DEPARTMENT OF
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& TECHNOLOGY

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ALGAL BRICK MAKING

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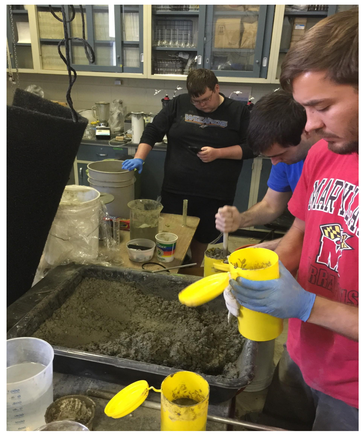

Abstract

The University of Maryland is participating in ongoing research involving controlled algal growth as a means to remove harmful nutrients that present a large problem in our waterways. This process however leaves large amounts of algal biomass that currently has little practical use. In efforts to find a use for this biomass, our team is using algal biomass as filler in a concrete mixture. Experiments are being conducted involving density, strength testing, and weathering resistance on different ratios of algae and concrete mixture. The main goal is to find a optimal ratio that does not compromise the integrity of the concrete itself. In finding a effective use for this biomass, we will not only sequester the nutrients removed from our watershed, but it will allow further implementation and scaling of Algal Turf Scrubber (ATS) technology to proceed.

Results

To analyze the effectiveness of algal biomass as a filler material in concrete we created samples with up to thirty-five percent algal biomass volume. The data observed after a 28 day curing time is displayed in Table A, along with mean values of mass and strength for each mixture. We weighed each sample using a digital scale and plotted the results. Figure 1 shows an increase in mass as the percentage of concrete is increased. Strength was then determined using a hydraulic press to break each sample. Figure 2 shows an increase in strength as the percentage of concrete in the samples is increased.

Figure 1: Cylinder Mass

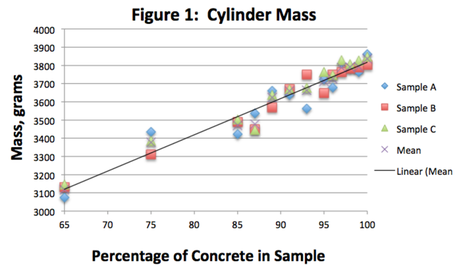

Figure 2: Cylinder Strenth

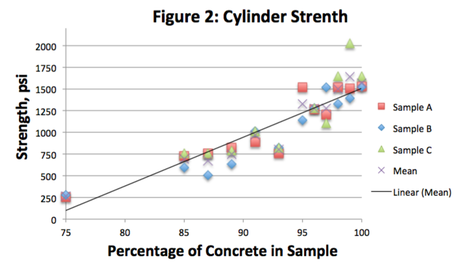

Table A: Algae Concrete Cylinder Data 28 Day Cure

Percentage of Concrete	Mass of cylinder, grams				Strength of cylinder, psi			
	Sample A	Sample B	Sample C	Mean	Sample A	Sample B	Sample C	Mean
100%	3861.72	3802.32	3847.32	3837.12	1531.4	1525.1	1645.3	1567.3
99%	3763.22	3788.12	3827.32	3792.89	1506.1	1392.2	2025.0	1641.1
98%	3784.52	3782.92	3806.52	3791.32	1518.8	1328.9	1645.3	1497.7
97%	3774.32	3761.62	3828.72	3788.22	1202.3	1518.8	1107.4	1276.2
96%	3678.92	3749.22	3746.72	3724.95	1265.6	1278.3	1278.3	1274.1
95%	3724.22	3648.32	3763.52	3712.02	1518.8	1139.1	N/A	1328.9
93%	3563.02	3749.42	3676.42	3662.95	759.4	822.7	822.7	801.6
91%	3637.72	3671.02	3670.32	3659.69	885.9	1012.5	1012.5	970.3
89%	3660.12	3569.92	3638.32	3622.79	822.7	632.8	791.0	748.8
87%	3537.02	3450.42	3445.12	3477.52	759.4	506.3	759.4	675.0
85%	3422.02	3489.42	3502.22	3471.22	727.7	594.8	759.4	694.0
75%	3435.32	3310.62	3385.52	3377.15	253.1	278.4	N/A	265.8
65%	3074.82	3131.62	3145.82	3117.42	Not tested, material did not cure			N/A

Implications to Research

Once a better understanding is achieved of the structural characteristics of the algal concrete, implementation of the concrete can then begin. The Algal Turf Scrubber produces a certain dry biomass after it has been used cleaning the watershed. In one year or growing season, the Algal Turf Scrubber will produce about 5000 grams/acre/yr of dry biomass. If we are able to produce concrete that is 90% concrete and 10% algae, we would be able to use an entire growth season of algae in just a mere 45,000 g/acre/ yr of concrete. That is a mere 100 pounds of concrete. These are just a series of rough calculations, but these numbers illustrate a scale in which huge amounts of algae could be taken from the Turf Scrubber and used in construction.

Conclusion

Our results correlate increased concrete amounts to the strength of the brick. This leads us to believe that algae alters the structural integrity of a brick. The effect of the algae on the brick lessens as the amount of algae decreases. We believe that low percent algae bricks can be used for non-weight bearing purposes. Using the algae concrete for lawn ornaments or stepping stones in one's backyard. The amount of possibilities for the algae bricks are only limited by one' s creativity. More in depth studies must be done in order to completely understand how algae changes the structural makeup of concrete.