Mixture of Waste with Used Tire and Eggshell as Alternative Concrete Raw Materials on Simple Dwelling

Irma Wirantina Kustanrika, Ranti Hidayawanti*, Supriadi Legino and Abdul Rokhman

***Abstract*— With the rampant development where the environmental aspect should be considered, it is necessary to reuse a material derived of the natural resources from which the source originates from the product waste which is the result of human discharges. The development of science in the field of concrete Technology allows the use of waste into a concrete forming material, so that at one side the use of natural materials that may damage the environmental can be restricted and on the other hand waste material utilized optimally for the raw materials of concrete formation. One of them is with using waste egg shells and the former inner tires that can't be used again. In this research will use raw materials eggshell as an additional material of cement and used tires as substitute of fine aggregate for normal concrete mixture. This research calculates the value of Concrete Press Strength, the value of Slump Test (Workability), and Porosity if the composition of the fine aggregate mixture is replaced constantly use of waste inner tires with aggregate composition smooth on a mixture of normal concrete composition with a value of 7% addition, 10%, and 13% as well as eggshell as an added cement material with value addition of 10%, 15%, and 20% as a result of concrete design mix normal.**

***Keywords*— Inner used tires, eggshell, normal concrete, simple dwelling.**

I. INTRODUCTION

In road construction activities, construction activities, and agricultural or water activities almost all use concrete. The use of concrete must have something to do with the use of cement, water, gravel and sand or other additives to achieve some desired objectives. The use of waste tires and eggshells aimed to overcome the problem of global warming. Used tire waste comes from inner tires and outer tires that are not feasible to use anymore and eggshell wastes are derived from egg residues consumed by humans but also the accumulation of waste from bakeries / cakes, noodle factories or waste hatching left in hatchery industries (hatchery).

Along with the number of used tires that are not feasible to use and egg shells are wasted because it is considered no benefit but it turns out the waste still has a high economic value if it can be managed properly.

The content of calcium is large enough to be utilized as a cement-added material. In Indonesia egg shell production will continue to abound as long as the egg is produced in the field of animal husbandry and used in restaurants, bakeries and noodles as raw materials for making food. According to data from the Directorate General of Livestock, egg production in Indonesia is around 1.5 million tons per year. So far, the potential of eggshell waste in Indonesia is quite large, but the potential until now has not fully utilized optimally. Utilization of eggshell is still more dominant as raw materials to make ornamental crafts.

Used tire waste is the world's largest waste contributor and belongs to a class of materials that non-bio-degradable, persistent, and persistent (persistent) organisms will not rot. If waste tires are burned will produce one of the most dangerous materials in the world, namely Dioxin. From the dangers of waste tires used for humans and the environment, there is a positive side of the main constituent material tires resistant to water, has sufficient stability, high resilience, and has a level of flexibility and bending properties are quite good and rubber has the properties to absorb vibration, a trial was conducted on the utilization of waste scrap tires as a base material of aggregate coarse aggregate on a normal concrete mixture.

II. PROCEDURE FOR PAPER SUBMISSION

According to Amari, Takeshi Themelis, Nickolas J.Wernick, Iddo K. [1], Using information on scrap tire composition and the current markets using them, we examine the technologies used to recover their value either for energy or as rubber. As the majority of scrap tires are used as fuel, we calculate their life cycle energy budget considering both the energy consumed for tire production and the energy recovered from their use as fuel. Based on our findings, we draw some preliminary conclusions on how to maximize value recovery from this ubiquitous artifact of industrial societies. According to Edinçliler, Ayşe Baykal, Gökhan Saygili, Altug [2], Use of the processed used tires in embankment construction is becoming an accepted way of beneficially recycling scrap tires due to shortages of natural mineral resources and increasing waste disposal costs. Using these used tires in construction requires an awareness of the properties and the limitations associated with their use. The main objective of this paper is to assess the different processing techniques on the mechanical properties of used tires-sand mixtures to improve the engineering properties of the available soil. In the first part, a literature study on the mechanical properties of the processed used tires such as tire shreds, tire chips, tire buffings and their mixtures with sand are summarized. In the second part, large-scale direct shear tests are performed to evaluate shear strength of tire crumb-sand mixtures where information is not readily available in the literature. The test results with used tire were compared with the

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other processed used tire-sand mixtures. Sand-used tire mixtures have higher shear strength than that of the sand alone and the shear strength parameters depend on the processing conditions of used tires. Three factors are found to significantly affect the mechanical properties: normal stress, processing techniques, and the used tire content. And opinion Cecich, Vanessa Gonzales, Linda Hoisaeter, Ase Williams, Joanne Reddy, Krishna [3], The results of this study indicate that shredded tires have a definite potential to be used as a backfill material for retaining structures.

Accoding to Tsai, W. T. Yang, J. M.Lai, C. W.Cheng, Y. H.Lin, C. C. Yeh, C. W.[4], The objective of this work was to study the chemical and physical characterization of eggshell and eggshell membrane particles prepared from the hen eggshell waste. Under the characterization measurements investigated, it was found that the pore structures of the two biomaterials belong to a typical Type II, indicating that they should be basically characteristic of nonporous materials or materials with macropores or open voids.

And according to Moyos Muhammad Yusuf [5], Dry egg shells contain about 95% calcium carbonate weighing 5.5 grams (Butcher and Miles, 1990). Meanwhile, Hunton (2005) reported that the egg shell comprised 97% calcium carbonate. In addition, the mean of the eggshell contains 3% phosphorus and 3% consists of magnesium, sodium, potassium, zinc, manganese, iron, and copper (Butcher and Miles, 1990). The content of calcium is large enough to be utilized as a cement-added material.

III. Methodology

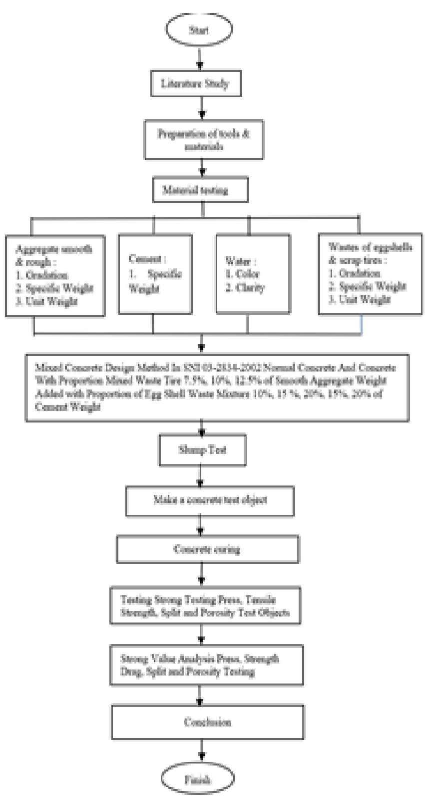

Fig. 1 Flow Chart of Research Methods

A. *Mix Design Method SNI 03-2834-2002*

Preparation of mixed concrete with mix design method of SNI 03-2834-2002 because considering economical side when compared with other method and also this method result accurate from what have been planned. Then the mix design result is substituted to the proportion of test specimens with eggshell waste variation 10%, 15%, 20% of cement and waste of used tire 7.5%, 10%, 12,5%

B. *Manufacture of Test Objects*

In the fifth stage, the test object is made of 9 cylinders in each variation of waste of eggshell 10%, 15%, 20% of cement and tire used 7.5%, 10%, 12.5%. So the total of all specimens to be made ie as many as 76 pieces. Before printing the concrete into the cylinder first to test the concrete crunch itself or the slump test. Here is a table of the number of concrete test objects and test age:

TABLE I: Number of Concrete Test Objects and Age of Test

Sample	Test specimen (Cylinder)	Testing (Day)
Normal Concrete	6 6 7	7 14 28
concrete waste scrap tires 7,5% + eggshell 10%	6 6 7	7 14 28
concrete waste scrap tires 10% + eggshell 15%	6 6 7	7 14 28
concrete waste scrap tires 12,5% + eggshell 20%	6 6 7	7 14 28
Total	76	

C. *Concrete Treatment (Curing)*

Concrete treatment is done so that the concrete that has been made can achieve the expected strength. Concrete treatment is usually soaked in water until the concrete is 28 days old and reaches 100% strength.

D. *Concrete Testing*

For concrete testing, concrete strength test and concrete tensile strength were performed on 7, 14 and 28 days, while porosity test was done on day 28 when concrete reached 100% strength.

E. *Analysis Technique*

The data obtained from the results of the research and then analyzed and compared the comparison between normal concrete with concrete mixed waste as substitution. With reference data that can be through slump testing trials, porosity testing, and concrete compressive strength and tensile strength of concrete on all specimens that have been made, then the conclusions can be drawn from this study.

IV. Analysis

A. Strong Concrete Testing Test Result

After the treatment reaches the specified age (7 days, 14 days and 28 days) then the concrete sample in the compressive strength test using the Compression Test tool. Here are graphs of concrete compressive strength test results:

Normal Concrete

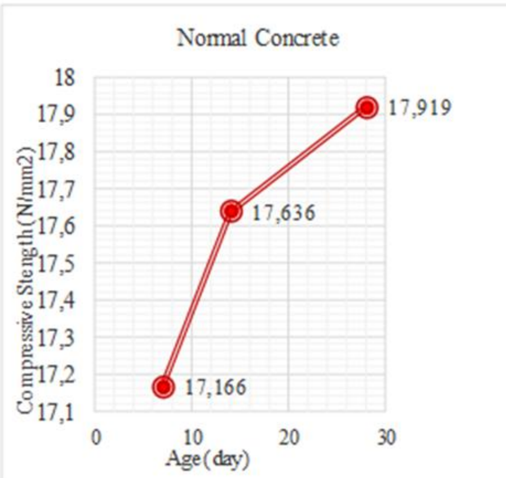

Fig 2: Normal concrete compressive strength

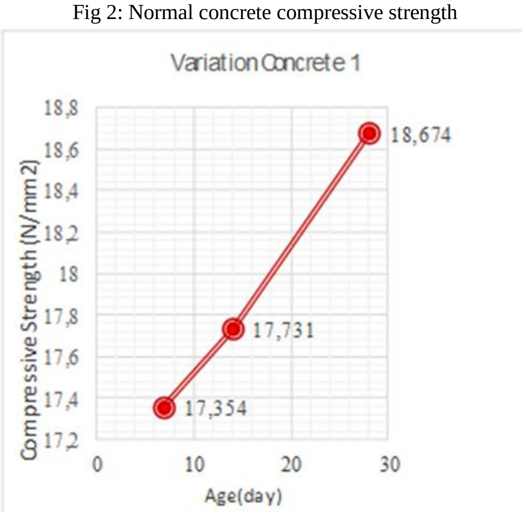

Fig 3: Variation Concrete 1, Waste of 7.5% Used Tire and Eggshell

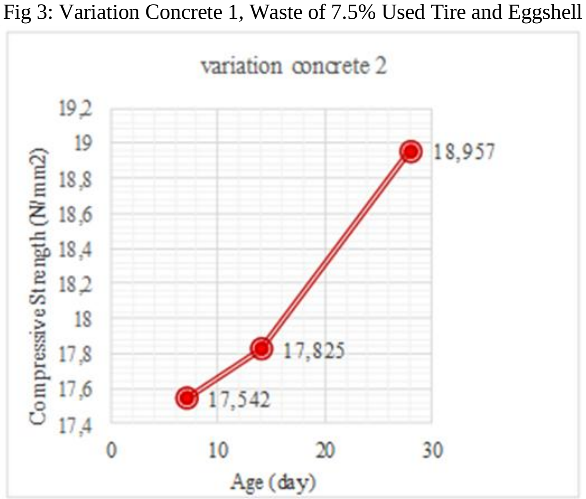

Fig 4: Variation Concrete 2, Waste of 10% Used Tire and Eggshell 15%

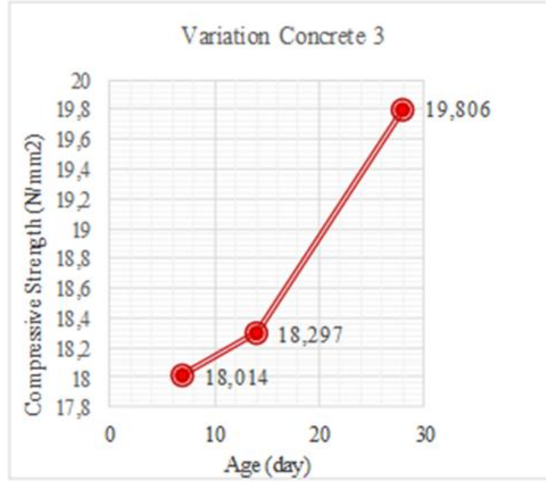

Fig 5: Concrete Variation 3, Waste of 12.5% Used Tire and Eggshell 20%

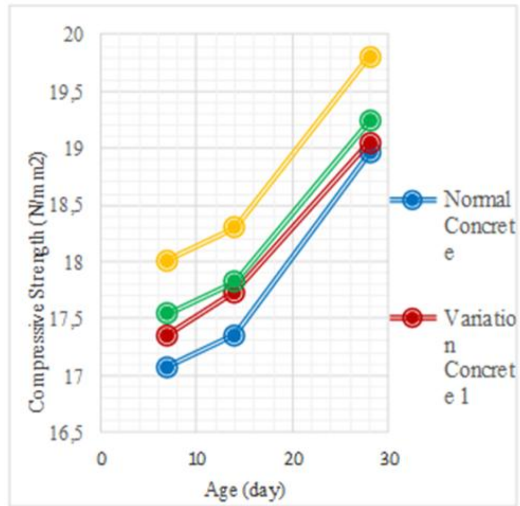

Fig 6: Normal Concrete - variation 3

From reading the data table 3.1 and chart 4.5 it can be seen that the highest value of compressive strength is concrete with variation of 3 waste 12.5% of tires used and 20% eggshell that is 19,806 N / mm².

B. Stength Tensile Test Results

Of the total number of specimens that have been made, then performed the treatment (curring) according to the age that has been determined. After the treatment reaches the determined age (7 days, 14 days and 28 days) then the concrete sample in the tensile strength test using the Compression Test tool. Here are the graphs of tensile strength testing results:

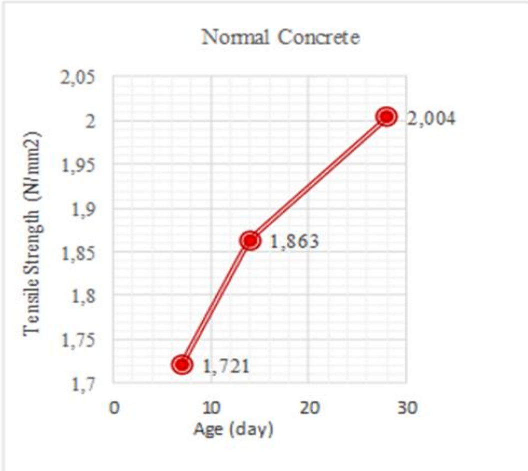

Fig 7: Normal Concrete

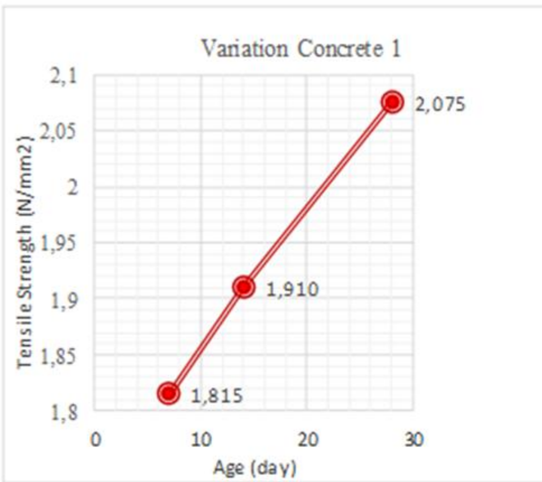

Fig 8: Variation Concrete 1, Waste of 7.5% Used Tire and EggShell 10%

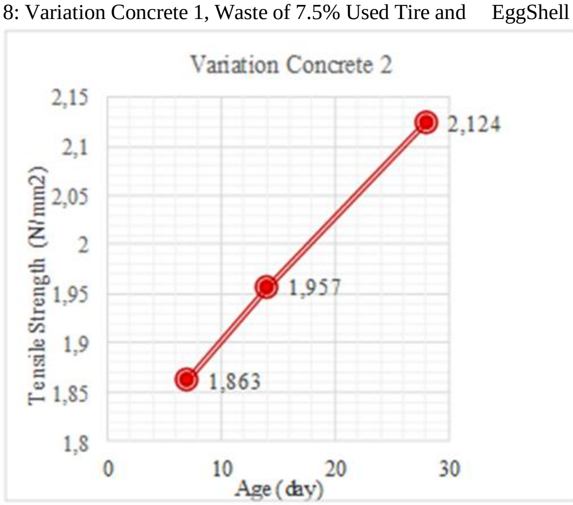

Fig 9: Variation Concrete 2, Waste of 10% Used Tire and EggShell 15%

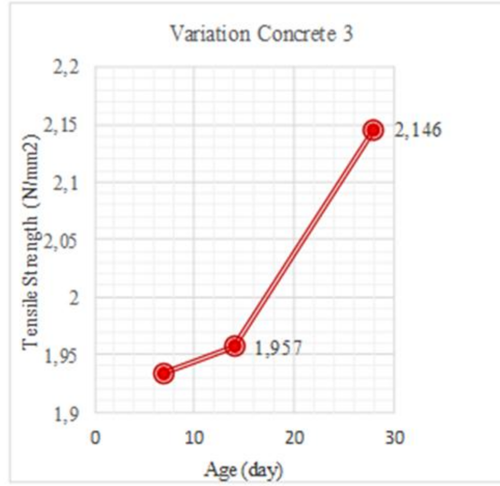

Fig 10: Concrete Variation 3, Waste of 12.5% Used Cut and EggShell 20%

Normal Concrete - Variation 3

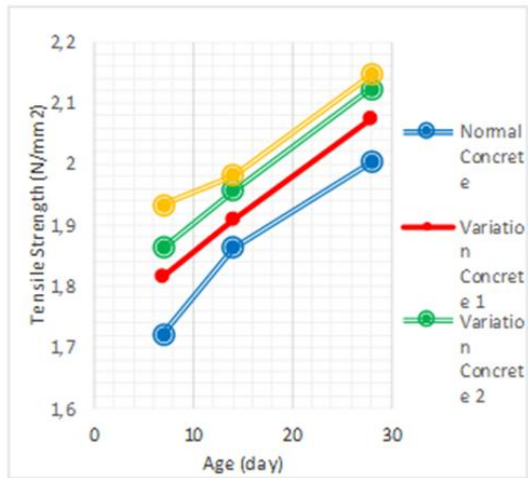

Fig 11: Normal concrete - variation 3

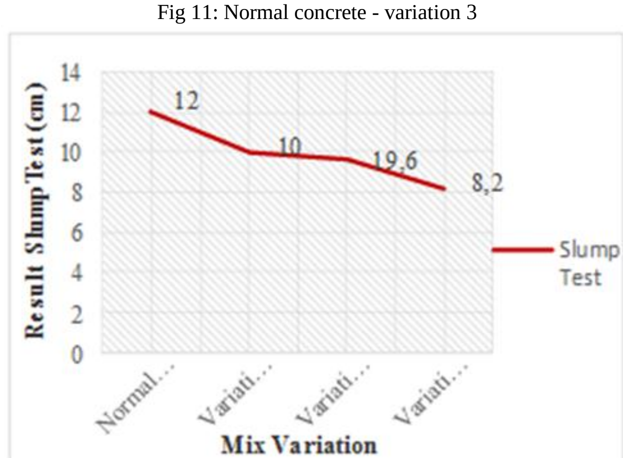

Fig 12: Test Results of Slump Test

C. Porosity Test Result

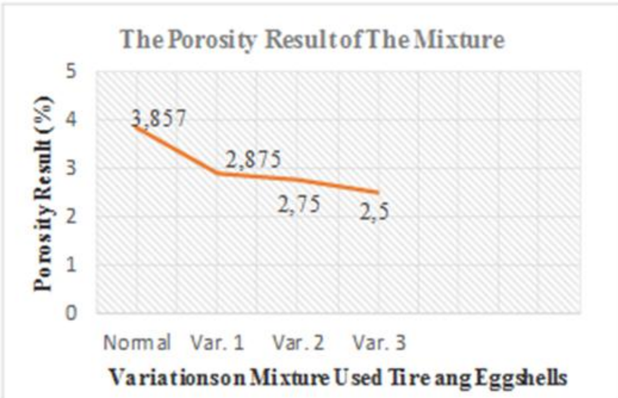

Fig 13: Porosity Test Result

V. CONCLUSION

The conclusion is:

a. The value of slump test for concrete use of percentage variation of 1 is 100 mm, the percentage of use of concrete variation 2 is 96 mm, the percentage of use of variation 3 is 82 mm, while the slump test value in normal concrete is 120 mm.

b. Porosity test results in this study is quite influential. With different values up to 1.3%, with the porosity value of each variation is 2.875% for variation 1, 2,750% for variation 2, 2,500% for variation 3, and 3, 857 for normal concrete.

c. The highest value of compressive strength is concrete with variation 3 (waste tire 12.5% and egg shell 20%) that is 19,806 N / mm².

d. The highest tensile strength value is concrete with variation 3 (waste of tire 12.5% and egg shell 20%) that is 2,146 N / mm².

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