UTILISATION OF INDUSTRIAL WASTE; FLY ASH/BOTTOM ASH TO HASTEN THE INTRINSIC BIOFOULING PROPERTIES IN CEMENT MORTAR: STRENGTH PROPERTIES

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In recent years, the incorporation of industrial waste materials into sustainable construction practices has emerged as a significant area of interest. This research aims to explore the application of fly ash and bottom ash, both commonly found industrial waste products, in enhancing the biofouling properties of cement mortar. Biofouling, which refers to the accumulation of marine organisms on submerged surfaces, poses a considerable challenge to marine structures, necessitating the development of effective mitigation strategies. This study employs a comprehensive research methodology that involves the preparation of cement mortar samples, wherein varying proportions of fly ash and bottom ash are used as partial replacements for the fine aggregate. To evaluate the physical properties of the mortar mixtures, various replacement percentages in 20% intervals are tested, ranging from 0% to 100%. The assessment is conducted following established standards (IS:4031-1998) and involves the performance of standard tests such as consistency, initial setting time, and final setting time. These tests allow for a comprehensive evaluation and comparison of the different mortar mixtures, providing important insights into their overall quality and characteristics.:4031-1998). In order to comprehensively assess the modified cement mortar, the mechanical properties were evaluated. The compressive strength was tested using the ASTM C109/C109M standard, while the tensile strength was measured through splitting tensile tests following ASTM C496/C496M guidelines. To further understand the impact of biofouling on the modified mortar mixtures, 16 samples were exposed to the intertidal zone at Dikkowita fisheries harbour for three months. Monthly visual observations and photographic documentation were methodically carried out to monitor and document the growth and extent of biofouling on the mortar surfaces. The findings presented in this study offer significant insights into the utilisation of fly ash and bottom ash as additives in cement mortar to enhance its resistance against biofouling. Through a comprehensive analysis of the physical, mechanical, and biofouling evaluations, the study thoroughly evaluates and discusses the most effective replacement percentages for achieving optimal biofouling resistance. This research holds valuable potential for advancing the use of fly ash and bottom ash in cement mortar and further enhancing its performance against biofouling. Using industrial waste materials in cement mortar is an essential practice to promote sustainability in the construction industry while simultaneously minimising the environmental consequences of waste disposal. The implications of our research extend further, as it holds the potential to advance the development of biofouling-resistant cement mortar for marine applications, thereby benefiting both the construction industry and coastal infrastructure development. Additionally, this research offers the possibility of reducing dependence on chemical anti-fouling treatments, thereby paving the way for even more environmentally friendly solutions.

Keywords: Industrial waste, Cement mortar, Biofouling, Mechanical properties, Bio-receptivity

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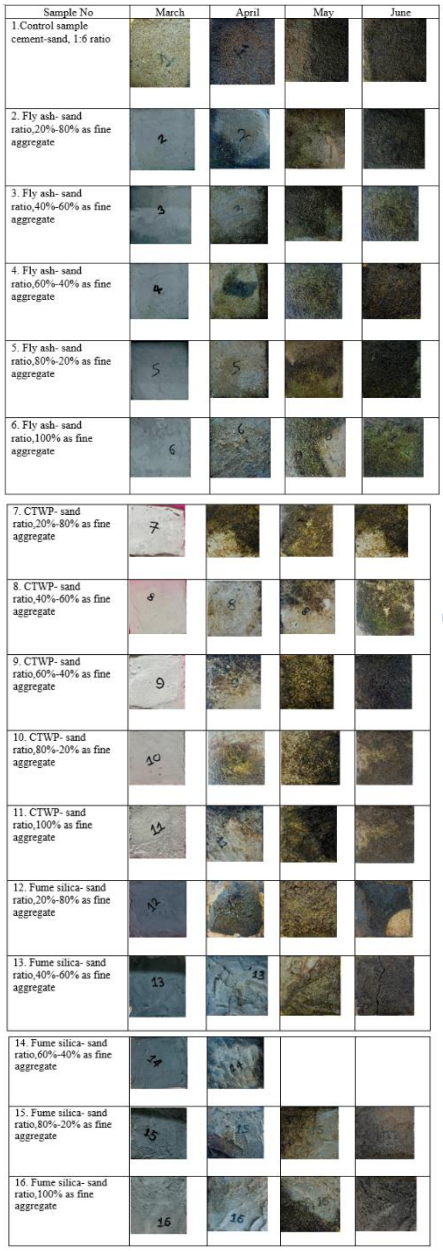
Biomass growth over 3 months



Test Results

ratio	Cement (g)	Sand(g)	Industrial Waste Material			Water (ml)	Consistency(mm)	Initial Setting Time	Final Setting Time
			Fly h	CTWP	Fume Silica				
1:6		100%						25min	> 8hours
1:6	58	171	171			80	20	>30min	>30min
1:6	58		342			115	8		
1:6	58	68	274			100	8		
1:6	58	171		171		95	6	>30min	
1:6	58			342		150	3	>30min	
1:6	58	68		274		100	1	>30min	
1:6	58	171			171	135	3	27min	30min
1:6	58				342	235	5	22.5min	36min
1:6	58	68			274	170	3	>30min	

Table 1: Initial Setting time and Final Setting Time Test Results

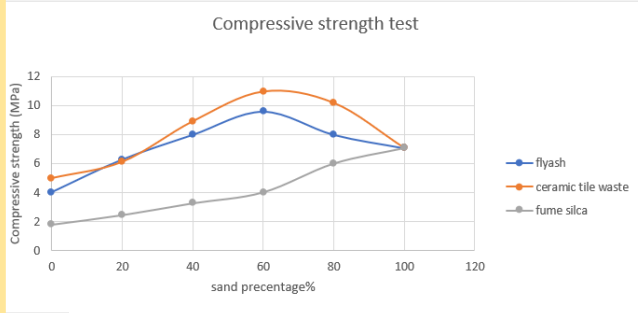


Figure 1: Compressive Strength Test Results

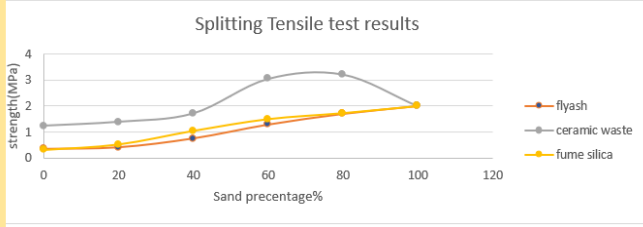


Figure 2: Splitting Tensile Test Results