Wiped surface (70/30 IPA/DIW)

Types of Fabrics Tested

Wipes – tested on SS and Glass

- Laminated knit wipe
- Polyester/microfiber knit wipe
- Cellulose/Polyester non-woven wipe
- Microfiber nonwoven wipe

Mops – tested on Vinyl and Epoxy

- Laminated sewn polyester mop
- Polypropylene Stitch bonded microfiber mop
- Microfiber pocket mop
- Ribbed microfiber foam mop

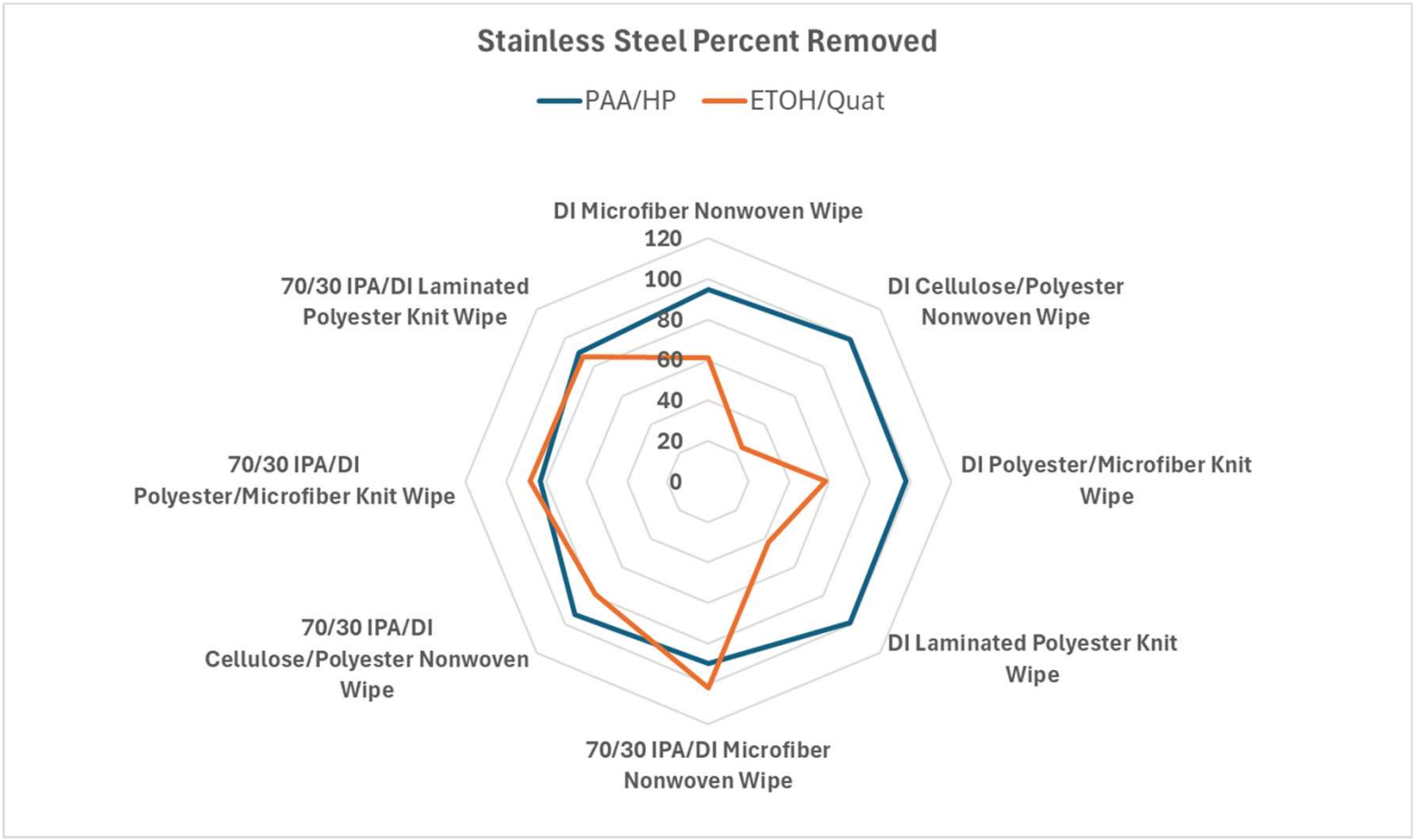
Fabric impacts disinfectant residue removal by influencing how well the wipe can absorb, release and physically remove residues.

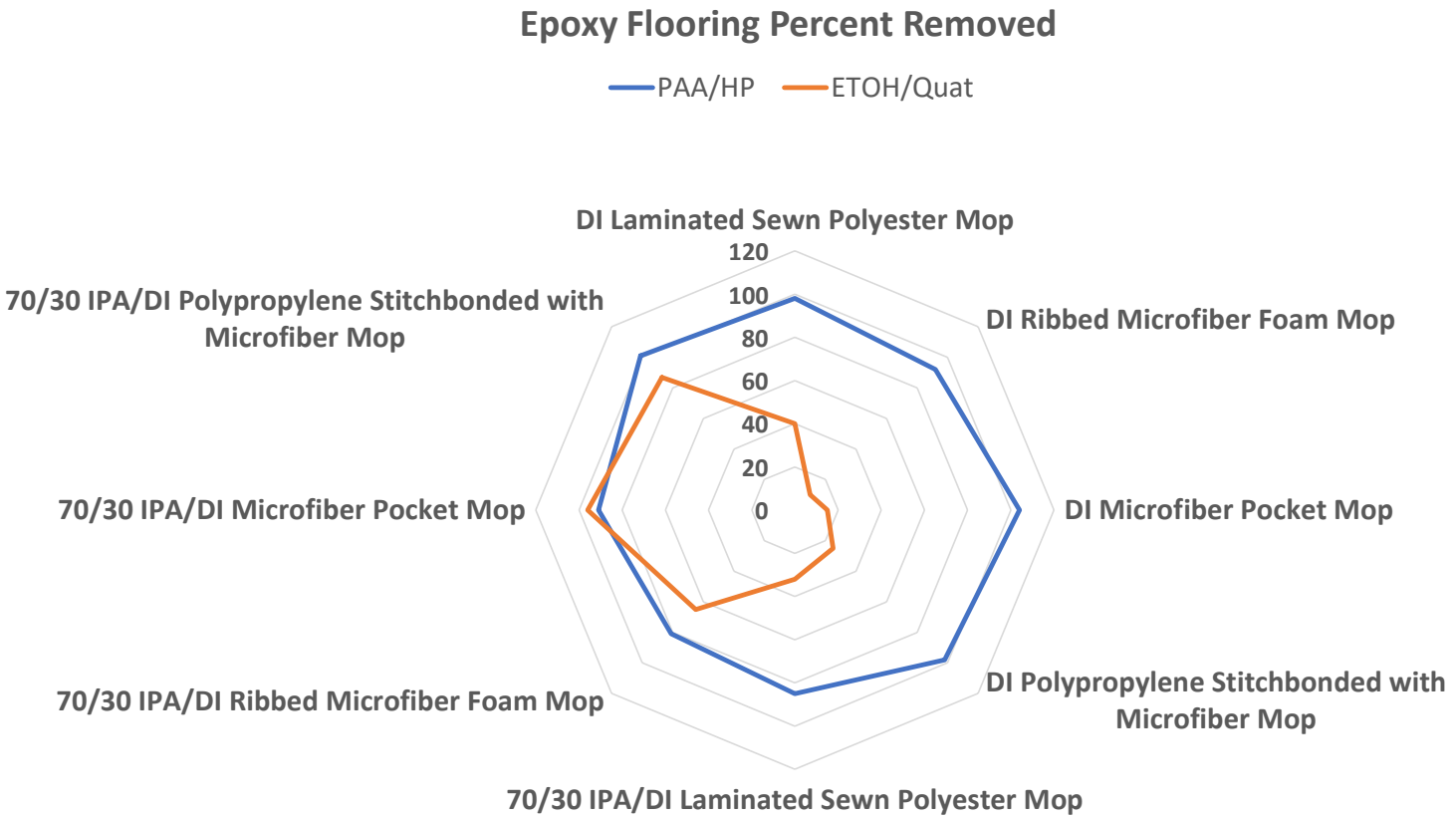
Biocides Tested

Biocides:

- Ethanol/quaternary ammonium disinfectant
- Peracetic acid/ H_2O_2

STUDY FINDINGS


Stainless Steel Percent Removed
PAA/HP
ETOH/Quat
DI Microfiber Nonwoven Wipe
120
100
80
60
40
20
0
DI Cellulose/Polyester Nonwoven Wipe
DI Polyester/Microfiber Knit Wipe
DI Laminated Polyester Knit Wipe
70/30 IPA/DI Microfiber Nonwoven Wipe
70/30 IPA/DI Cellulose/Polyester Nonwoven Wipe
70/30 IPA/DI Polyester/Microfiber Knit Wipe
70/30 IPA/DI Laminated Polyester Knit Wipe


Epoxy Flooring Percent Removed
PAA/HP
ETOH/Quat
DI Laminated Sewn Polyester Mop
DI Ribbed Microfiber Foam Mop
DI Microfiber Pocket Mop
DI Polypropylene Stitchbonded with Microfiber Mop
70/30 IPA/DI Laminated Sewn Polyester Mop
70/30 IPA/DI Ribbed Microfiber Foam Mop
70/30 IPA/DI Microfiber Pocket Mop
70/30 IPA/DI Polypropylene Stitchbonded with Microfiber Mop
120
100
80
60
40
20
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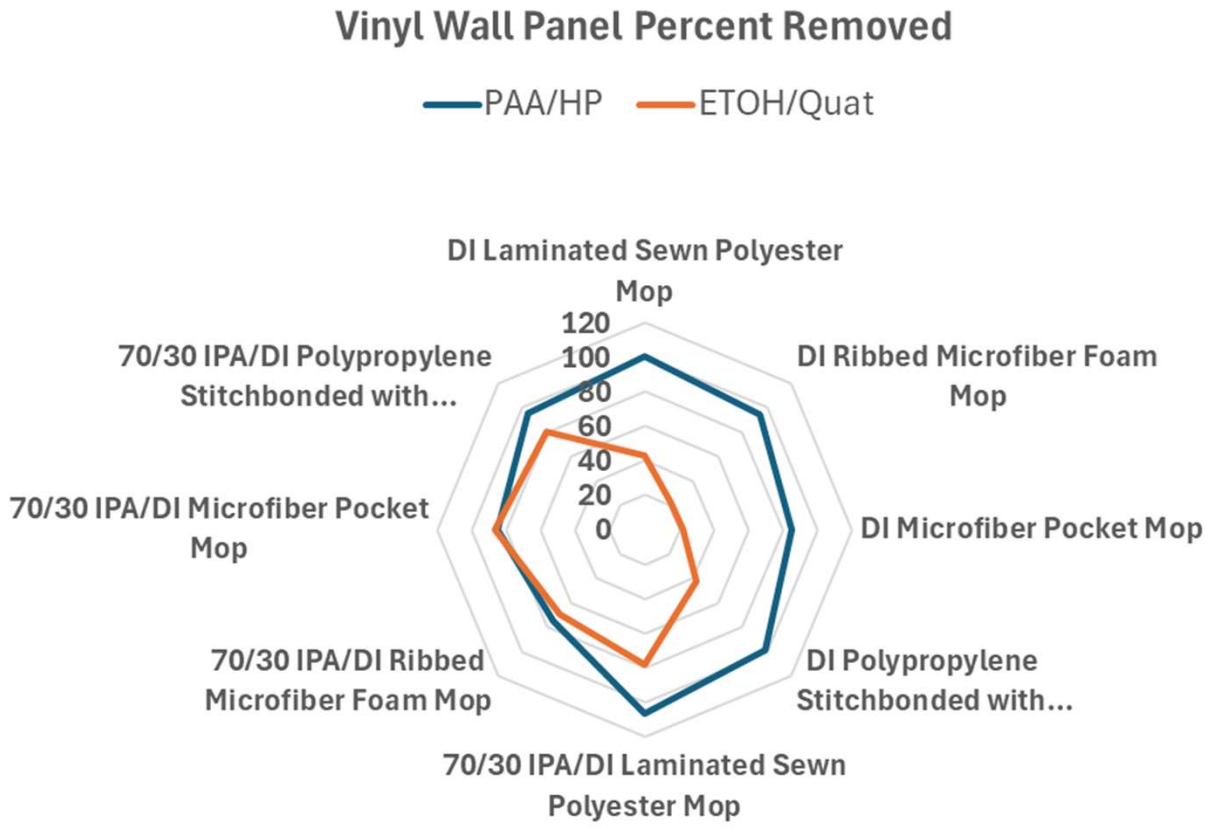
Vinyl Wall Panel Percent Removed
PAA/HP
ETOH/Quat
DI Laminated Sewn Polyester Mop
DI Ribbed Microfiber Foam Mop
DI Microfiber Pocket Mop
DI Polypropylene Stitchbonded with...
70/30 IPA/DI Laminated Sewn Polyester Mop
70/30 IPA/DI Ribbed Microfiber Foam Mop
70/30 IPA/DI Microfiber Pocket Mop
70/30 IPA/DI Polypropylene Stitchbonded with...
120
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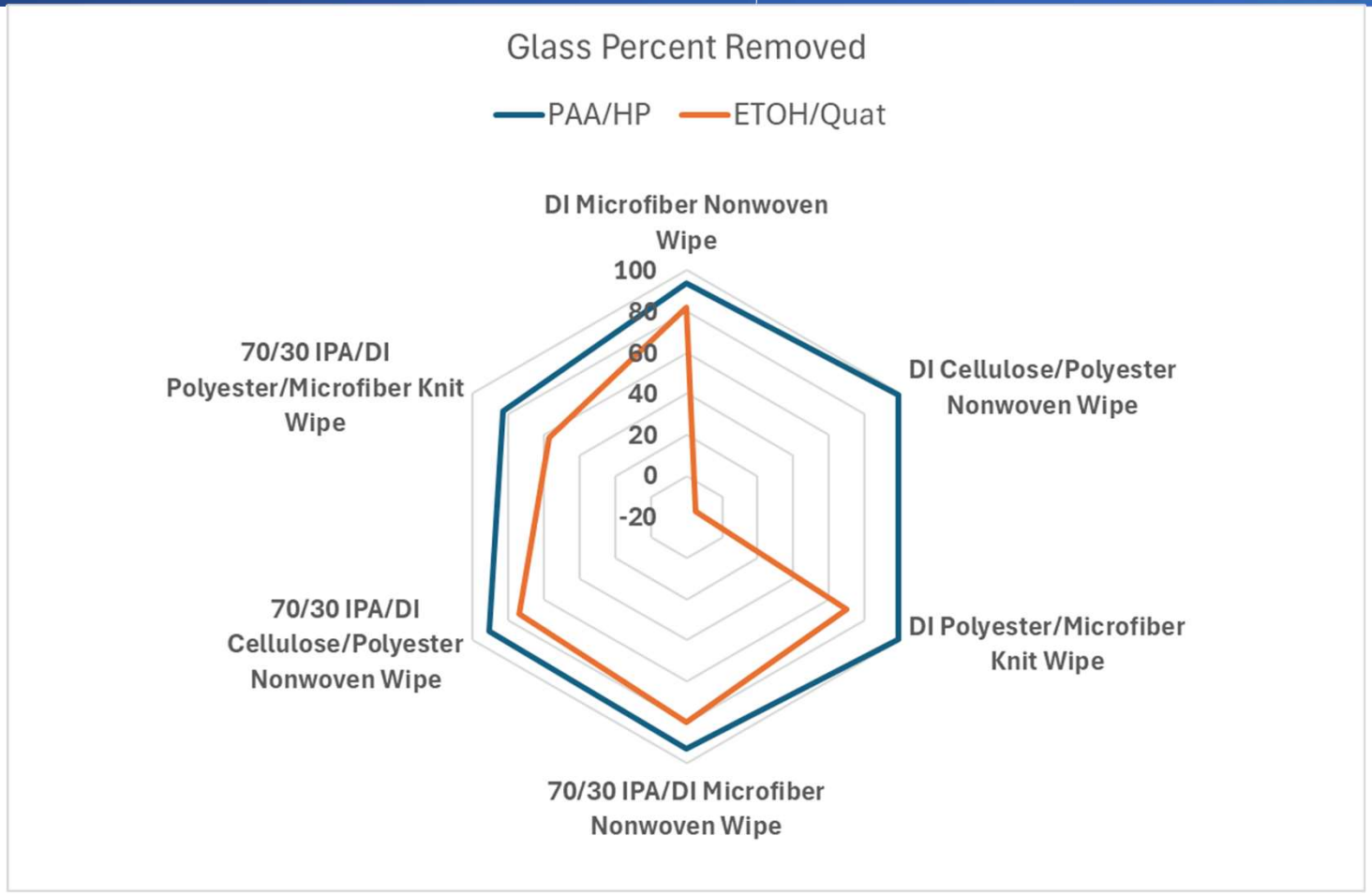
Glass Percent Removed
PAA/HP
ETOH/Quat
DI Microfiber Nonwoven Wipe
100
80
60
40
20
0
-20
DI Cellulose/Polyester Nonwoven Wipe
DI Polyester/Microfiber Knit Wipe
70/30 IPA/DI Microfiber Nonwoven Wipe
70/30 IPA/DI Cellulose/Polyester Nonwoven Wipe
70/30 IPA/DI Polyester/Microfiber Knit Wipe

What we have determined based on data

Biocide Type vs. Removal Solution

- Alcohol-based disinfectants → Removed best with 70%IPA
- Water-based disinfectants → Removed best with Water

Fabric Matters

- Microfiber and knit fabrics = Most effective for residue pickup
- Fabric structure influences contact and absorption

Observation

- Optimal residue removal depends on pairing the right solution with the right fabric for the biocide used.

One Issue, Many Paths...

Final Thoughts

Lessons Learned from the Tales

- *Same root cause – disinfectant residues*
- *Different paths taken on one recent change*
- *Residues were the hidden factor all along*
- *Accumulation of residue will be harder to remove*

Lessons Learned from the Data

- *Frequency of cleaning and associated residue buildup*
- *Selection of appropriate removal agent based on residue type*
- *Surface characteristics influencing residue adhesion and removal*
- *Compatibility of wipe fabric and removal agent for optimal performance*

So next time you are disinfecting…don't forget to check if your unwanted guest – residues – are still hanging around.