Abstract. According to National Statistics Approximately 1.35 billion gallons of used oil are generated yearly. With the increasing of the concrete usage, a more cost effective and economic new type of admixtures may give positive impacts on the Malaysian construction building as well as worldwide concrete usage. To objective of this is study is to investigate the effect of used cooking oil in terms of slump test, compressive strength test and rebound hammer. By adding the used cooking oil to the concrete, it increases the slump value from 4% to 72%. And the compressive strength have an increment from 1% to 16.8%. The used cooking oil obtains the optimum contribution to the concrete mix proportion of containing used cooking oil of 1.50% from the cement content. The result of used cooking oil from experimental program of slump value and compressive strength proved that used cooking oil have positive effects on replacement of commercially available superplasticizer.

1. Introduction
Over the years, it has been increasing of industrial wastes and by-products either solid based and/or liquid based chemical in all over the world. Even though the environmental agencies over the country have their laws and regulations regarding the safe handling or disposal of them, but there was a big chunk of such waste are illegally disposed off, which may cause severe environmental disorder. Pollution towards environment can caused unstable ecosystem, harm humans and caused disorder in living organisms [1]. In some rural areas, we can still find people cooking and bathing using the water at a river which also cause pollution. Oil is one of the contributors towards water pollution which causes nearly a quarter of all pollution incidents [2]. Oil is one of the most commonly reported types of water pollution and causes nearly a quarter of all pollution incidents. A rapid growth of food service sector in Malaysia has led to a sudden increase of used cooking oil as wastes. Some of this used cooking oil has been properly disposed but most of them are illegally disposed. Nowadays improper disposal of used cooking oil has been a serious issue. According to the Malaysia HRI Food Service Sector Report in 2009 [3], Trade sources comment that the food service market has been growing at a rapid average rate of around 7 percent per annum over the past five years. They indicated that this market is likely to grow at between 7 percent and 10 percent per annum over the next three to five years. Used cooking oil will increase the loading in water treatment plant process. Is required higher amount of energy to treat the wastewater. One of the most popular solutions nowadays is by recycling the used cooking oil and converts it into biodiesel [4]. In Malaysia, there are companies which have a valid recognized license to collect the used cooking oil from community and processed the oil into biodiesel [5]. Previous research was reported that used oil such as used engine oil and soy bean oil were having a potential to act as concrete admixture to improve concrete performance. According to Beddu (2012) [6], a certain dosage of used engine oil can improve the fresh and hardened properties of various types of concrete. In the other hand, their performance of used engine oil in concrete
containing fly ash (FA) [7] and Microwave incinerated Rice Husk Ash (MIRHA) did not impart any negative effects and comparable with commercially available superplasticizer [8]. Bilal et. al [9] have studied the effects of used engine oil on fresh and hardened properties and also structural performance of concrete and it gave the positive effects comparable with the available commercially air entraining agent. Used engine oil also suggested by Aravind and Animesh [10] to be use in highway construction but requires well organized oil collection system. The further research is noteworthy to produce the good quality and performance of concrete. The effects of soybean as a curing agent for concrete pavement have been done [11].

2. Methodology

Seven mixes were made with water/binder ratios (w/b) of 0.55. Water and admixture was measured in percentage by weight proportion of cement used. Ordinary Portland Cement (OPC) Type 1 was used in this research, according to BS EN 197-1 2000. OPC Type 1 was preferred because the observation on concrete properties can be done in normal hydration process hence the advantages of silica fume usage in concrete can be optimized. Aggregate that used to prepare concrete are confirming to BS 882: 1992. In this experimental program, used cooking oil was used as chemical admixture to improve concrete performance. The specimens were compacted by external vibration, varying the vibration time according to its consistency. After casting the specimens in the moulds, they were covered with polythene sheet to prevent evaporation and left for 24 hours. Eventually, all specimens were removed from the moulds and were transferred into the water bath at room temperature for curing until the desired age of testing at 3, 7, 28 and 56. The tested properties of fresh concrete included slump that carried out conforming BS 1881: Part 102: 1983. The tested properties of hardened concrete were the compressive strength, and flexural test were measured at 3, 7, 28 and 56 days for compressive strength test while 28 and 56 days for rebound hammer test also 28 days for flexural test.

3. Results and Discussions

3.1. Concrete Workability

As shown as Figure 1, the slump value for the control test was 25mm, and by addition of different mixed proportion of UCO, the slump value was increased from 25mm to 43mm as for mixed proportion of 2.00% UCO. From control test to 0.25% UCO, there is 0% of increment for the slump test. There are increment of 4% of slump value from 0.25% UCO to 0.50% 0f UCO. From 0.50% to 1.50%, the increment of slump value was similar until it comes to 2.0% UCO. From the increasing of 25mm to 43mm, the slump value was increase by percentage of 72%. Until 1.50% UCO, the slump value only increase averagely by 16%, but from 1.50% UCO to 2.00% UCO, the slump value increase by 48% which was a high increment compare to previous mixed proportion of UCO.

![Figure 1: Slump Value of Concrete containing UCO](image1)

![Figure 2: Compressive strength for concrete containing UCO](image2)

3.2. Concrete Compressive Strength

For the early curing ages of 3 days, concrete strength of control test was 16.38MPa. From control test to 0.25%, there is an increment of 3.42% for the compressive strength. While from 0.25% to 0.50%,
the increment compare to control test is 7.26%. For the following 0.75% and 1.00%, the increments of compressive strength are respectively being 9.22% and 11.34%. The 1.50% of UCO achieves the highest increment which is 16.80% and the final 2.00% of UCO was the lowest increment of 3.30%. The graph of result goes up compare to the control test and shows the positive increment. For the following 7 days, the hardened concrete continues the development of concrete strength, while the strength for control test was 19.33MPa. The concrete strength for 1.50% UCO was also higher than control test with increment of 16.80% and the other mixed proportion obtained similar increment percentage from curing ages of 3 days. All of the mixed proportion achieved higher concrete strength than the control test. The graph pattern of increment for curing ages of 7 days was similar to the result of 3 days. Figure 2 show the different of compression test result from curing ages of 3 days to 56 days. For the compressive strength test of 28 days curing ages, the final strength of concrete strength was 26.09MPa. The highest concrete strength for different mixed proportion of UCO was 1.50% UCO which is 30.48MPa while the concrete strength for control test is 26.09MPa. The same result with curing ages of 3 days and 7 days, the range of increment for compressive strength from 3.30% to 16.80%. While for the compression test of 56 days of curing ages, the increment of the strength was similar with previous curing ages and 1.5% UCO stills the highest strength with 34.19MPa than 30.30MPa of control test.

3.3. Flexural Strength

From Figure 3, it can be clearly seen that the flexural strength increase from 1.8MPa of 0% used cooking oil to 2.01MPa of 1.5% used cooking oil. The flexural strength is increased by 11.7%. Based on the graph, it shows that further addition of used cooking oil had decreased the flexural strength from 2.01MPa of 1.5% used cooking oil to 1.91MPa of 2.0% used cooking oil. The flexural strength value had decreased by 5%. However, the flexural strength of 2.0% used cooking oil is still higher than control test (0% used cooking oil). The flexural strength of 0% used cooking oil to 2.0% used cooking oil is increased by 6%.

![Figure 3: Graph of Flexural Strength VS Percentage of UCO](image)

Based on the results, it is positively shows that the addition of used cooking oil in OPC concrete can actually increase the flexural strength of concrete. But this increasing will come to a limit where further additions of UCO can actually split the flexural strength. Thus, the strength started to decrease. Overall, it shows that used cooking oil can actually behave like super plasticizer. The UCO added in OPC concrete has increased the flexural strength which at the same time has improved the stiffness of the concrete.
4. Conclusion
UCO show a positive result on the concrete performance. When the proportion and dosage of UCO increased from 0.25% to 2.00%, the slump value had increment from 1mm to 18mm and as 72% of increment compare to the control test. When it comes to the compressive strength, the result also shows the used cooking oil with increment of 16.8% on the strength compare to control test. So it is show that the effects of UCO increase the workability and improve the compressive strength up to 2.00% compare to the control test. For the experimental program, total of 7 samples was prepared according to different proportion of UCO from control test, 0.25%, 0.50%, 0.75%, 1.00%, 1.50%, and 2.00%. Based on the performance of UCO, it achieves the maximum contribution at 1.50% when it obtains maximum increment of the compressive strength of 16.8% compare to the control test with 0.00% of UCO.

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