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Optimization of Compressive Strength of K-350 Concrete with Sika Viscocrete-3115 N Superplasticizer Additive

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ABSTRACT: Concrete is one of the most widely used construction materials in various infrastructure projects due to its high compressive strength and durability. However, in practice, improving concrete quality is often necessary to meet higher strength standards, one of which is through the use of admixtures such as superplasticizers. The method used in this study is a laboratory experiment with variations in superplasticizer content of 3%, 5%, 6%, 7%, and 10% by cement weight. Compressive strength testing was conducted at concrete ages of 3 days, 7 days, 14 days, 21 days, and 28 days following the SNI 03-2834-2000 standard. The results showed that the addition of Superplasticizer Sika Viscocrete-3115 N significantly increased the compressive strength of concrete compared to concrete without admixtures. The maximum compressive strength was achieved at a specific dosage variation, while excessive use of the superplasticizer reduced concrete strength due to increased porosity.

KEYWORDS: Compressive Strength, K-350 Concrete, Superplasticizer.

INTRODUCTION

Advancements in construction technology in Indonesia are rapidly progressing alongside increasing societal demand for modern infrastructure, such as high-rise buildings, bridges, and other public facilities. This development drives the need for innovation in selecting construction materials that are not only optimally durable but also cost-effective and efficient. Concrete is a primary material widely used in construction projects due to its strength, durability, and economic benefits. However, the main challenge in the industry is enhancing concrete quality to meet higher standards without compromising efficiency and sustainability.

Concrete offers several advantages over other construction materials, including abundant raw material availability, fire resistance, and relatively low production costs. Additionally, concrete can be improved through various methods, such as mix design innovations and the use of additives. One of the most critical factors affecting concrete quality is its compressive strength, which determines the durability and stability of structures. Therefore, efforts to enhance concrete compressive strength are a primary focus in research and development of concrete technology.

The water-cement ratio (WCR) is a key factor influencing concrete compressive strength. A lower WCR generally results in higher compressive strength. However, an excessively low WCR can make concrete difficult to work with, leading to imperfect compaction and reduced quality. To address this, innovations such as the use of admixtures like superplasticizers have been introduced. Superplasticizers improve concrete workability without requiring additional water, allowing for a lower WCR while maintaining ease of application.

Previous studies have explored the benefits of superplasticizers in enhancing concrete quality. Superplasticizers have been shown to significantly increase compressive strength by reducing the water required in the concrete mix. A study by Sandi Hernomo (2021) demonstrated that adding 6% superplasticizer to K-350 concrete significantly improved compressive strength compared to concrete without additives. Therefore, this study aims to further analyze the effect of adding Sika Viscocrete-3115 N superplasticizer on the compressive strength of K-350 concrete with varying dosages.

This research is expected to provide deeper insights into the use of superplasticizers to improve concrete quality, particularly in terms of compressive strength and mixing efficiency. The results are anticipated to serve as a reference for the construction industry in selecting the best methods to enhance concrete quality without sacrificing economic and sustainability aspects.

RESEARCH METHODOLOGY

This study was conducted using an experimental approach at the Construction Materials Technology Laboratory of Universitas Muhammadiyah Palembang. The research process included material testing, concrete mix design, concrete mixing, curing of test specimens, and testing of specimens.

The concrete quality used was K-350, with a target compressive strength of 31.2 MPa. The study investigated the effect of adding Sika Viscocrete-3115 N superplasticizer at

dosages of 3%, 5%, 6%, 7%, and 10% by cement weight. Compressive strength tests were conducted at concrete ages of 3, 7, 14, 21, and 28 days, following the SNI 03-2834-2000 standard. The analysis focused on the compressive strength of K-350 concrete.

Location and Time

The research was conducted at the Construction Materials Technology Laboratory of Universitas Muhammadiyah Palembang from March to April 2023.

Equipment and Materials

The equipment used in this study included:

1) A set of sieves for fine and coarse aggregates.
2) A scale for weighing test specimens and concrete mix materials.
3) Cube molds (15 x 15 x 15 cm) for casting test specimens.
4) A concrete mixer for mixing concrete materials.
5) A compression testing machine for testing the compressive strength of specimens.

The materials used were tested beforehand to ensure compliance with applicable standards. The materials included:

1) Cement : Semen Baturaja
2) Fine aggregate : Sand
3) Coarse aggregate : Crushed stone.
4) Water : Palembang municipal water (PDAM).
5) Additive : Sika Viscocrete-3115 N superplasticizer.

RESULTS AND DISCUSSION

Compressive Strength Testing

Compressive strength tests were conducted at concrete ages of 3, 7, 14, 21, and 28 days at the Construction Materials Technology Laboratory of Universitas Muhammadiyah Palembang using a compression testing machine. The results are summarized below.

Table 1. 3-Days Old Compressive Strength

No	Mixing percentage of Superplasticizer Sika Viscocrete- 3115 N	Mixing Date	Testing Date	Area	Load		Compressive Strength
					(kN)	(Kg)	
1	0%	19-7-2023	22/7/2023	225	310.1	31599.19	169.2
2	3%	19-7-2023	22/7/2023	225	312.2	31813.18	170.3
3	5%	19-7-2023	22/7/2023	225	318	32404.2	173.5
4	6%	19-7-2023	22/7/2023	225	322.4	32852.56	175.9
5	7%	19-7-2023	22/7/2023	225	324.8	33097.12	177.2
6	10%	19-7-2023	22/7/2023	225	336	34238.4	183.3

Source : 2023 Tests

When presented in a graph, the results of the compressive strength testing of normal concrete and concrete with the addition of Sika Viscocrete-3115 N superplasticizer at 3 days of age are as shown in the graph below:

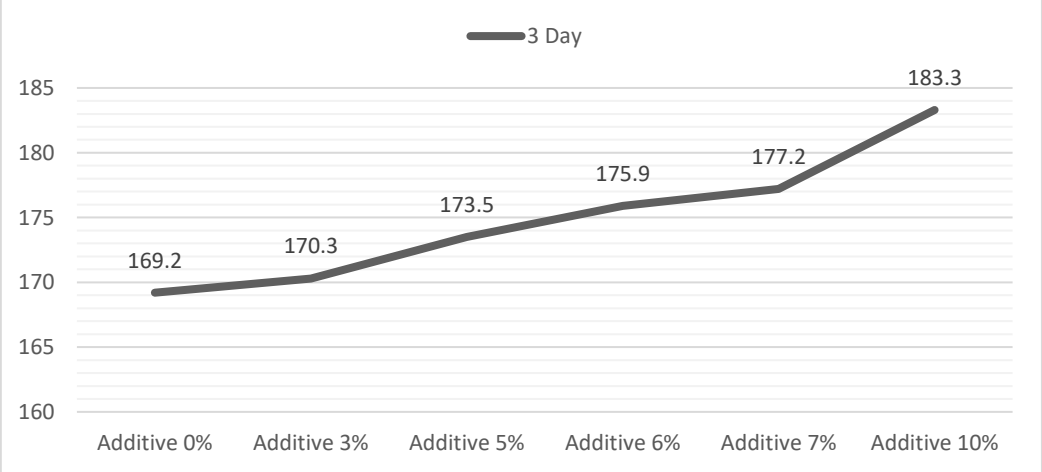


Figure 1. Graph of Concrete Compressive Strength at 3 Days old

The experimental results indicate that normal concrete without the addition of Sika Viscocrete-3115 N superplasticizer, tested at 3 days of age, exhibited a compressive strength of 169.3 MPa. In contrast, concrete mixtures incorporating Sika Viscocrete-3115 N superplasticizer at varying dosages demonstrated enhanced compressive strengths at the same age. Specifically, a 3% dosage of the superplasticizer yielded a compressive strength of 170.3 MPa, while a 5% dosage resulted in a strength of 173.5 MPa. The highest compressive strength at this age, 175.9 MPa, was achieved with a 6% dosage. Further increases in the superplasticizer content to 7% and 10% resulted in compressive strengths of 177.2 MPa and 183.3 MPa, respectively, with the 10% dosage producing the maximum compressive strength observed at 3 days.

Table 2. 7-Days Old Compressive Strength

No	Mixing percentage of Superplasticizer Sika Viscocrete- 3115 N	Mixing Date	Testing Date	Area	Load		Compressive Strength
					(kN)	(Kg)	
1	0%	19-7-2023	26/7/2023	225	322.4	32852.56	175.9
2	3%	19-7-2023	26/7/2023	225	324.1	33025.79	176.8
3	5%	19-7-2023	26/7/2023	225	328.2	33443.58	179
4	6%	19-7-2023	26/7/2023	225	334.3	34065.17	182.4
5	7%	19-7-2023	26/7/2023	225	339.4	34584.86	185.1
6	10%	19-7-2023	26/7/2023	225	346.7	35328.73	189.1

Source : 2023 Tests

When presented in a graph, the results of the compressive strength testing of normal concrete and concrete with the addition of Sika Viscocrete-3115 N superplasticizer at 7 days of age are as shown in the graph below:

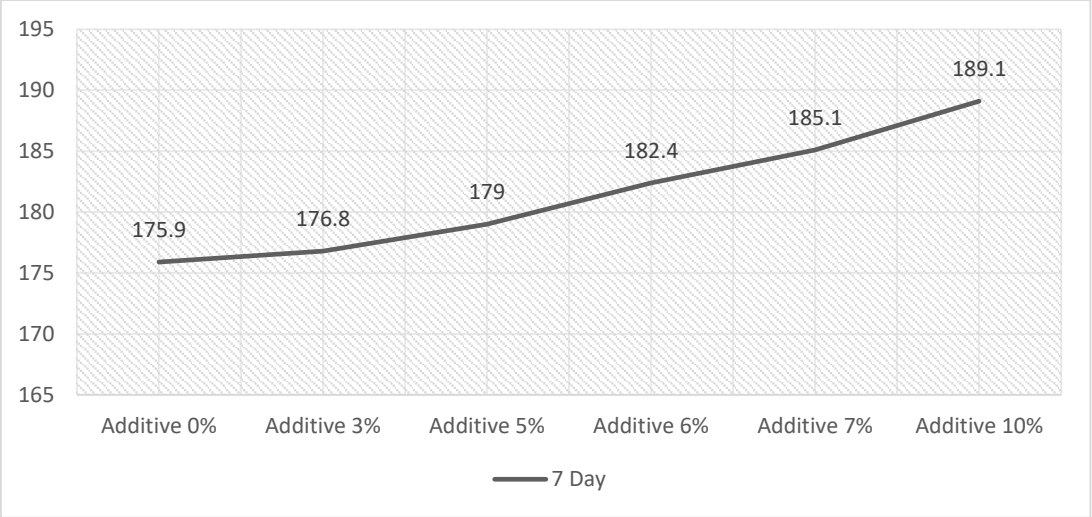


Figure 2. Graph of Concrete Compressive Strength at 7 Days old

The results of the compressive strength testing of concrete at 7 days of age revealed that the highest compressive strength was achieved by concrete incorporating a 10% dosage of Sika Viscocrete-3115 N superplasticizer, yielding a value of 189.1 MPa. In comparison, normal concrete without any superplasticizer (0% additive) exhibited a compressive strength of 175.9 MPa. Concrete mixtures with 3% and 5% dosages of Sika Viscocrete-3115 N superplasticizer recorded compressive strengths of 176.8 MPa and 179.0 MPa, respectively. Further increases in the superplasticizer dosage to 6% and 7% resulted in compressive strengths of 182.4 MPa and 185.1 MPa, respectively.

Table 3. 14-Days Old Compressive Strength

No	No	Mixing percentage of Superplasticizer Sika Viscocrete-3115 N	Mixing Date	Testing Date	Area		Load
					(kN)	(Kg)	
1	0%	19-7-2023	2/8/2023	225	441.8	45019.42	241.06
2	3%	19-7-2023	2/8/2023	225	442.1	45050	241.23
3	5%	19-7-2023	2/8/2023	225	447	45549.3	243.90
4	6%	19-7-2023	2/8/2023	225	449.5	45804.05	245.26
5	7%	19-7-2023	2/8/2023	225	452.7	46130.13	247.01
6	10%	19-7-2023	2/8/2023	225	461.4	47016.7	251.76

Source: 2023 Tests

When represented graphically, the outcomes of the compressive strength tests for normal concrete and concrete incorporating Sika Viscocrete-3115 N superplasticizer at 14 days of age are depicted in the graph below:

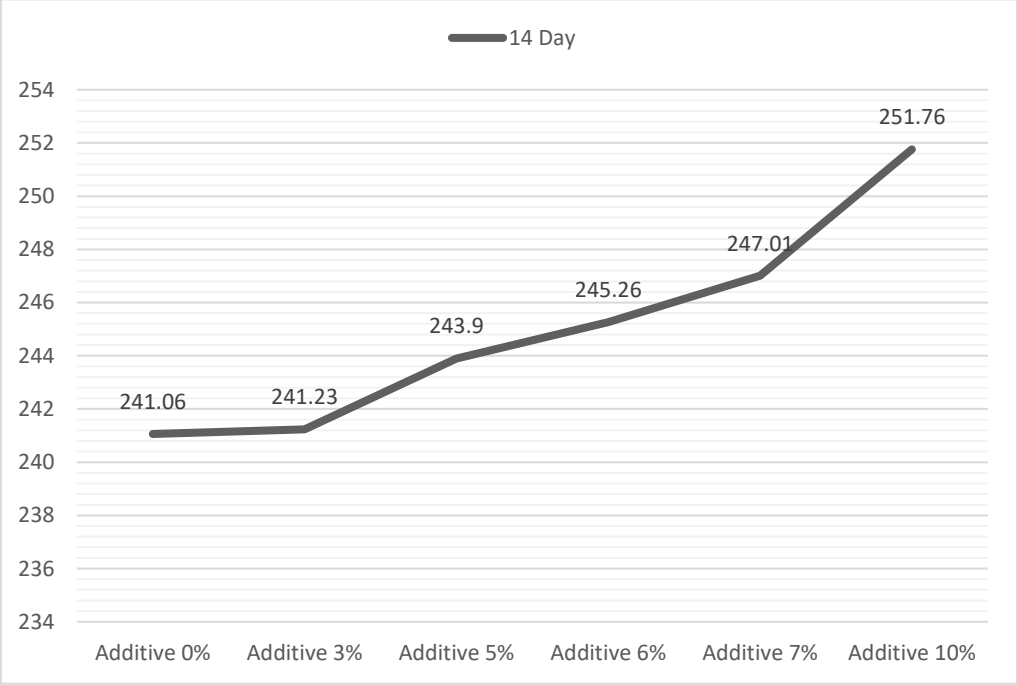


Figure 3. Graph of Concrete Compressive Strength at 14 Days old

The findings from the compressive strength testing of concrete at 14 days of age indicate that the highest compressive strength was achieved by concrete with a 15% dosage of Sika Viscocrete-3115 N superplasticizer, recording a value of 103.92 MPa. In contrast, normal concrete without additives exhibited a compressive strength of 90.50 MPa. Concrete mixtures with superplasticizer dosages of 10%, 13%, 17%, and 20% yielded compressive strengths of 51.16 MPa, 48.66 MPa, 49.56 MPa, and 51.30 MPa, respectively.

Table 4. 21-Days Old Compressive Strength

No	Mixing percentage of Superplasticizer Sika Viscocrete-3115 N	Mixing Date	Testing Date	Area	Load		Compressive Strength
					(kN)	(Kg)	
1	0%	19-7-2023	9/8/2023	225	642	65419.8	350.31
2	3%	19-7-2023	9/8/2023	225	646.1	65837.59	352.54
3	5%	19-7-2023	9/8/2023	225	652.1	66448.99	355.88
4	6%	19-7-2023	9/8/2023	225	657.8	67029.82	358.92
5	7%	19-7-2023	9/8/2023	225	661.2	67376.28	360.78
6	10%	19-7-2023	9/8/2023	225	664	67661.6	362.31

Source: 2023 Tests

When represented graphically, the outcomes of the compressive strength tests for normal concrete and concrete incorporating Sika Viscocrete-3115 N superplasticizer at 21 days of age are depicted in the graph below:

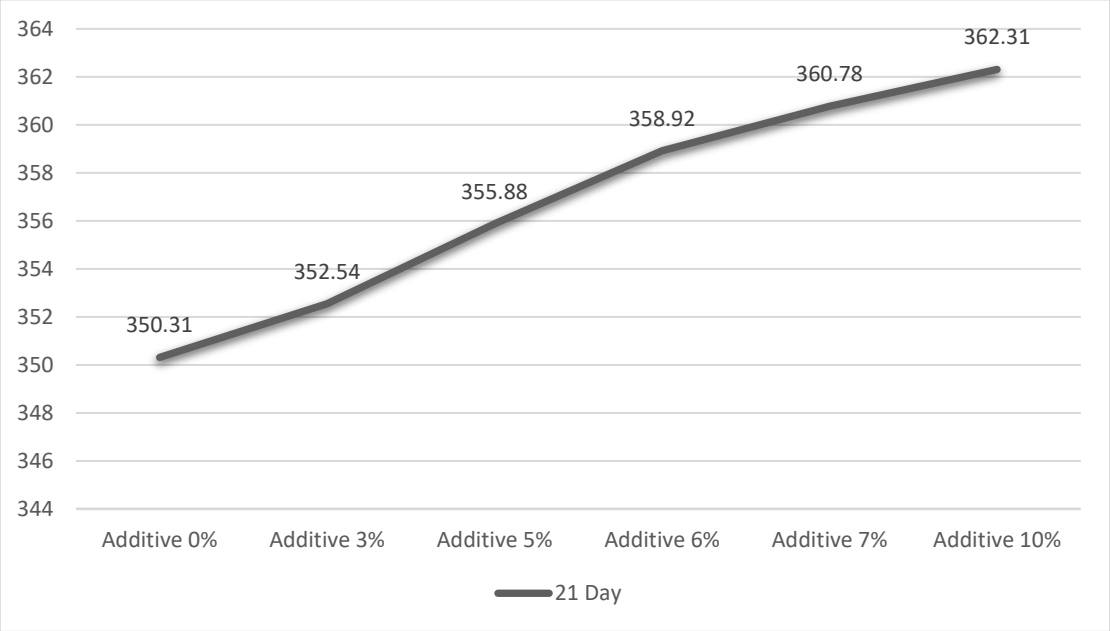


Figure 4. Graph of Concrete Compressive Strength at 21 Days old

Table 5. 28-Days Old Compressive Strength

No	Mixing percentage of Superplasticizer Sika Viscocrete- 3115 N	Mixing Date	Testing Date	Area	Load		Compressive Strength
					(kN)	(Kg)	
1	0%	19-7-2023	16/8/2023	225	647	65929.3	353.04
2	3%	19-7-2023	16/8/2023	225	651.7	66408.23	355.6
3	5%	19-7-2023	16/8/2023	225	658.5	67101.15	359.31
4	6%	19-7-2023	16/8/2023	225	660.3	67284.57	360.3

5	7%	19-7-2023	16/8/2023	225	664.2	67681.98	362.42
6	10%	19-7-2023	16/8/2023	225	668.2	68089.58	364.6

Source : 2023 Tests

When presented in a graph, the results of the compressive strength testing of normal concrete and concrete with the addition of Sika Viscocrete-3115 N superplasticizer at 28 days of age are as shown in the graph below:

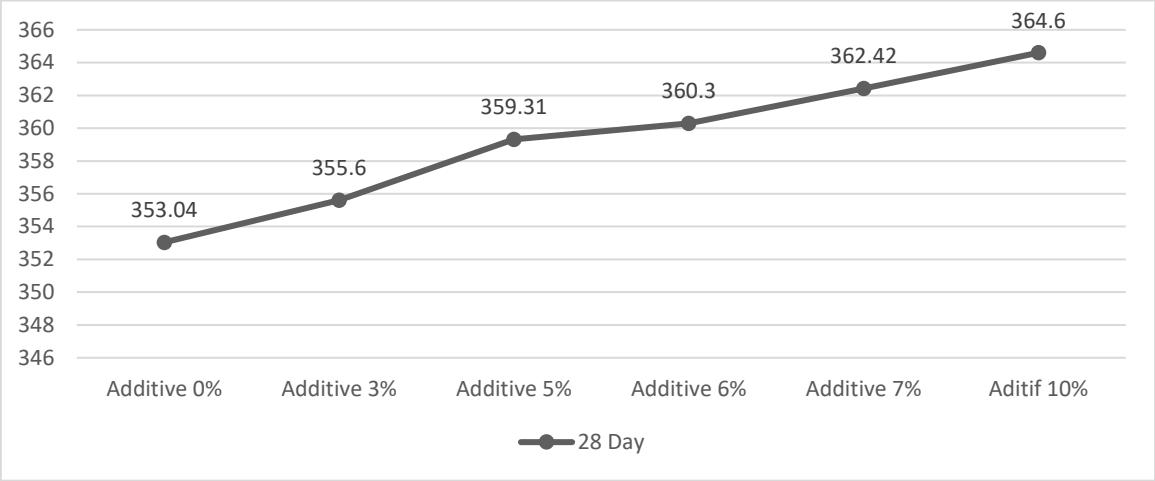
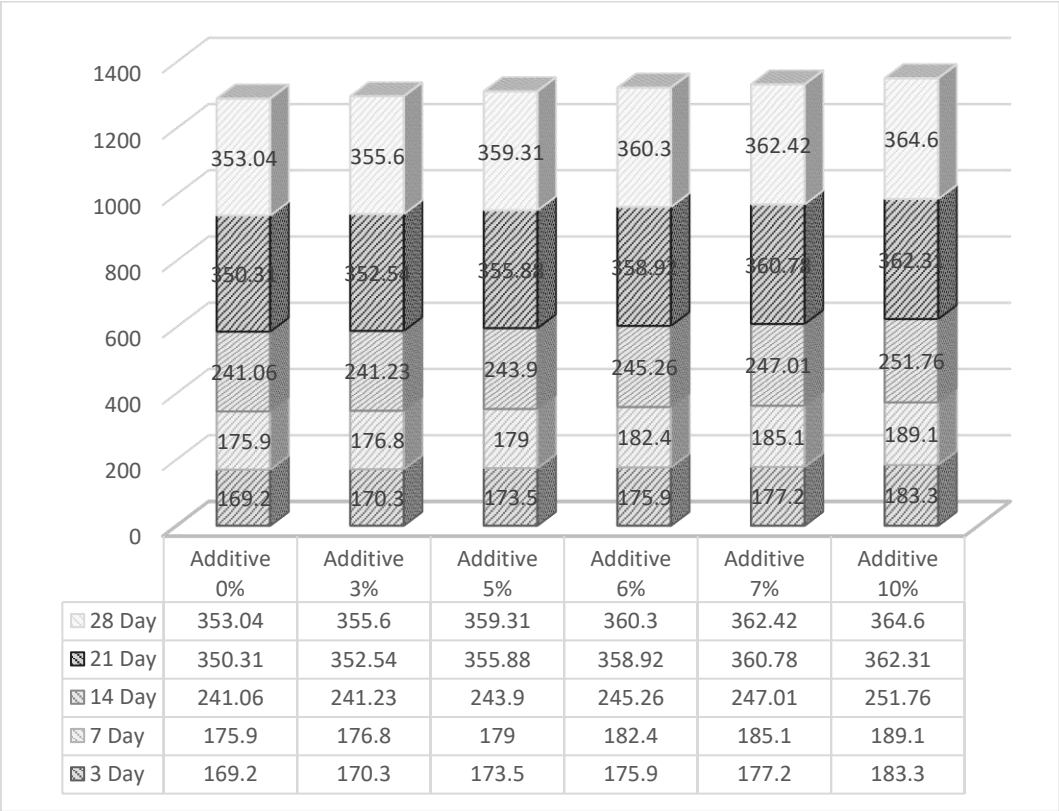


Figure 5. Graph of Concrete Compressive Strength at 28 Days old

The results of the compressive strength testing of concrete at 28 days of age demonstrate that the highest compressive strength was attained by concrete incorporating a 10% dosage of Sika Viscocrete-3115 N superplasticizer, achieving a value of 364.6 MPa. In comparison, normal concrete without additives (0% superplasticizer) recorded a compressive strength of 353.04 MPa. Concrete mixtures with 3% and 5% dosages of Sika Viscocrete-3115 N superplasticizer exhibited compressive strengths of 355.6 MPa and 359.31 MPa, respectively. Further increases in the superplasticizer dosage to 6% and 7% resulted in compressive strengths of 360.3 MPa and 362.42 MPa, respectively.



	Additive 0%	Additive 3%	Additive 5%	Additive 6%	Additive 7%	Additive 10%
28 Day	353.04	355.6	359.31	360.3	362.42	364.6
21 Day	350.31	352.54	355.88	358.92	360.78	362.31
14 Day	241.06	241.23	243.9	245.26	247.01	251.76
7 Day	175.9	176.8	179	182.4	185.1	189.1
3 Day	169.2	170.3	173.5	175.9	177.2	183.3

Figure 6. Concrete Compressive Strength Graph

According to the research findings, normal concrete achieved a maximum compressive strength of 353.04 MPa at 28 days of age. In contrast, concrete incorporating a 3% dosage of Sika Viscocrete-3115 N superplasticizer recorded a peak compressive strength of 355.6 MPa at the same age. With a 5% dosage of the superplasticizer, the maximum compressive strength reached 359.31 MPa at 28 days. A 6% dosage resulted in a maximum compressive strength of 360.3 MPa at 28 days, while a 7% dosage yielded a peak strength of 362.42 MPa at the same age. The highest compressive strength, 364.6 MPa, was observed at 28 days for concrete with a 10% dosage of Sika Viscocrete-3115 N superplasticizer.

The findings indicate that the incorporation of Sika Viscocrete-3115 N superplasticizer significantly influences the compressive strength of concrete. Specifically, with each incremental addition of the superplasticizer and a corresponding reduction in water content, the compressive strength of the concrete progressively increases. It can be concluded that the highest compressive strength, measuring 364.6 MPa, was achieved at 28 days for concrete containing a 10% dosage of Sika Viscocrete-3115 N superplasticizer. This 10% dosage positively impacted the compressive strength, resulting in an approximate 3.3% increase compared to normal concrete.

CONCLUSION

The use of Sika Viscocrete-3115 N superplasticizer significantly improved the compressive strength of K-350 concrete. The highest compressive strength of 364.6 MPa was achieved with a 10% dosage at 28 days, demonstrating that an appropriate superplasticizer dosage can optimize concrete quality. These findings confirm that Sika Viscocrete-3115 N is highly recommended for enhancing concrete durability. With proper formulation, concrete becomes stronger and more efficient, offering a viable solution for various construction projects.

REFERENCES

1. Andika, R., & Sari, P. (2020). Pengaruh Superplasticizer terhadap Kuat Tekan Beton pada Berbagai Variasi Campuran. Jurnal Teknik Sipil, 18(2), 45-53.
2. Budiman, A., & Setiawan, H. (2019). Analisis Penggunaan Superplasticizer dalam Meningkatkan Kinerja Beton. Jurnal Rekayasa Konstruksi, 25(1), 30-40.
3. Prasetyo, D., & Lestari, M. (2021). Studi Eksperimental Kuat Tekan Beton dengan Penambahan Aditif Superplasticizer. Jurnal Material dan Struktur, 10(3), 112-120.
4. Rahman, T., & Wijaya, B. (2018). Efektivitas Superplasticizer dalam Campuran Beton Mutu Tinggi. Jurnal Ilmu Teknik, 15(4), 75-83.
5. Susanto, F., & Ardiansyah, R. (2022). Optimalisasi Penggunaan Superplasticizer Sika Viscocrete - 3115 N terhadap Kuat Tekan Beton. Jurnal Teknologi Beton, 7(2), 55-65.