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The influence of carbon on selective removal of phenolic compounds

Jeremy K. Steach and Denise Fisher Jones
Eastman Chemical Company

Previous work:

- TSRC 2008 – Watts, A. “The Influence of Water on the Selective Filtration of Phenol in Upstream versus Downstream Filter Segments”
- TSRC 2007 –Wilson, S. – “Influence of Water on Selective Filtration”
- CORESTA 2006 – Newbury, J. – “The Effect of Alternative Smoking Regimes on the Yield and Selective Removal of Specific Smoke Components by Cellulose Acetate Filters”
- CORESTA 2006 – Renfro, L – “The Effect of Filter Parameters on the Selective Removal of Some Phenolic Compounds by Cellulose Acetate Filters”
- TSRC 2004 – Wilson, S. – “Comparing the Selective Filtration Properties of Traditional Plasticizers”
- CORESTA 2003 – Renfro, L – “Estimating the Selective Removal of Specific Smoke Components by Cellulose Acetate Filters”
- TSRC 2001 – Wilson, S – “Smoke Composition Changes Resulting from Filter Ventilation”
- TSRC 2000 – Wilson, S – “The Influence of Plasticizer on Cigarette Filter Performance”

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Objective

- Determine the effect of carbon on the selective removal of phenolic compounds in dalmation and cavity filters
- Determine the influence of triacetin on selective removal for carbon filters
- Characterize aging effects of carbon in cigarette filters on selective removal

Filter rod properties

- Tow Item: 2.7/Y/35
- Target PD: 350 mm H_2O
- Rod Length: 108 mm
- Circumference: 24.45 mm
- Plugwrap: Nonporous
- Rods were prepared on a Mollins plugmaker with an Eastman Mini tow processing unit.

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Filter types analyzed

Filter Type	Carbon (mg)	Triacetin (% wt)
Tow	0	0
Tow	0	7
Carbon on Tow (Dalmation)	~ 60	0
Carbon on Tow (Dalmation)	~ 60	3
Carbon on Tow (Dalmation)	~ 60	7
Carbon Cavity	~ 60	7

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Cigarette construction

- All cigarettes were constructed using tobacco columns from commercially available full flavor cigarettes.
- The cigarettes were constructed by hand for each type on the same day due to the time study.
- Constructed cigarettes were stored at 60% humidity and 72 ℉.
- Cigarettes were glued 24 hours prior to smoking.
- Cavity filters were made by cutting the 7% PZ, no carbon filter tip into two pieces and using a plastic straw to create a cavity that was filled with 60 mg carbon.

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Smoking conditions

- Filtrona 8-port smoking machine
- 35 mL puff volume, 2 second puffs every 60 seconds, and 2 clearing puffs
- Cigarettes were selected to have an average filter tip pressure drop of 70 mm H_20 per port
- 2 cigarettes were smoked for each of the 8 ports per filter type
- HPLC was used to determine selective removal of phenolic compounds

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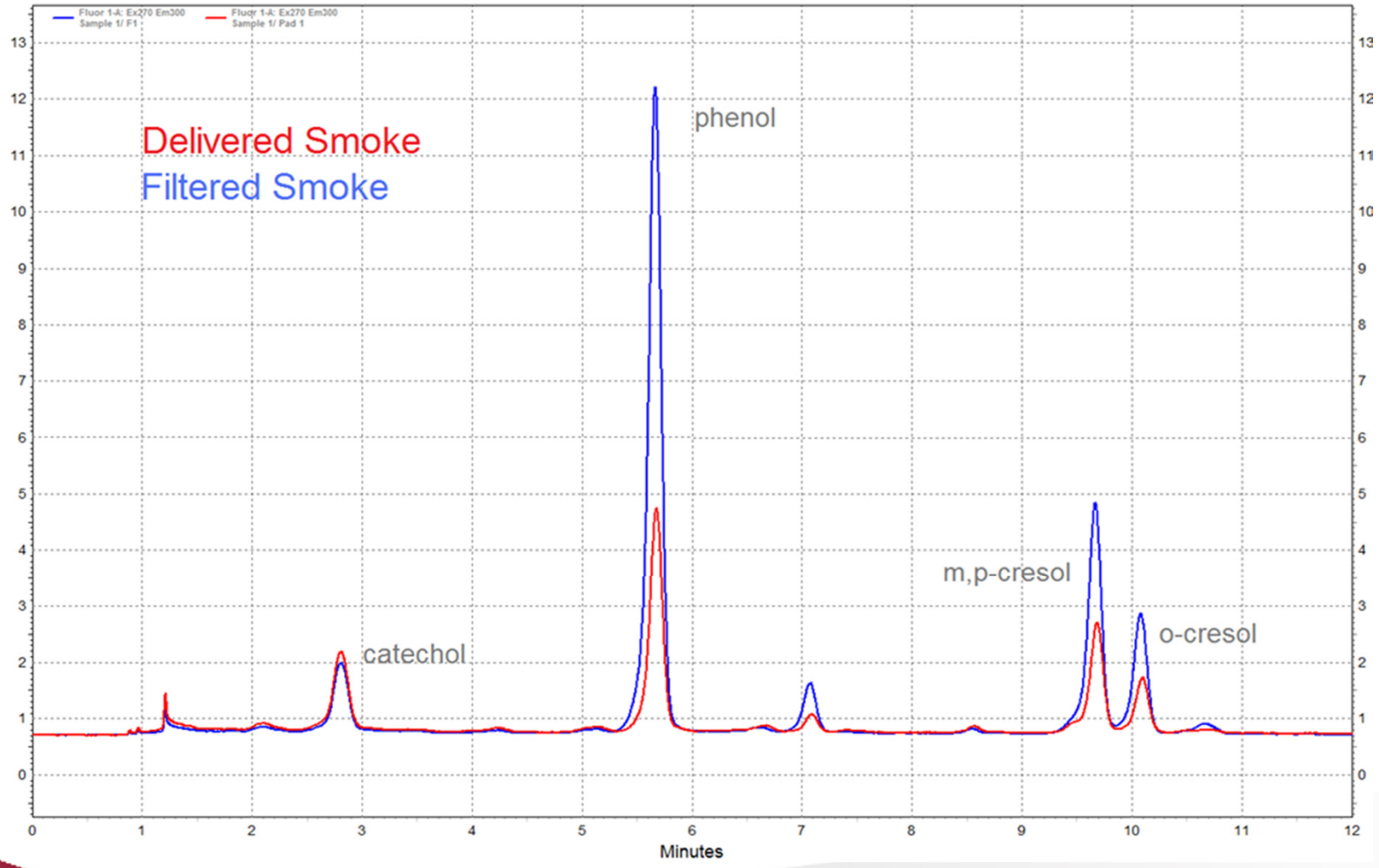
Typical chromatogram



Removal efficiency calculation

$$RE = \frac{X_A - X_D}{X_A}$$

RE **= Removal efficiency**

X_A **= Available delivery when no filter is present**

X_D **= Delivery on Cambridge pad when a filter is present**

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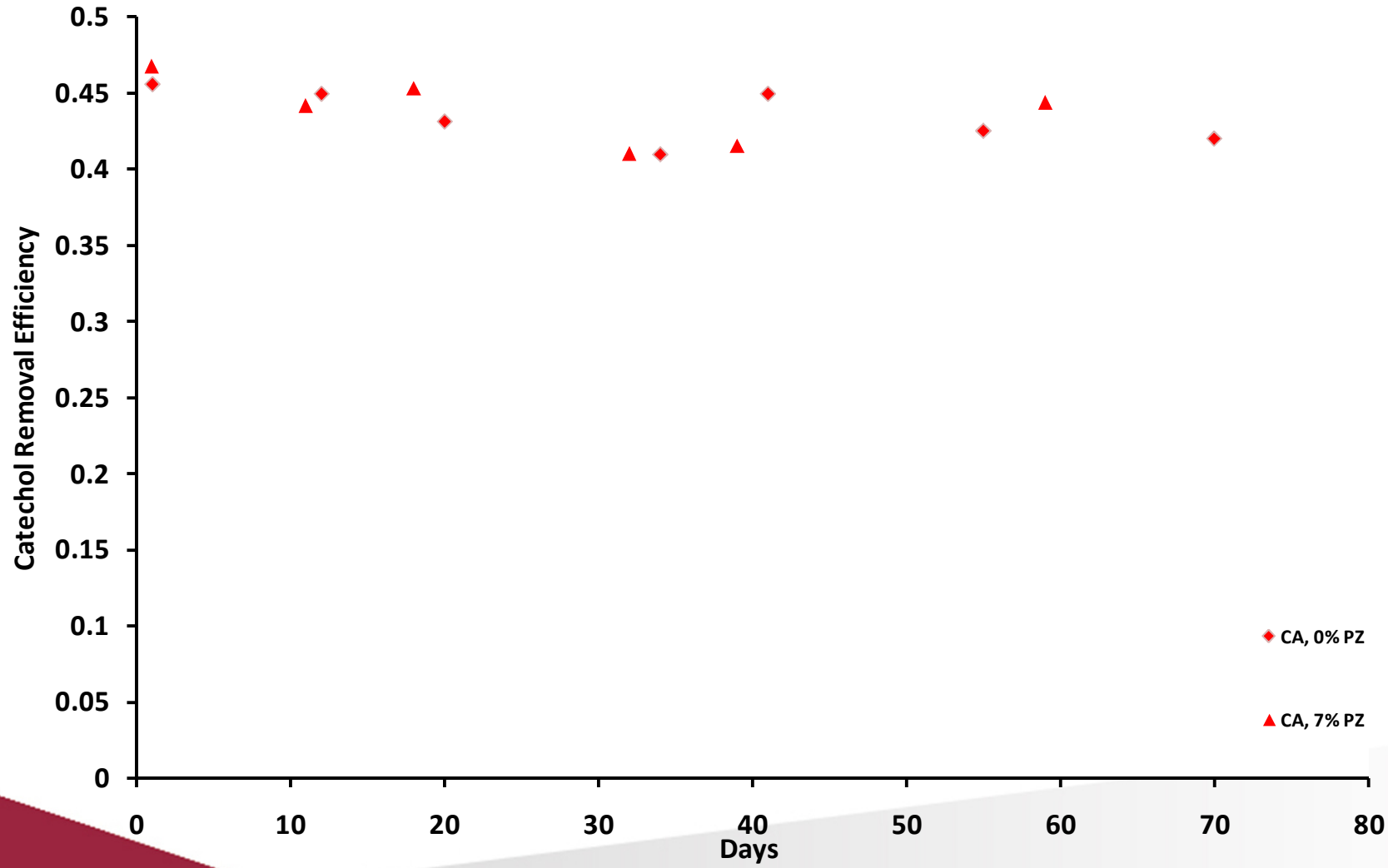
Catechol removal efficiency



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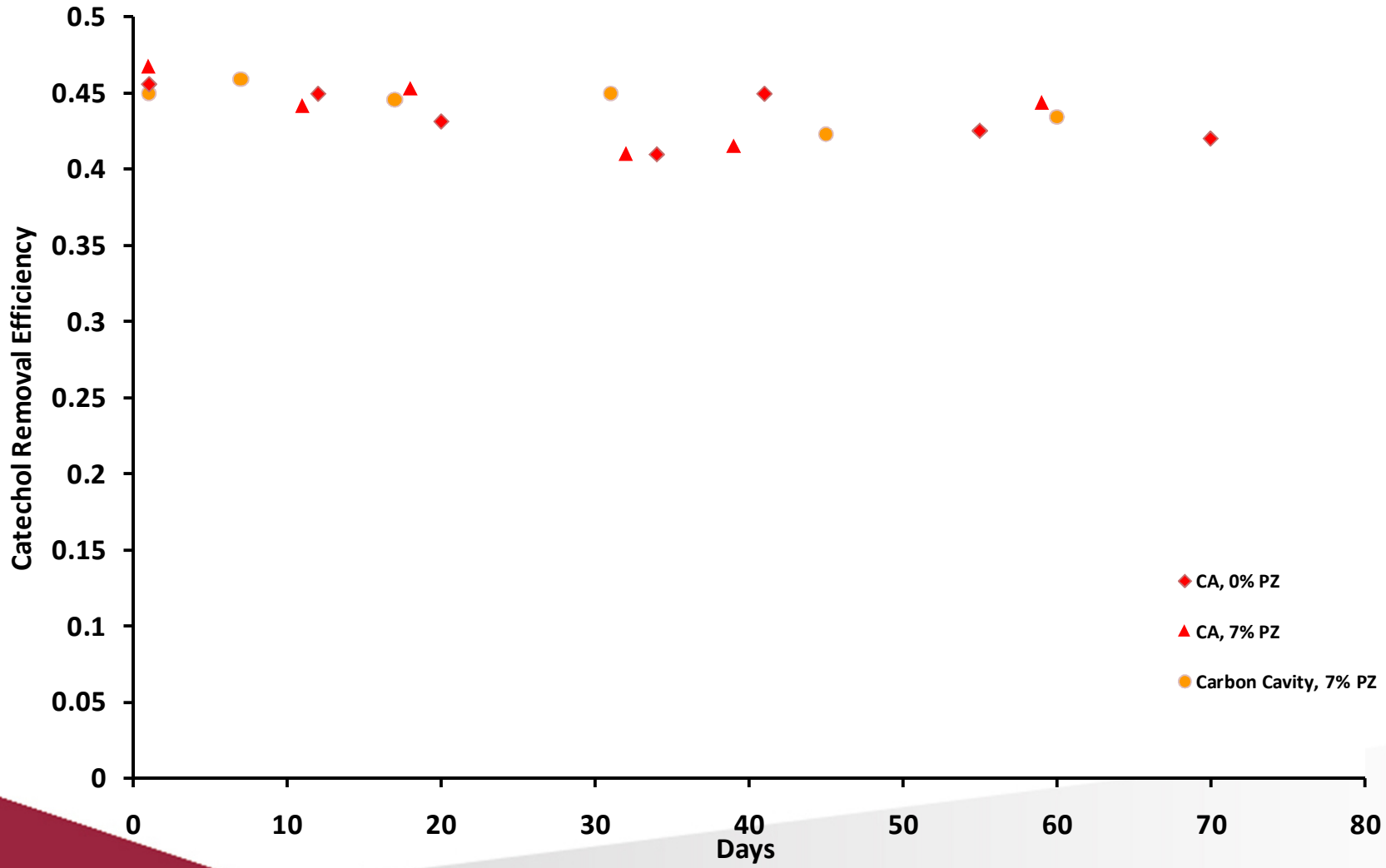
Catechol removal efficiency



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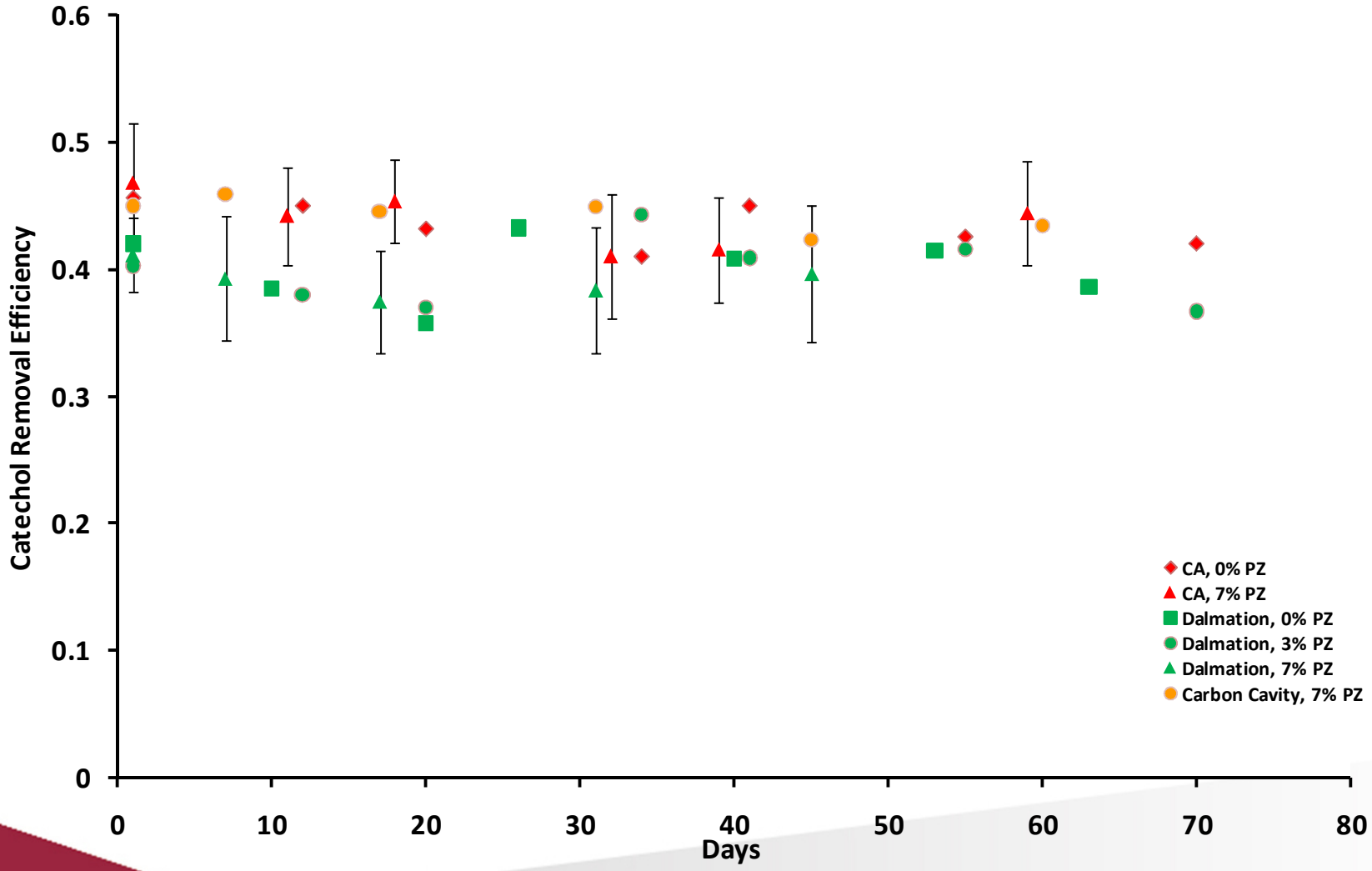
Catechol removal efficiency



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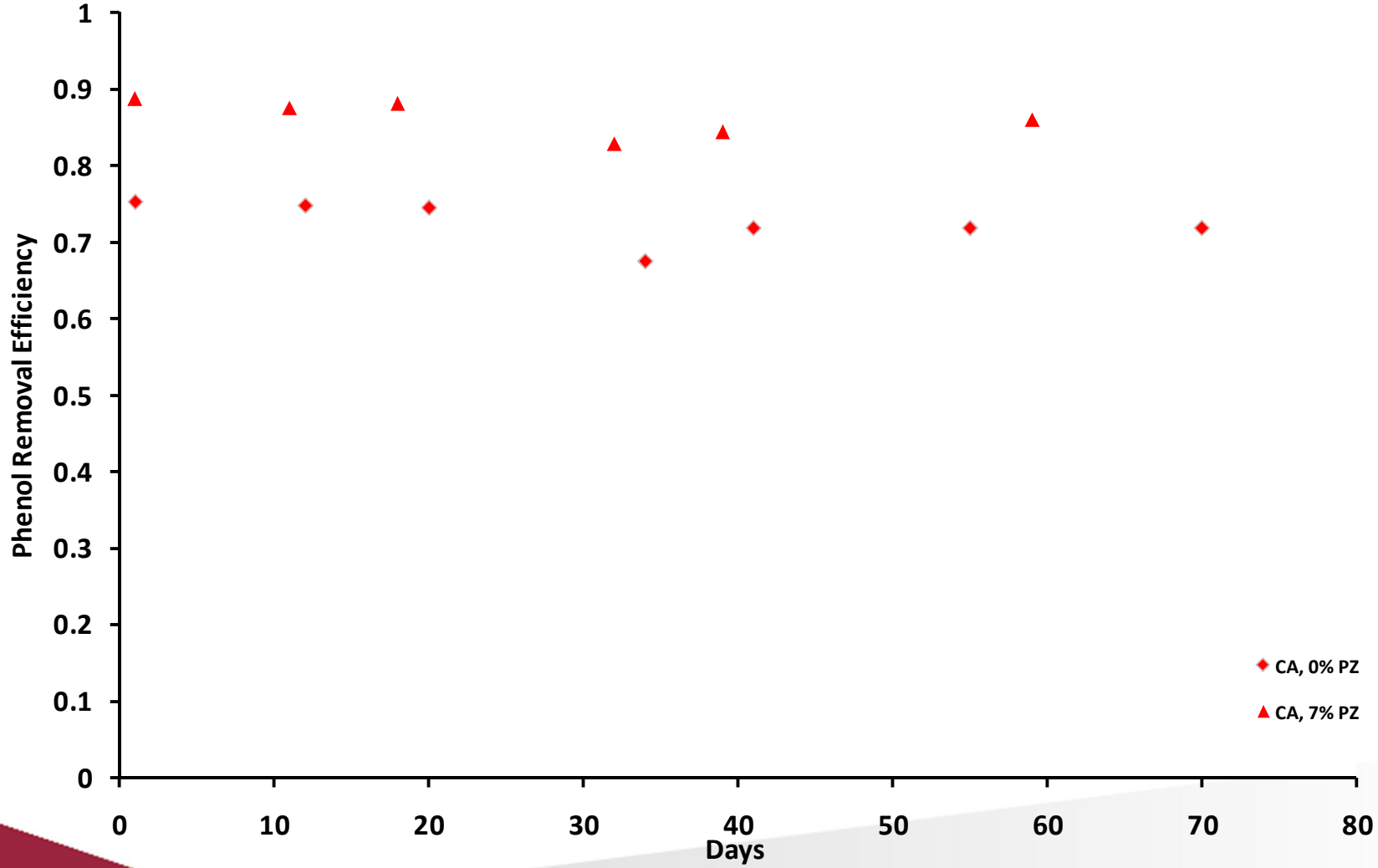
Phenol removal efficiency



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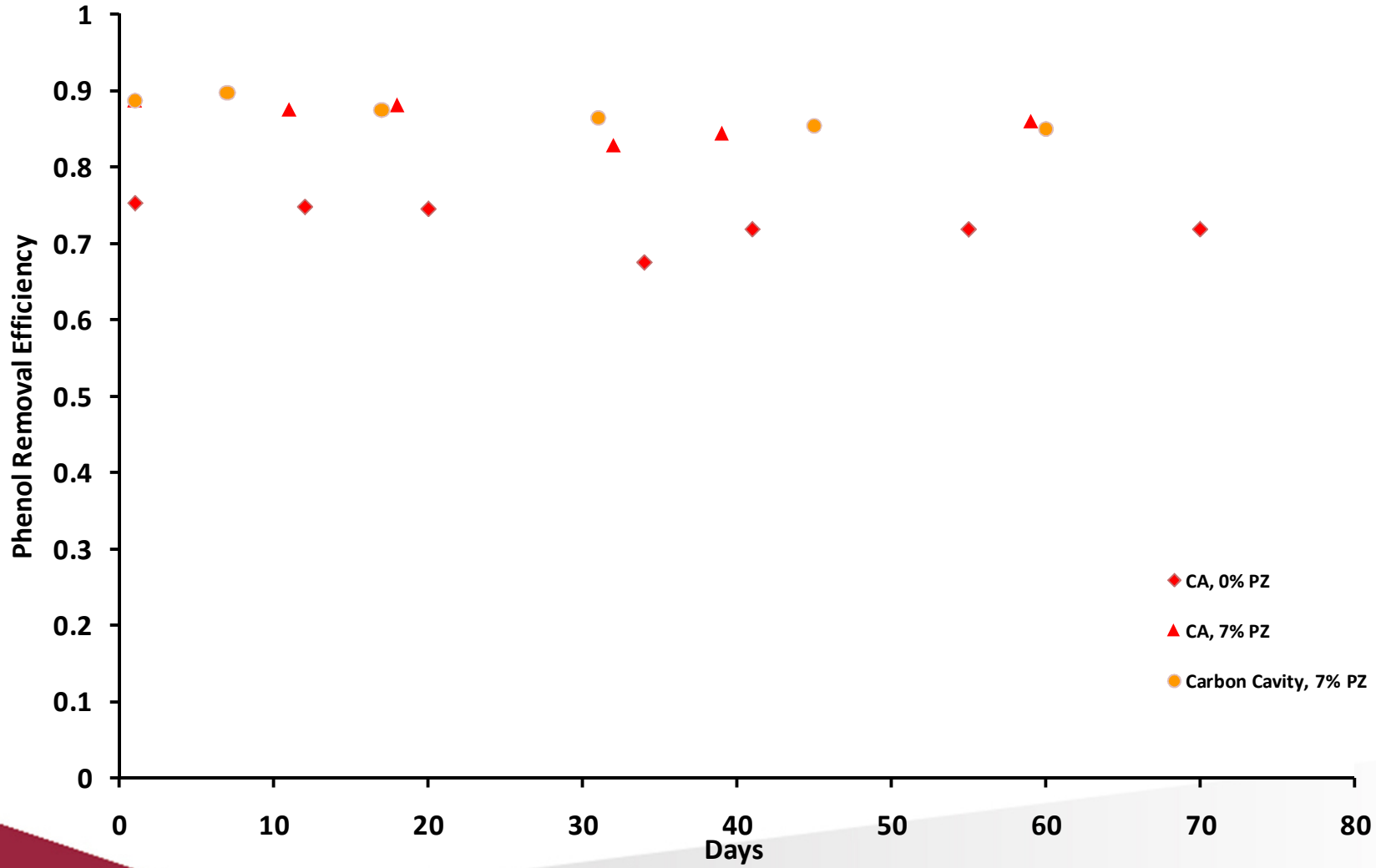
Phenol removal efficiency



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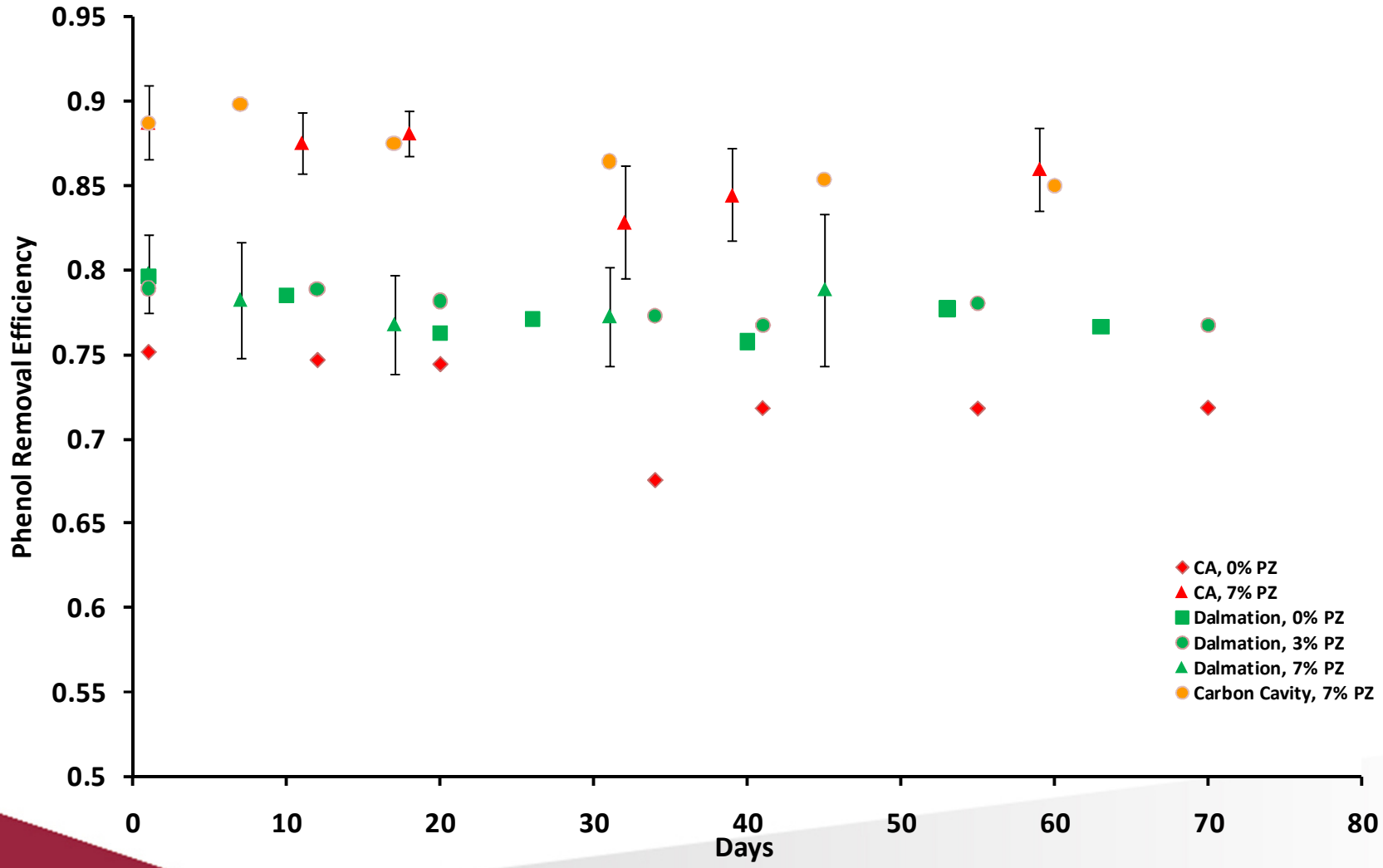
Phenol removal efficiency



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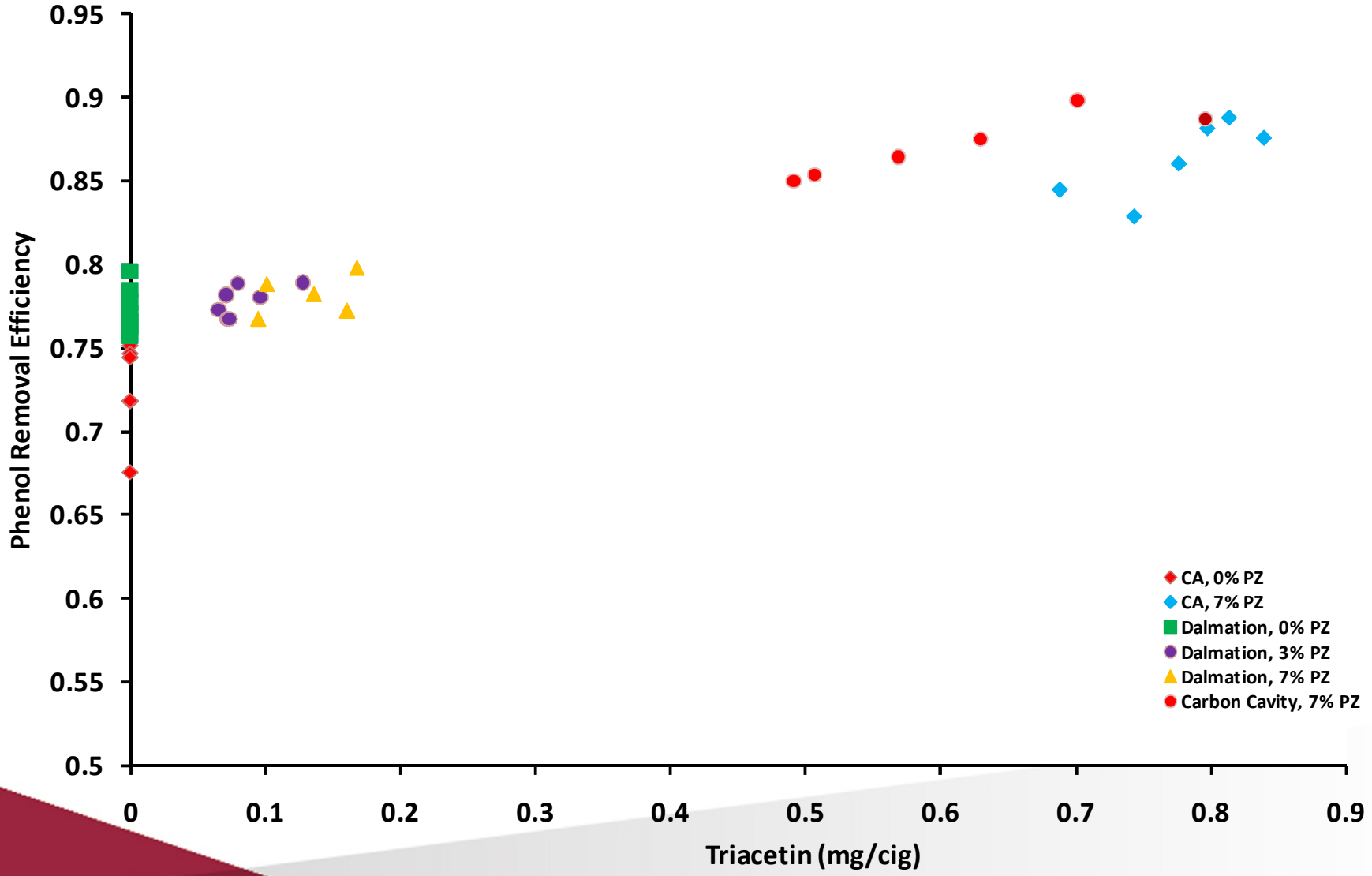
Phenol removal efficiency vs. triacetin delivery



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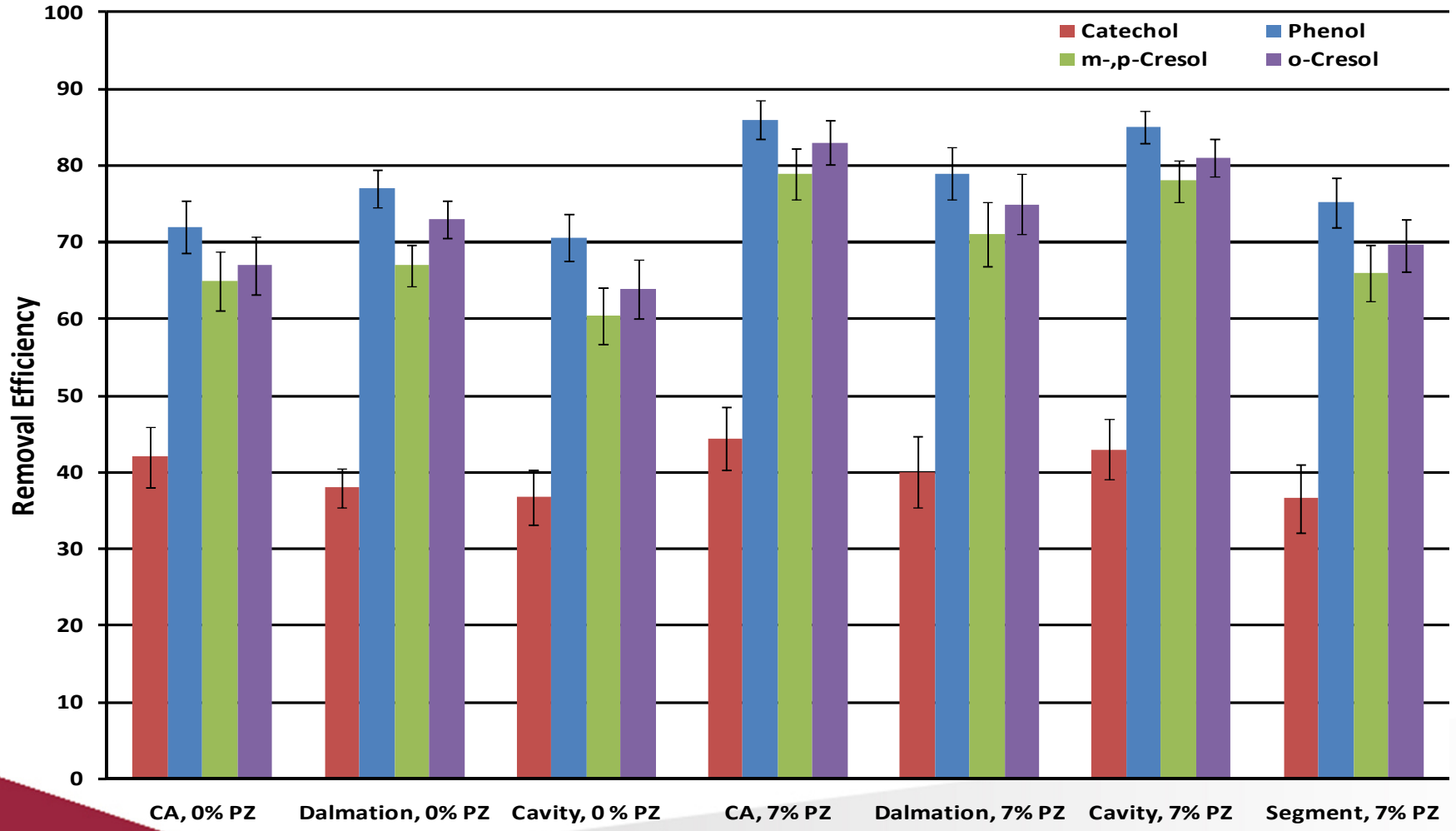
Removal efficiency comparison



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Conclusions

- Carbon does not appear to increase the selective removal of phenolic compounds
- Triacetin does not enhance selective removal of phenolic compounds for dalmation filters
- Cavity filters removal efficiency decreases over time period studied
- Dalmation and cavity filters have considerably different removal efficiencies for phenolic compounds

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Acknowledgments

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Thank You
Questions?

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