

# Comparison Study Of The Use Naftalena From Coal Tar Waste With Camper Naphtalene As Concrete Admixture

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## Abstract

Concrete is a mixture of Portland cement or other hydraulic cement, fine aggregate, coarse aggregate, and water, with or without additives (admixture). The naphthalene superplasticizer used comes from distillation of coal tar and a little from the rest of petroleum, but there is also camphor naphthalene. Where camphor grains contain 250-500 mg of naphthalene. Naphthalene is mostly produced from coal tar distillation, and a little from the rest of the fractionation of petroleum, by the molecular formula (C<sub>10</sub>H<sub>8</sub>) and in the form of two unified benzene rings. This compound is volatile, volatile even in the form of solids. The vapor produced is flammable. The purpose of this study was to determine the effect of the use of naphthalene from coal tar waste with camphor naphthalene as concrete admixture, and determine the effect of naphthalene from coal tar waste with camphor naphthalene on concrete toughness, density, water absorption, of concrete compressive strength. It is expected that the use of naphthalene can reduce the use of cement, and reduce water use. But it does not reduce the strength of the concrete so as to reduce costs in making concrete. The variations in the use of camphor naphthalene and coal tar naphthalene are 20%, 30%, 40%.

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*Keywords:* Naphthalene coal tar, naphthalene camphor, compressive strength.

## 1. Introduction

In the world of civil construction, concrete is generally used as construction material in structures. Concrete is a mixture of Portland cement or other hydraulic cement, fine aggregate, coarse aggregate, and water, with or without additives (admixture). As we age, the concrete will harden and will reach the strength of the plan (fc') at 28 days. Concrete has good compressive strength, therefore concrete is widely used or used for the selection of types of structures, especially structures, bridges and roads [1]. The increasing development in the construction sector is very influential on the existing concrete technology, its use is indeed very high in terms of cost, selection of good quality materials, with good compressive strength in concrete and reduce the risk of damage or porous concrete. As is known, that in cement production contributes to global warming due to CO<sub>2</sub> emissions which are quite large. In increasing the

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amount of cement used in the manufacture of concrete it will cause an increase in global warming, but for the use of Portland cement itself will continuously cause the basic material for making cement itself will be depleted [2].

Therefore, a lot of research to find alternative materials that can reduce the use of cement. There are several methods used to reduce the use of cement, and reduce the use of water but will not reduce the strength in concrete is to provide added material. Materials added to concrete mixes are usually used to modify the properties and characteristics of concrete such as using superplasticizer as admixture of concrete, in addition to being easy to do and saving costs. And use a mixture of materials for making concrete with waste that is no longer utilized and is environmentally friendly. And reduce costs when making concrete.

Previous studies using superplasticizer added ingredients namely Naphtalene and Polycarboxilate Additive to normal compressive strength, in this study the analysis was carried out to analyze the compressive strength of naphthalene and polycarboxilate superplasticizers compared to normal concrete without reducing the use of admixture mutubeton planned, with the addition of admixture by 1% of cement weight, and slump obtained  $10 \pm 2$ cm. The results obtained from the use of naphthalene admixture can increase the compressive strength of concrete by 8.8 MPa at 28 days of testing. The added ingredients in the use of admixture polycarboxilate when compared to the addition of naphthalene admixture, but it also can reduce water up to 40.98% for the use of polycarboxilate and 24.88% in the use of naphthalene admixture [3].

The naphtalene superplasticizer used mostly comes from distillation of coal tar, and a little from the rest of petroleum, but there is also naphthalene from camphor. Camphor is no longer a strange item in our lives, camphor has a very distinctive and sharp odor. Camphor contains a substance called naphthalene which is a compound. Where a camphor contains 250-500 mg of naphthalene. Naphthalene is an aromatic crystalline hydrocarbon in the form of a white solid with the formula naphthalene (C<sub>10</sub>H<sub>8</sub>) and in the form of two unified benzene rings. This compound is volatile, volatile even in the form of solids. The vapor produced is flammable [4].

Therefore, it is interested to try to make a research on the comparison of the use of naphthalene from coal tar waste with camphor naphthalene as concrete admixture. With the hope of using camphor naphthalene, it can reduce the use of cement and reduce water, the price will be economical.

In this study offers that the incorporation and use of added materials such as camphor naphthalene and coal tar waste will be more practical in work, easy to apply (workability), good elasticity in concrete, the time of initial binding (setting time) in a gradual process will be good, the price materials needed for naphthalene camphor added ingredients are cheaper and economical prices, naphthalene camphor added ingredients are not hard to find, as well as saving costs when making concrete. The unit price of concrete will not be too expensive if the added material used is relatively economical and produces good quality concrete

## 2. Methodology

The research method used in this thesis is an experimental method in a concrete laboratory. The experimental method is an experimental method used in studying the effect of a variable on other variables that function to improve the compressive strength and quality of concrete by providing added materials, one of which is the use of admixture. All processes or procedures in conducting this research refer to SNI (Indonesian National Standard). This research will be conducted at PT Wika Beton Laboratory, from September 2019-January 2020.

Before carrying out the process of making concrete (mixing), the first thing we will do is prepare the materials that will be used for the concrete manufacturing process, such as testing the materials that will be used so that we know the quality and specifications for the use of these materials, and according to the specifications of the concrete we need. The process of testing materials such as testing an aggregate such as coarse (splite) and fine aggregate (sand) testing is often called (sieve analysis test) aims to find out the fineness of an aggregate, specific gravity aims to determine the specific gravity at an aggregate both fine and coarse aggregate, absorption (absorption) aims to determine the water content in an aggregate on a dry surface, the weight content (density), organic content of fine aggregates (organic Impurities for fine aggregates) aims to determine the levels of organic or impurities in the sand

we are testing by mixing water and then we match the color of the water with a test tool that we normally use (Orbeco Analytical System, Inc.).

After all stages of the physical aggregate testing process is complete, then the process of designing and selecting materials that are suitable for the purpose of the concrete in accordance with certain specifications and strengths (mix design), when the process of designing a mixture on concrete is according to specifications we will do a trial of making fresh concrete usually the process stirring can use a mixer or with a manual stirring process, after the stirring process has been homogeneous or evenly distributed we are testing fresh concrete between other slump tests using abram cones and iron sticks or using flow test boards, aiming that we know the freshness of fresh concrete and making cylinder test sample.

This study the constituent materials in the concrete mixture are as follows:

- a) Coal tar used comes from PT. Krakatau Steel
- b) Cement used Type 1 - OPC from Wika Beton.
- c) The coarse aggregate used originates from the Cigudeg splite, and the fine aggregate used Galunggung sand received by PT. Wika Concrete CPB
- d) The water used comes from the Bor wells in the Gunung Putri - Bogor area
- e) admixture materials used in concrete are Naphthalene camphor type superpartilizer and coal tar naphthalene.

Table 1. Material Requirements for 1 m<sup>3</sup>

Material	Unit	Mix 0%	Mix 20%	Mix 30%	Mix 40%
Cement	Kg	480	480	480	480
Sand	Kg	740	740	740	740
Splite	Kg	1065	1065	1065	1065
Water	Kg	90	90	90	90
Coal Tar	Kg	-	300	300	300
Naphtalene Ball	Kg	-	400	300	200

The study was conducted as many as 7 variations namely control concrete, naphthalene with variations of 20%, 30%, 40% and naphthalene coal tar variations of 20%, 30%, 40% with a total concrete sample of 63 concrete samples.

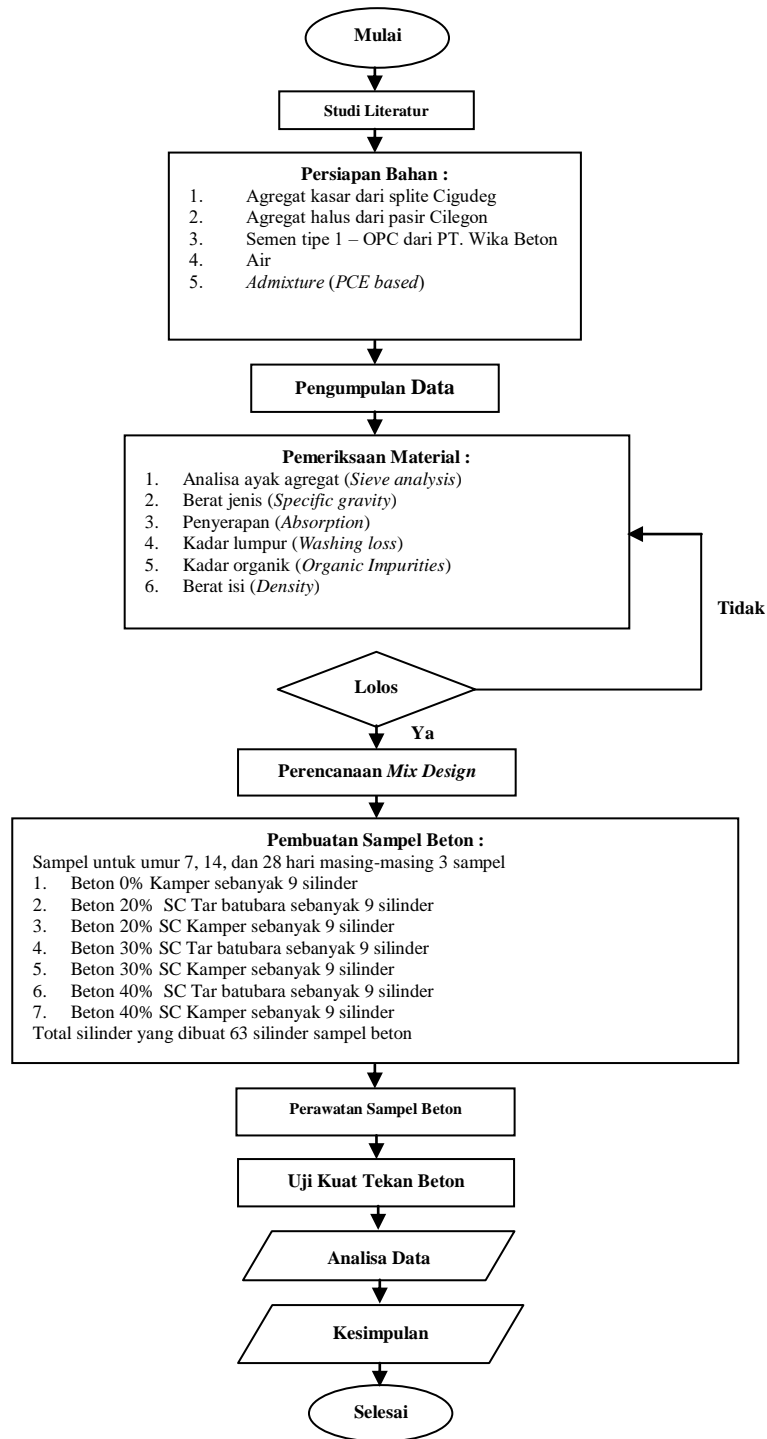


Figure 1 Research Flowchart (Flowchart)

### 3. Result and Analysis

#### 3.1. Coal tar

Coal tar is a by-product of the carbonation process of coal or wood during gas production. Tar is liquid, dark in color, and has a strong odor. This material is sensitive to temperature changes. Tar contains toxic chemicals that are harmful to human health and the environment. Tar is a mixture of a solution of disperse wood smoke in water made by condensing pilorisi smoke. Tar can be produced from coconut shell pilorisi with a phenol content of 4.13%, 11.3% carbon, and 10.2% acid [5].



**Figure 2** Coal Tar  
Source : Research Data

#### 3.2. Camphor naphthalene

Camphor naphthalene contains 250-500 mg of naphthalene. Naphthalene is mostly produced from distillation of coal tar, and a little from the rest of the fractionation of petroleum, by the molecular formula ( $C_{10}H_8$ ) and in the form of two unified benzene rings. This compound is volatile, volatile even in the form of solids. The vapor produced is flammable [6].



**Figure 3** Naphtallene Ball  
Source : Research Data

#### 3.3. Slump Testing (Workability)

Slump testing (workability) is needed to determine the level of fresh concrete permeability. The higher the value of the slump, the concrete is thinner and easier to do, and vice versa. In this study the researchers planned a slump value of  $10 \pm 2$  cm.

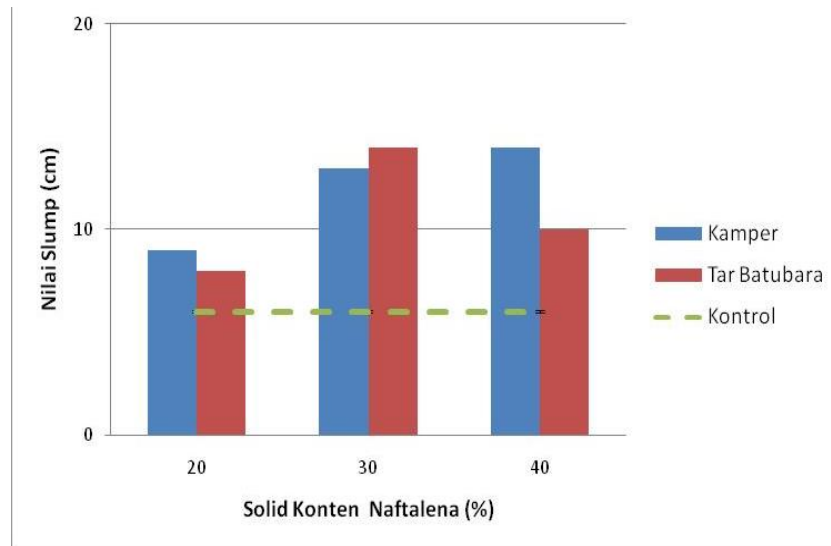


Figure 4 Slump Test (in Indonesia)

In a linear trendline the concrete using camphor added material or coal tar will experience an increase in slump so that the concrete acceleration will be better which has an easy impact on the process. For the highest slump value in 40% camphor concrete and 30% coal tar concrete with 14 cm slump value.

#### 3.4. Concrete Density Test

Density (density) is a test of weight or volume weight, one of the benefits of testing the results can be used to calculate the weight on the structure or calculate the loading.

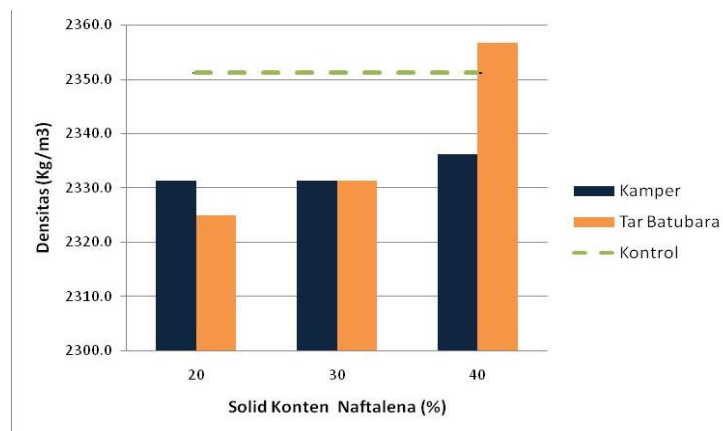


Figure 5 Density Concrete (Density)

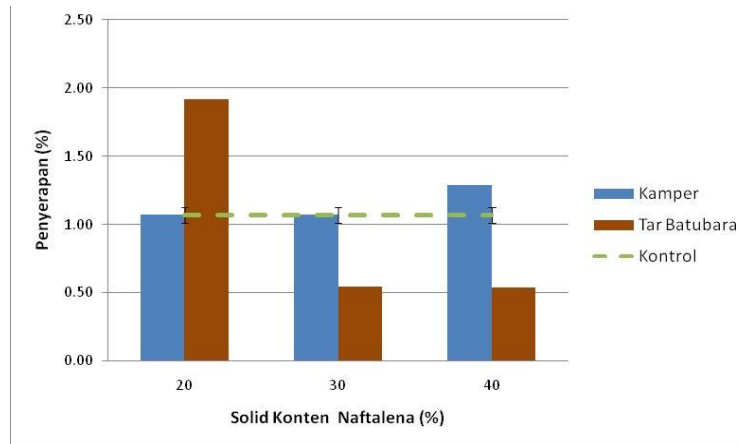
Source : Research Data

Concrete has a density of 2200-2500 kg / m<sup>3</sup> 40% coal tar concrete has the highest density against other variations.

#### 3.5. Concrete Absorption Testing

Water Absorption Testing can find out what percentage of concrete can absorb water, for normal concrete conditions a smaller percentage of water absorption is better because the concrete can be waterproof so that if applied to the structure it can prevent water from entering so the reinforcing iron is not exposed to water making the structure durable and strong. In this research, the results of absorption of concrete using camphor the greater the percentage of

camphor variation, the greater the absorption of concrete. The result of absorption of 40% camphor concrete variation has the greatest value of 1.29% of the other concrete.

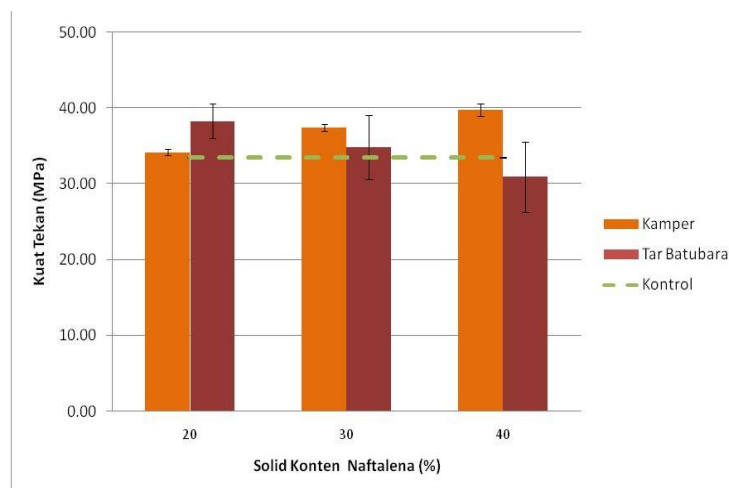


**Figure 6** Absorption Concrete  
Source : Research Data

The results of the absorption of concrete using 20% coal tar has the highest absorption of 1.92% compared to other coal tar variations and control concrete.

### 3.6. Concrete Compressive Strength Testing

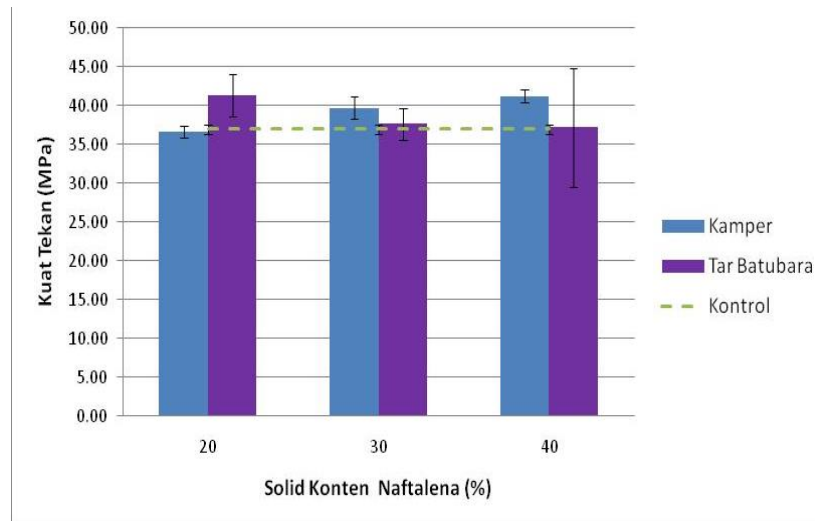
Concrete compressive strength testing is done by using a compressive test tool with 9 concrete samples per variation. 3 samples on days 7, 14, 28 other samples on day 28. Following are the results of the 7-day-old concrete compressive strength test:



**Figure 7** Compressive strength 7 day  
Source: Research Data

In the study of compressive strength of 7 days old concrete that is control concrete produces 33.53 MPa (figure 7). Using camphor naphthalene that is a variation of 20% has a compressive strength of 34.20 Mpa, 30% has a compressive strength of 37.40 Mpa, 40% has a compressive strength of 39.80 Mpa. While naphthalene coal tar produces compressive strength, that is, the variation of 20% has a compressive strength of 38.30 MPa, 30% has a compressive strength of 34.90 MPa, 40% has a compressive strength of 30.92 MPa.

### 3.7. Compressive Strength Testing for 14 Days

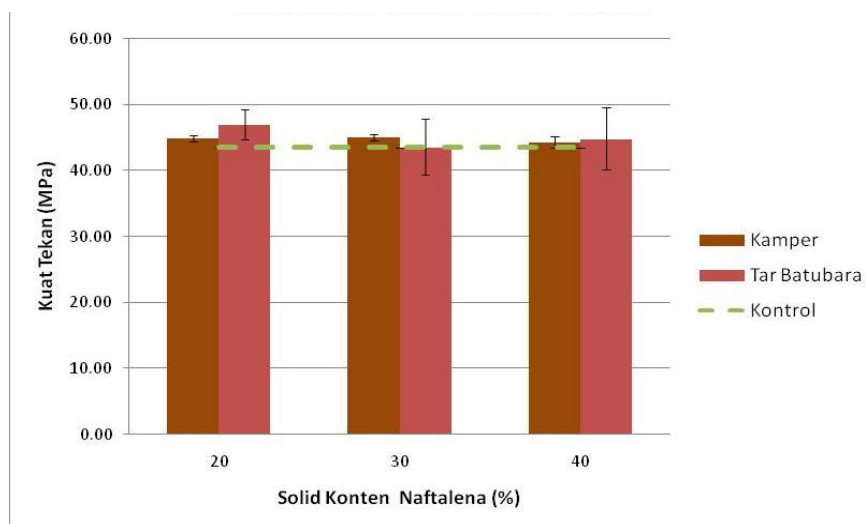


**Figure 8** Compressive Strength Testing for 14 Days  
Source: Research Data

In the study of compressive strength of 14 days of age, the control concrete produced 36.97 MPa (figure 8). Using camphor naphthalene that is a variation of 20% has a compressive strength of 36.63 MPa, 30% has a compressive strength of 39.77 MPa, 40% has a compressive strength of 41.26 MPa. While naphthalene coal tar produces compressive strength, that is, the variation of 20% has a compressive strength of 41.34 MPa, 30% has a compressive strength of 37.65 MPa, 40% has a compressive strength of 37.21 MPa.

### 3.8. Compressive Strength Testing for 28 Days.

In the research of 28 days the compressive strength of concrete that is control concrete produces 43.46 MPa (figure 9). Using camphor naphthalene that is a variation of 20% has a compressive strength of 44.85 Mpa, 30% has a compressive strength of 45.05 Mpa, 40% has a compressive strength of 44.27 Mpa. While naphthalene coal tar produces compressive strength, that is, the variation of 20% has a compressive strength of 46.97 MPa, 30% has a compressive strength of 43.58 MPa, 40% has a compressive strength of 44.83 MPa.



**Figure 9** Compressive Strength Testing for 28 Days  
Source: Research Data



#### 4. Conclusion

- a) In this study the value of camphor slump is 40% and coal tar concrete is 30%
- b) higher which is 14 cm compared to other concrete and control concrete variations. With this, concrete using 40% camphor and 40% coal tar is easier to work with.
- c) In this study the results of the density of concrete with 40% coal tar have the highest supply of 2356.7 kg / m<sup>3</sup>.
- d) Concrete using camphor 40% variation has the greatest absorption which is 1.29% compared to other variations and control concrete, while concrete using 20% coal tar has the greatest absorption which is 1.92% compared to other coal tar variations and control concrete .
- e) For the age of 14 days concrete using camphor 40% and concrete using coal tar 20% has a compressive strength that is almost the same 12% higher than the control concrete. For the age of 28 days camphor concrete 30% has 3.7% higher than the control concrete and coal tar concrete 20% has 8.1% higher than the control concrete.

#### 5. Recommendation

The recommendations that can be derived from this research are:

- a) For further research, it can be continued with the initial binding time research (setting time).
- b) The recommended use of the strength produced for the strength value using camphor naphthalene, that is, the variation of 20% has a compressive strength of 44.85 Mpa higher than the control concrete with 43.46 MPa. Whereas for naphthalene coal tar produces compressive strength that is a variation of 20% has a compressive strength of 46.97 MPa for control concrete and other concrete variations.

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