CALCEAN MINERALS & MATERIALS LLC

Technical Performance Report

Ammonia Reduction Performance of Turf Infill Materials

Comparative Evaluation of Aragonite Calcium Carbonate and Commercial Infill Systems

Prepared by Calcean Minerals & Materials LLC

DISTRIBUTED BY:
TARGET TECHNOLOGIES INTERNATIONAL INC.
www.Targettechnologies.net

Trial Summary

This study evaluated the performance of multiple commercially available turf infill materials in reducing ammonia concentrations generated from animal urine on synthetic turf systems. Ammonia is a primary contributor to odor formation in pet turf, dog runs, and other animal-use environments.

Aragonite calcium carbonate infill materials (two particle size ranges) were compared against several alternative infill types, including zeolite-based, polymer-coated sand, olive pits, cooling infill materials, and silica sand, as well as a turf-only control.

Objective

Evaluate and compare the effectiveness of various turf infill materials in reducing ammonia concentrations over time under controlled conditions.

Methods

Synthetic turf sections were prepared with infill materials and 20 mL of coyote urine was applied to a 4 in × 4 in area to simulate canine urine deposition. Each infill material was applied at a consistent rate of 2 lb per cubic foot and compared to a turf-only control.

Ammonia concentrations were measured using a Forensics Detectors NH3000 ammonia meter (0–1000 ppm range). Measurements were recorded at turf surface level and 9 inches above the turf surface at timed intervals over a 24-hour period.

Results and Discussion

All infill materials demonstrated ammonia reduction over time compared to the turf-only control; however, clear differences in the rate of reduction were observed.

Aragonite calcium carbonate infill materials showed the most rapid decline in ammonia concentration, particularly within the first 2–4 hours, which represents the timeframe most relevant to odor perception. The infill aragonite grade (20 × 45 mesh) exhibited the fastest reduction, with the coarser grade (10 × 30 mesh) also consistently outperforming all non-aragonite materials.

In comparison, zeolite-based, polymer-coated, organic (olive pit-based), and silica-based infill materials exhibited slower and more gradual reduction profiles, with elevated ammonia concentrations persisting at early and mid timepoints. Organic infill materials demonstrated intermediate performance but did not match the rate of reduction observed with aragonite.

When normalized to initial concentrations, aragonite materials achieved the highest percent ammonia reduction during early time intervals, particularly within the first 60–120 minutes.

Conclusion

Aragonite calcium carbonate infill materials demonstrated the fastest ammonia reduction across all materials evaluated. These results indicate that aragonite-based infill materials may offer advantages in applications requiring rapid ammonia mitigation and odor control.

Data

Supplemental data tables include bulk density measurements, particle size distribution (Rotap analysis), ammonia concentration measurements at turf and airspace levels, and percent ammonia reduction calculations over time.

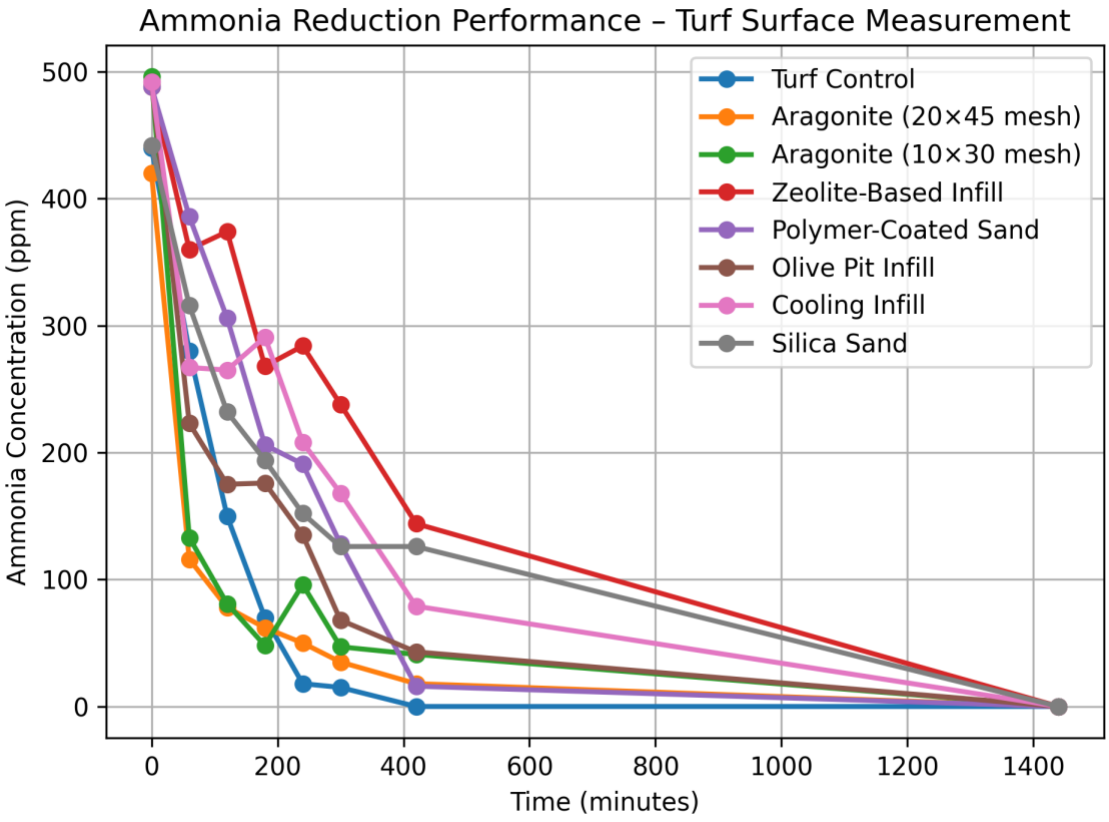

Figure 1: Ammonia reduction performance measured at the synthetic turf surface.

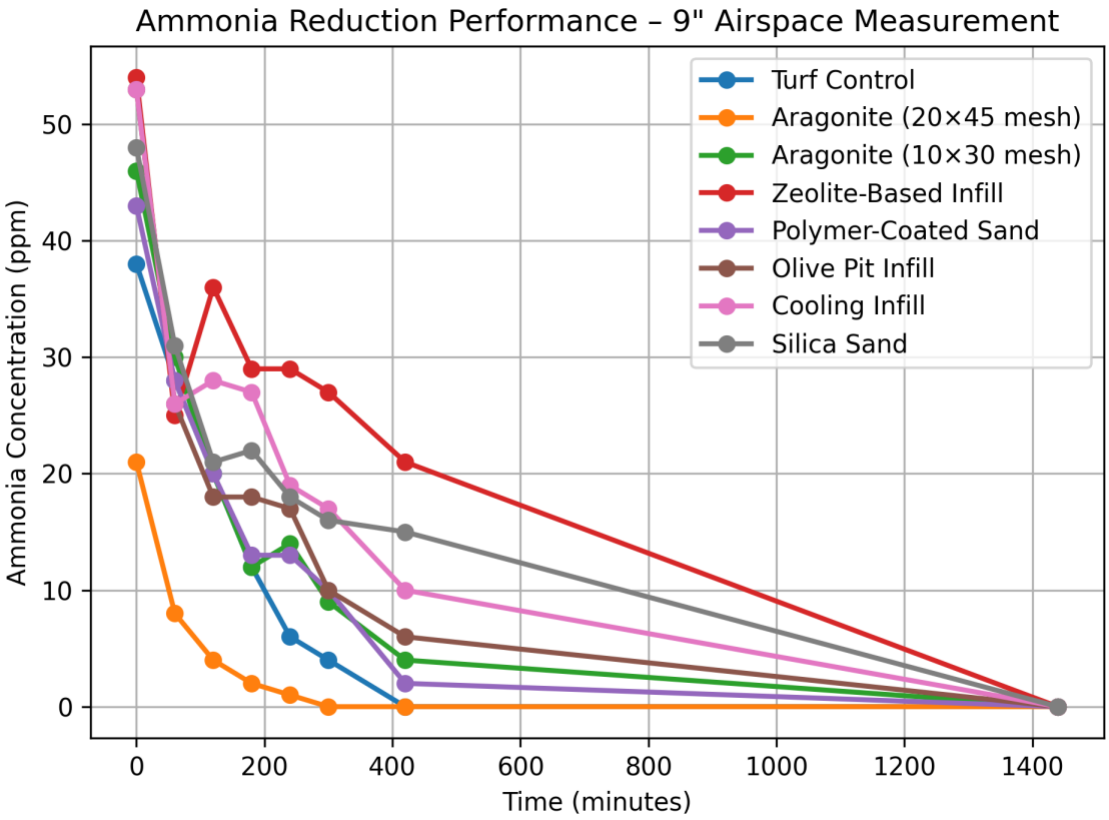

Figure 2: Ammonia reduction performance measured 9in above turf surface.

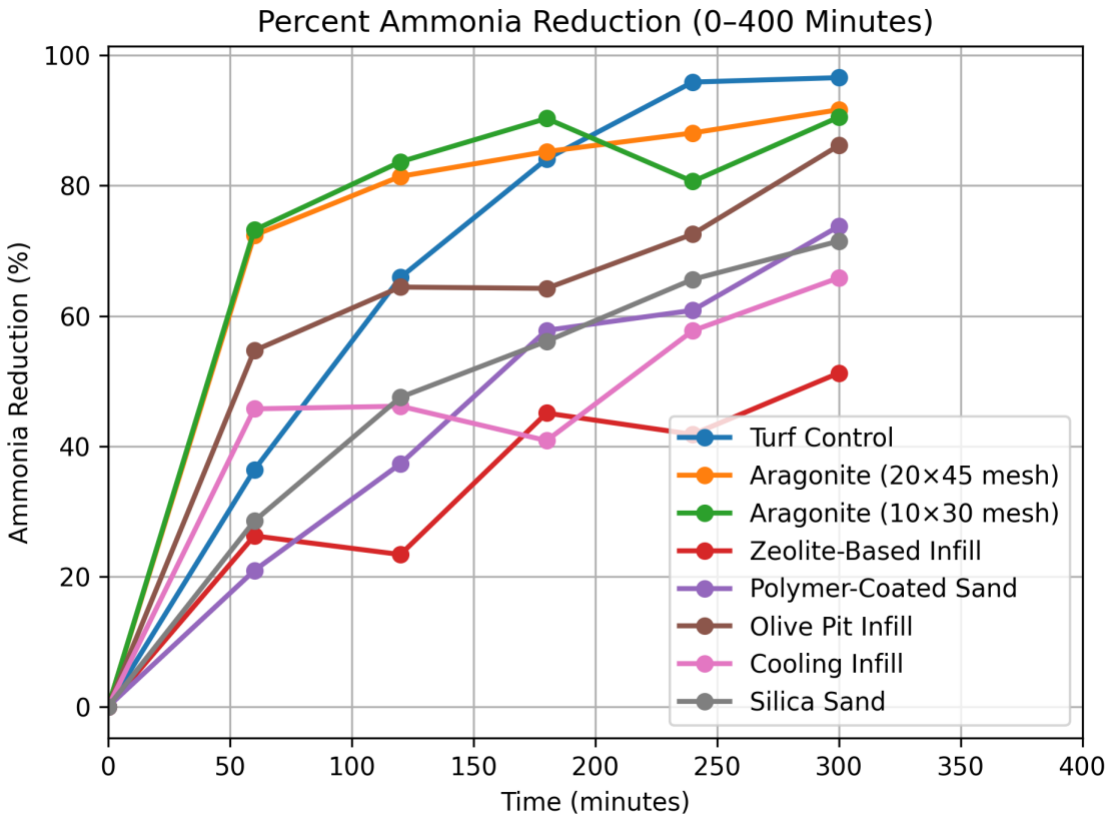

Figure 3: Percent ammonia reduction over the first 5 hours

Infill Sample	Rotap Analysis (% Retained)					
	10	20	30	40	50	Pan
Olive Pits	0.99	86.17	8.55	0.94	1.54	1.81
Cooling Infill	0.004	35.38	58.71	2.43	2.74	0.003
Polymer Coated Ir	0	45.87	50.69	0.0162	0.0169	0.0012
Aragonite 10 x 30	0	40.37	52.07	7.04	0.0014	0.0038
Aragonite 20 x 45	0	0.0017	2.24	38.96	58.17	0.0046
Zeolite	0.41	44.96	27.32	19.94	5.05	2.35
Silica Sand	0.88	14.08	75.52	8.88	0.43	0.08

Table 1: Particle size distribution measured via Rotap Analysis

Infill Sample	Loose g/cm^3	Packed g/cm^3
Olive Pits	0.748	0.869
Cooling Infill	1.5016	1.668
Polymer Coated Ir	1.603	1.705
Aragonite 10 x 30	1.195	1.328
Aragonite 20 x 45	1.572	1.709
Zeolite	0.7304	0.83
Silica Sand	1.48	1.6

Table 2: Bulk density of each respective treatment group

9" Level ppm								
Time (minutes)	Base No Infill	Aragonite 20 x 45	Aragonite 10 x 30	Zeolite	Polymer Coated Infill	Olive Pits	Cooling Infill Material	Silica
0	38	21	46	54	57	68	62	62
60	28	8	30	25	36	39	29	37
120	20	4	20	36	24	27	25	42
180	12	2	12	29	21	21	32	34
240	6	1	14	29	19	18	21	26
300	4	0	9	27	14	10	16	26
420	0	0	4	21	2	8	8	23
1440	0	0	0	0	0	0	0	0

Table 3: Raw data of ammonia readings at 9” airspace measurements

Turf Level ppm								
Time (minutes)	Base No Infill	Aragonite 20 x 45	Aragonite 10 x 30	Zeolite	Polymer Coated Infill	Olive Pits	Cooling Infill Material	Silica
0	440	420	496	488	488	492	492	442
60	280	116	133	360	386	223	267	316
120	150	78	81	374	306	175	265	232
180	70	62	48	268	206	176	291	194
240	18	50	96	284	191	135	208	152
300	15	35	47	238	128	68	168	126
420	0	18	41	144	16	43	79	126
1440	0	0	0	0	0	0	0	0

Table 4: Raw data of ammonia readings at turf level

Percent Ammonia Reduction Over Time								
Time (minutes)	Base No Infill	Aragonite 20 x 45	Aragonite 10 x 30	Zeolite	Polymer Coated Infill	Olive Pits	Cooling Infill Material	Silica
0	0	0	0	0	0	0	0	0
60	36.36363636	72.38095238	73.18548387	26.2295082	20.90163934	54.6747967	45.73170732	28.5067873
120	65.90909091	81.42857143	83.66935484	23.3606557	37.29508197	64.4308943	46.13821138	47.5113122
180	84.09090909	85.23809524	90.32258065	45.0819672	57.78688525	64.2276423	40.85365854	56.1085973
240	95.90909091	88.0952381	80.64516129	41.8032787	60.86065574	72.5609756	57.72357724	65.6108597
300	96.59090909	91.66666667	90.52419355	51.2295082	73.7704918	86.1788618	65.85365854	71.4932127
420	100	95.71428571	91.73387097	70.4918033	96.72131148	91.2601626	83.94308943	71.4932127
1440	100	100	100	100	100	100	100	100

Table 5: Ammonia reduction calculated as percent change over time