Quest Journals
Journal of Architecture and Civil Engineering
Volume 7 ~ Issue 11 (2022) pp: 84-90
ISSN(Online) : 2321-8193
www.questjournals.org

Research Paper

Compressive Strength of Concrete Using Carbide Waste and Medical Masks Waste Immersed in Sea Water and Fresh Water

Indah Rosanti[1], Satriyo Utomo[1], Sarpawi[1], Nernawani[1], Iin Arianti[1]
[1]*(Department of Civil Engineering, Politeknik Negeri Pontianak, Indonesia)*

ABSTRACT: *Using cement as an adhesive material poses many problems, such as the relatively high cost. Many innovations have been made to find a substitute for cement or sand in the manufacture of concrete mixtures. This study tries to determine the utilization of making gases balloon waste (carbide waste) in the form of powder as a cement substitute, and medical mask waste cut into small length as a substitute for sand in concrete mixtures. the average compressive strength of the sample aged 7 days for a concrete composition of 0%, 2.5%, 5% under the design compressive strength, for the 7% obtained is 26.12 MPa, and for the sample aged 28 days it is 30.28 MPa immersed in fresh water, while samples immersed in seawater had an average compressive strength value at 7 days and 28 days of 13.91 MPa and 17.31 MPa, respectively. From these results it is concluded that the mixture of carbide waste and medical mask waste 7% produces the greatest compressive strength of concrete.*

KEYWORDS: *Carbide waste, Medical masks waste, Sea water immersion, Fresh water immersion*

***R**eceived 10 Nov., 2022; **R**evised 22 Nov., 2022; **A**ccepted 24 Nov., 2022 © The author(s) 2022.*
P**ublished with open access at **www.questjournals.org

I. INTRODUCTION

There are many innovations in making concrete materials as a substitute for cement. The use of waste making gases balloons and medical masks waste as an additive material for making concrete mixtures was tried in this research to determine their effect on the compressive strength of concrete [15], [16], [17], [18], [19], and [20]. Examples of building structures located in seawater made of concrete are breakwaters, harbor docks and their foundations[1], [3], and [5], so we are interested in researching waste making gases balloons [13] and [14] as an substitute to cement and medical masks waste as an substitute to sand and then immersed into seawater and freshwater.

From the discussion above, one way that can be used to reduce the use of cement as a constituent of concrete but does not reduce the strength of the concrete is to minimize the use of sand and the addition of other materials as a substitute for cement. The materials we use to reduce the use of sand are waste from making gas balloons and waste masks. The urgency of this research is to refer to the amount of medical mask waste and balloon gas production waste that is disposed of, thus causing pollution to the environment which is damaged by the waste. Especially recently during the Covid-19 pandemic, a lot of medical mask waste was thrown away carelessly. This research is expected to reduce this waste and be useful in building structures with sufficient strength.

II. MATERIAL AND METHOD

The material used in this research is carbide waste in the form of powder, in the concrete mix it will function as a cement substitute, and medical mask waste which will be cut into small lengths will function as a sand substitute. The initial test is to carry out an examination to determine the physical properties of the coarse aggregate and fine aggregate to be used in the concrete mixture carried out in the Department of Civil Engineering laboratory. The tests include sieve analysis, water content, density, specific gravity, and Los Angeles abrasion test [6].

Figure 1: Carbide waste powder

Figure 2: medical mask waste cutting

The test object will be made into four types, namely normal concrete; 2.5% (carbide waste and mask waste); 5.0% (carbide and mask waste); and 7.0% (carbide waste and mask waste). After the test object are 1 day old, the test object will be immersed in fresh water and sea water, then it will be tested when the test object is 7 and 28 days old to determine its compressive strength using universal testing machine (UTM) [7], and [10]. The proportion of the mixture of each material based on the results of the mix design is as follows [22]:

Tabel 1: Mix design proportion of 1 m^3 concrete

No	Description	Normal	2.5%	5.0%	7.0%	Unit
1	f'c	30	30	30	30	MPa
2	w/c	0.469	0.481	0.494	0.505	
3	Slump	100	100	100	100	mm
4	Aggregate max.	30	30	30	30	mm
5	Water	200.00	200.00	200.00	200.00	liter
6	Weight of cement	426.07	415.42	404.77	396.25	kg
7	Sand	867.93	846.23	824.53	807.17	kg
8	Coarse agg.	854.64	854.64	854.64	854.64	kg
9	Carbide waste	0.00	10.65	21.30	29.82	kg
10	Medical masks waste	0.00	21.70	43.40	60.76	kg

III. RESULT AND DISCUSSION

The results of testing the physical properties of sand and coarse aggregate [4], [6], [8], and [9] in this study can be seen in the following:

Figure 3: Fine Aggregates Grading

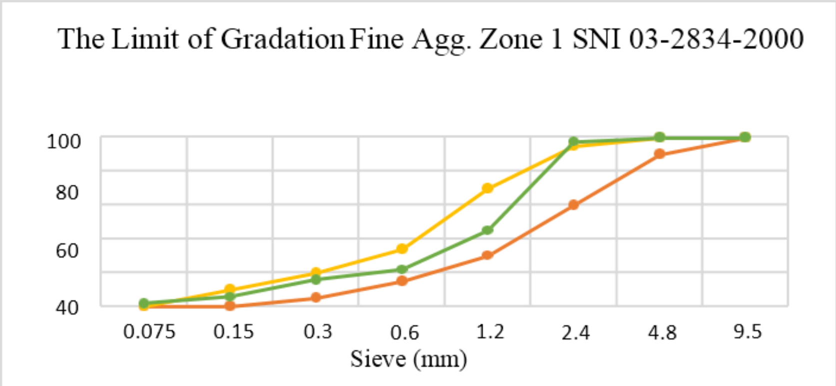

Figure 4: Coarse Aggregates Grading

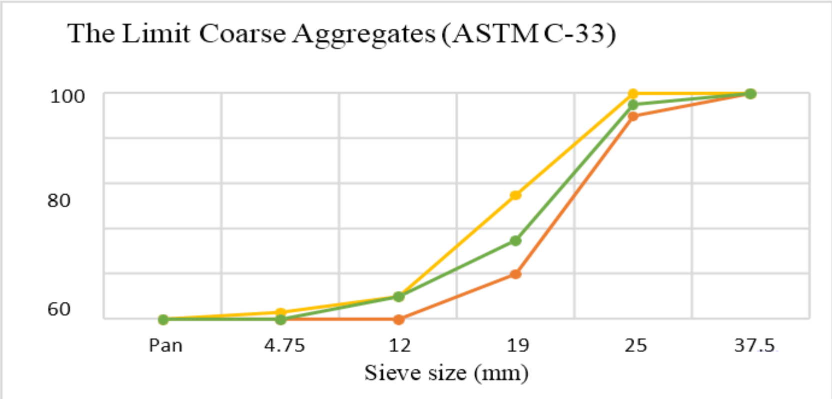

Table 2: Water Content test (Fine Aggregates)

Inquiry	I	II	
Mold	1	2	
Weight of Mold (W1)	555	555	
Weight of Mold + Sample (W2)	3823	4380	
Sample (W3=W2-W1)	3268	3825	
Mold + Dry Sample (W4)	3540	4038	
Weight of dry Sample (W5=W4-W1)	2985	3483	
Inquiry	**I**	**II**	**Average**
Water Content = $\frac{(w3-w5)}{w5}$ x 100%	9,48	9,82	9,60

Table 3: Water Content test (Coarse Aggregates)

Inquiry	I	II	
Mold	1	2	
Weight of Mold (W1)	555	555	
Weight of Mold + Sample (W2)	5532	4450	
Sample (W3=W2-W1)	4977	3895	
Mold + Dry Sample (W4)	5290	4208	
Weight of dry Sample (W5=W4-W1)	4735	3653	
Inquiry	**I**	**II**	**Average**
Water Content = $\frac{(w3-w5)}{w5}$ x 100%	5,11	6,62	5,9

Table 4: Testing For Specific Gravity of Fine Aggregate

Inquiry	I	II	
Weight of Dry Surface Saturated (Bj)	500	500	
Weight of Dry Test in Oven (B2)	492,1	493,48	
Mold + Water (B3)	792,46	792,46	
Weight of Mold + Water + Sample (B1)	955,84	9,7028	
Inquiry	**I**	**II**	**Average**
Specific Gravity *Bulk/ov.* = $\frac{B2}{B3+Bj-B1}$	1,46	1,53	1,50
Specific Grafity *SSD.* = $\frac{Bj}{B3+Bj-B1}$	1,49	1,55	1,50
Inquiry	**I**	**II**	**Average**
Specific Grafity *app.* = $\frac{B2}{B3+B2-B1}$	1,50	1,56	1,50
Absorption = $\frac{Bj-B2}{B2}x100\%$	1,61	1,32	1,50

Table 5: Testing For Specific Gravity of Coarse Aggregate

Inquiry	I	II	
Weight of Dry Surface Saturated (Bj)	500,77	500,98	
Weight of Dry Test in Oven (B2)	491,54	498,60	
Mold + Water (B3)	1204,15	1204,15	
Weight of Mold + Water + Sample (B1)	1490,66	1502,41	
Inquiry	**I**	**II**	**Average**
Specific Gravity *Bulk/ov.* = $\frac{B2}{B3+Bj-B1}$	2,29	2,46	2,40
Specific Grafity *SSD.* = $\frac{Bj}{B3+Bj-B1}$	2,34	2,47	2,40
Inquiry	**I**	**II**	**Average**
Specific Grafity *app.* = $\frac{B2}{B3+B2-B1}$	2,40	2,49	2,40
Absorption = $\frac{Bj-B2}{B2}x100\%$	1,58	0,48	1,20

Table 6: Test of Density (Fine Aggregate)

Inquiry	Compact		Loose	
	I	II	I	II
Weight of Mould (W1)	2170	2170	2170	2170
Weight of *Mould* + Sample (W2)	6895	6974	6721	6581
Sample (W3 = W2-W1)	4725	4804	4551	4411
Weight *Mould* + Water (W4)	5200	5200	5200	5200
Volume Of Mould (V= W4-W1)	3030	3030	3030	3030
Density = $\frac{W3}{V}$ (kg/dm^3)	1,56	1,59	1,50	1,46
Average	1,57		1,48	
Average	1,53			

Table 7: Test of Density (Coarse Aggregate)

Inquiry	Compact		Loose	
	I	II	I	II
Weight of Mould (W1)	2170	2170	2170	2170
Weight of *Mould* + Sample (W2)	7448	7460	7020	7050
Sample (W3 = W2-W1)	5278	5290	4850	4880
Weight *Mould* + Water (W4)	5200	5200	5200	5200
Volume Of Mould (V= W4-W1)	3030	3030	3030	3030
Inquiry	**I**	**II**	**I**	**II**
Density = $\frac{W3}{V}$ (kg/dm^3)	1,74	1,75	1,60	1,61
Average	1,74		1,61	
Average	1,67			

Table 8: Los Angeles Abrasion Test (Coarse Aggregate)

THE RESULTS TESTING OF ABRASION ASTM C 131 – 03					
Grading Chek		**Collation**		**Collation**	
Sieve		**1**		**2**	
Pass	**Detain**	**Before (gr)**	**After (gr)**	**Before (gr)**	**After (gr)**
76,2	63,5				
63,5	50,8				
50,8	38,1				
38,1	25,4	1250,00			
25,4	19,1	1250,00			
19,1	12,7	1250,00			
12,7	9,50	1250,00			
9,50	6,35				
6,35	4,75				
4,75	2,36				
TOTAL MATERIAL (gr)		5000,00			
Weight of Material with no. 12 (gr)		4231,200			
Abrasion (%)		15,38%			

Figure 5: Compressive Strength of Concrete (7 Days)

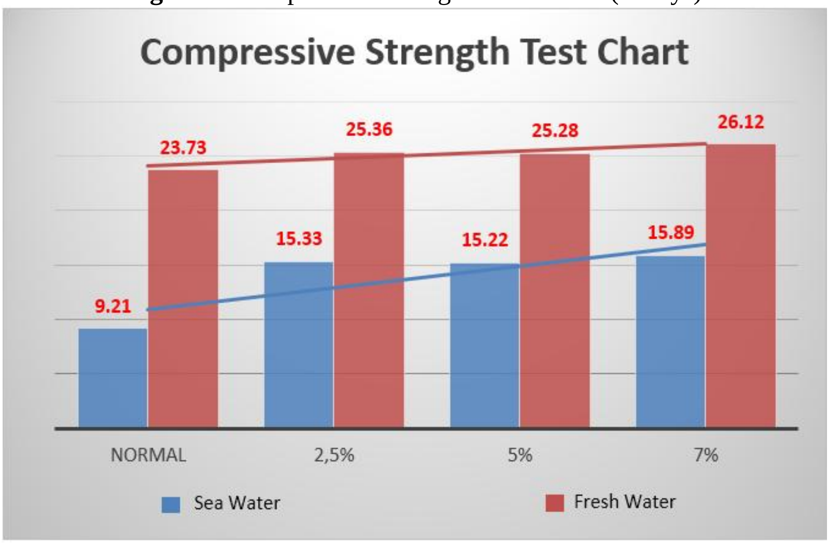

Fig. 5 above shows the average result of the compressive strength of concrete per sample in four treatments: normal, 2.5%, 5%, and 7%. It can be seen in fig. 5 that the highest compressive strength of concrete, aged seven days with fresh water immersion, is 26.12 MPa and 15.89 MPa in sea water immersion.

Figure 6: Compressive Strength of Concrete (28 Days)

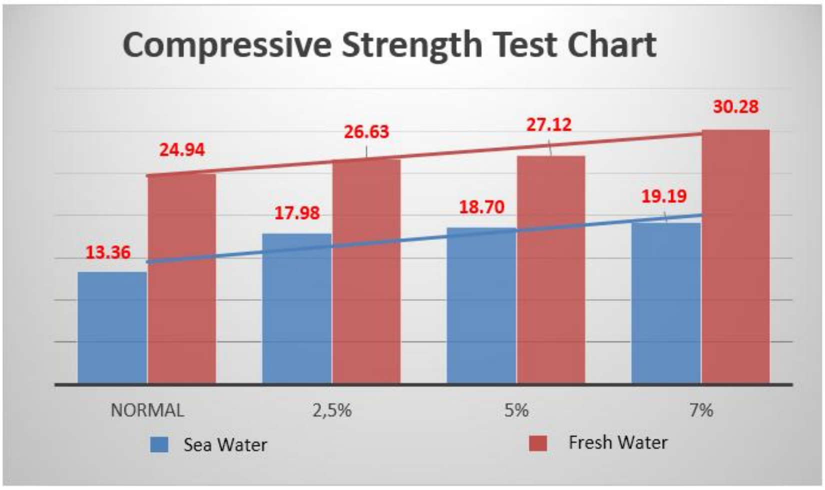

Fig. 6 shows the comparison of the compressive strength of concrete at the age of 28 days, with the highest value seen in concrete with the waste of as much as 7% for both immersion treatments, namely 30.28 MPa in fresh water immersion and 19.19 MPa in sea water immersion.

IV. CONCLUSION

From the results of testing the compressive strength of concrete, it can be concluded that using mask waste as aggregate and carbide waste as cement substitute material in the concrete mixture can increase the compressive strength of concrete. The highest average compressive strength of concrete specimens at the age of 28 days was 30.28 MPa with 7% substitution of carbide waste and mask waste immersed in fresh water, while the result of immersed in sea water was 19.19 MPa.

From the test results show that the compressive strength increases when the test object are immersed in fresh water, and the compressive strength decreases when immersed in seawater, so the use of carbide waste and medical mask waste can be used in concrete that is related to fresh water, but if it is to be used in sea water must receive special treatment.

REFERENCES

[1]. Imran, I. and Zulkifli, E, Perencanaan Dasar Struktur Beton Bertulang. 2018. ITB Press, Bandung, Indonesia.
[2]. ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. 2014. West Conshohocken, PA 19428-2959, United States.
[3]. Imran, I. and Hendrik, F, Perencanaan Lanjut Struktur Beton Bertulang. 2018. ITB Press, Bandung, Indonesia.
[4]. ASTM C33-11. Standard Specification for Concrete Aggregates. 2011. West Conshohocken, PA 19428-2959, United States.
[5]. Wang, C. K. and Salmon, C. G. Desain Beton Bertulang. Erlangga. 1993. Jakarta, Indonesia.
[6]. ASTM C131-03. Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine. 2003. West Conshohocken, PA 19428-2959, United States.
[7]. ASTM C39-18. Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. 2018. West Conshohocken, PA 19428-2959, United States.
[8]. Badan Standardisasi Nasional. SNI 1969:2008. Pengujian Berat Jenis dan Penyerapan Air Kerikil. 2008. Jakarta.
[9]. Badan Standardisasi Nasional. SNI 1970:2008. Pengujian Berat Jenis dan Penyerapan Air Pasir. 2008. Jakarta.
[10]. Badan Standardisasi Nasional. SNI 1974:2011. Cara Uji Kuat Tekan Beton dengan Benda Uji Silinder. 2011. Jakarta.
[11]. Badan Standardisasi Nasional. SNI 1972:2008. Cara Uji Slump Beton. 2008. Jakarta.
[12]. Badan Standardisasi Nasional. SNI 2493:2011. Tata Cara Pembuatan dan Perawatan Benda Uji Beton di Laboratorium. 2011. Jakarta.
[13]. Sitohang, L., et al., Pemanfaatan Limbah Kaleng Minuman Aluminium Untuk Produksi Gas Hidrogen Menggunakan Katalis Kalium Hidroksida (KOH). Jurnal Teknologi Kimia Unimal, 2017. **6**(1): p. 55-67.
[14]. Siregar, Y. D. I. Produksi Gas Hidrogen dari Limbah Aluminium. Jurnal Valensi, 2010. **2**(1): p. 362-368.
[15]. Hartono, et al., Penggunaan Campuran Abu Sampah Organik dan Limbah Karbit sebagai Bahan Pengganti Semen Pada Mortar. Jurnal Ilmiah Semesta Teknika, 2009. **12**(1): p. 86-91.
[16]. Nindya, et al., Studi Pemanfaatan Limbah B3 Karbit dan Fly Ash Sebagai Bahan Campuran Beton Siap Pakai (BSP). Jurnal Presipitasi. 2016. **13**(1): p. 34-41.
[17]. Aprida, L. F., et al., Identifikasi Potensi Pemanfaatan Limbah Karbit dan Abu Sekam Padi sebagai Bahan Alternatif Pengganti Semen. Conference Proceeding on Waste Treament Technology. 2018. **1**(1): p. 13-16.
[18]. Rajiman. Pengaruh Penambahan Limbah Karbit dan Agregat Alam (Feldspart) Terhadap Sifat Fisik Beton. Jurnal Teknologi Aplikasi Konstruksi. 2015. **4(**2): p. 118-124.

[19]. Mahendra, P. and Risdianto, Y. Pemanfaatan Limbah Karbit Sebagai Material Pengganti Semen Terhadap Kuat Tekan Beton Normal. Rekayasa Teknik Sipil. 2019. **2**(2): p. 1-7.
[20]. Saputra, W. A. et al., Pemanfaatan Limbah Karbit Sebagai Bahan Tambah Pada Mortar Ditinjau Dari Kuat Tekan. Jurnal Pendidikan Teknik Sipil, 2020. **9**(3): p. 154 - 160. https://doi.org/10.21009/jpensil.v9i3.16454.
[21]. Sri Raharja, S. A. Pengaruh Penggunaan Abu Sekam Padi Sebagai Bahan Pengganti Sebagian Semen Terhadap Kuat Tekan dan Modulus Elastisitas Beton Kinerja Tinggi. Matriks Teknik Sipil, 2015. 1(4): p. 503-510.
[22]. ACI 211.1-91, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete. 2009.