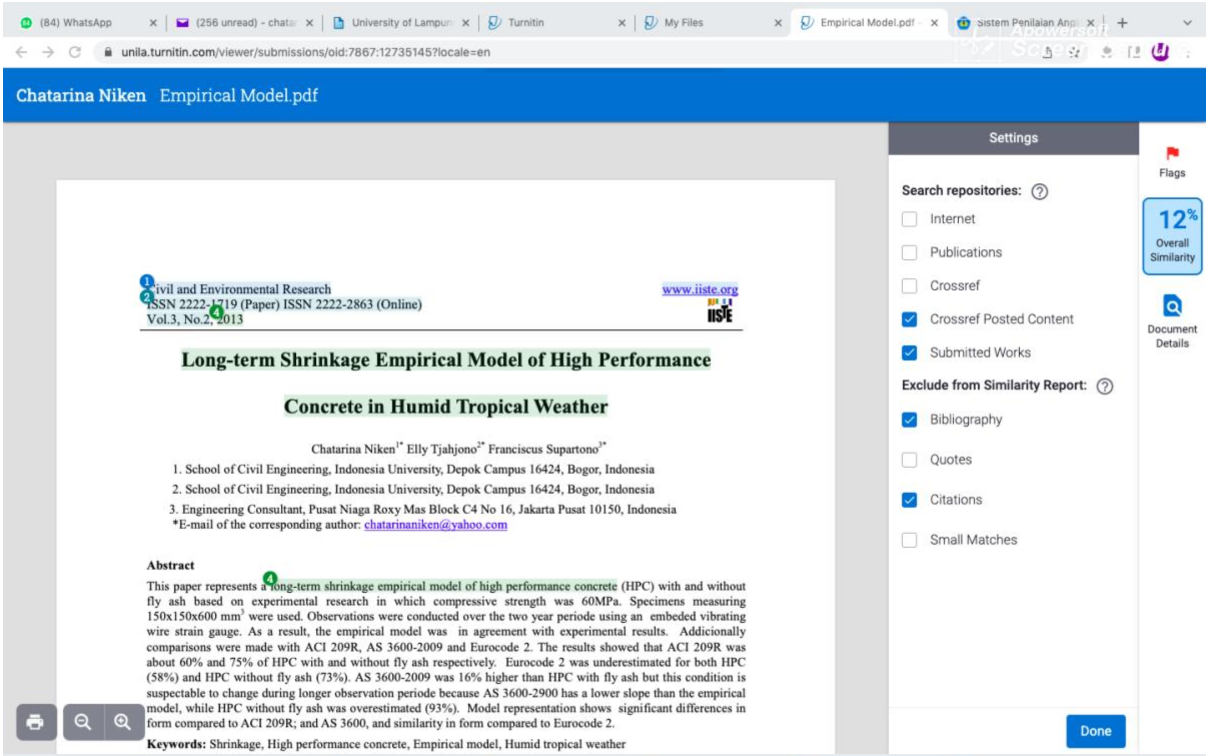
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Long-term Shrinkage Empirical Model of High Performance
Concrete in Humid Tropical Weather
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Abstract
This paper represents a long-term shrinkage empirical model of high performance concrete (HPC) with and without fly ash based on experimental research in which compressive strength was 60MPa. Specimens measuring 150x150x600 mm3 were used. Observations were conducted over the two year periode using an embeded vibrating wire strain gauge. As a result, the empirical model was in agreement with experimental results. Addicionally comparisons were made with ACI 209R, AS 3600-2009 and Eurocode 2. The results showed that ACI 209R was about 60% and 75% of HPC with and without fly ash respectively. Eurocode 2 was underestimated for both HPC (58%) and HPC without fly ash (73%). AS 3600-2009 was 16% higher than HPC with fly ash but this condition is suspectable to change during longer observation periode because AS 3600-2900 has a lower slope than the empirical model, while HPC without fly ash was overestimated (93%). Model representation shows significant differences in form compared to ACI 209R; and AS 3600, and similarity in form compared to Eurocode 2.
Keywords: Shrinkage, High performance concrete, Empirical model, Humid tropical weather
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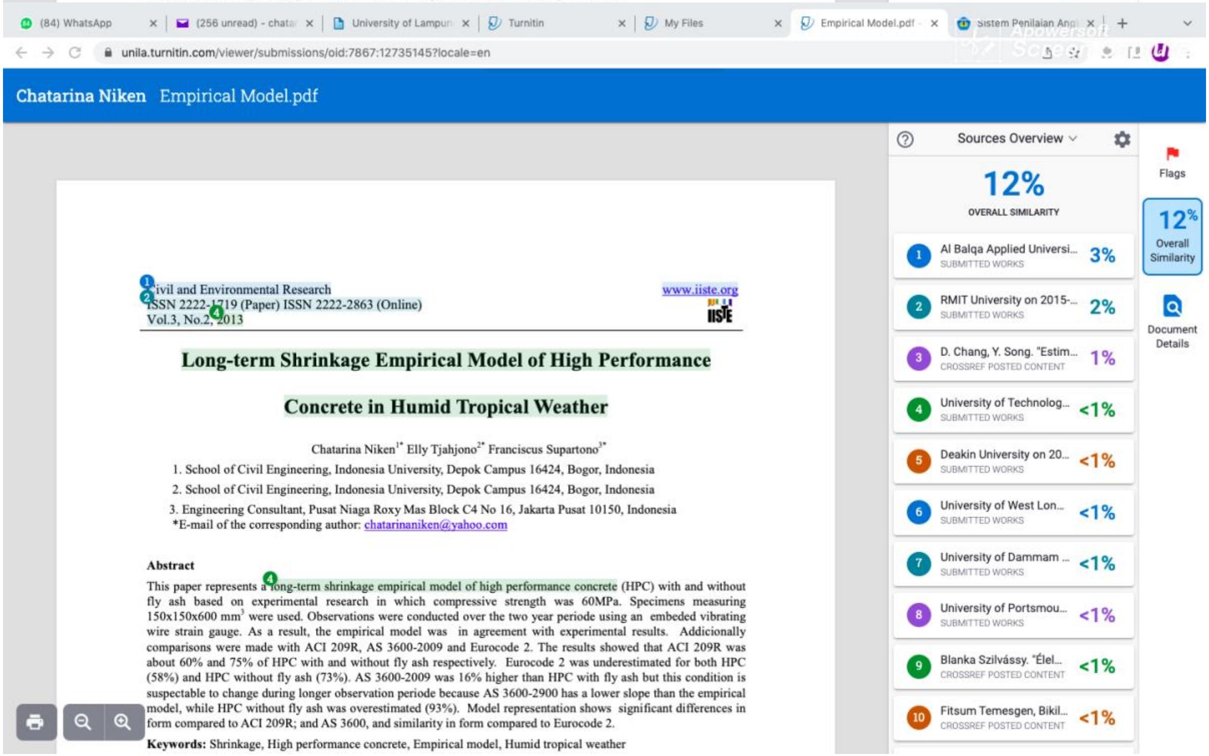
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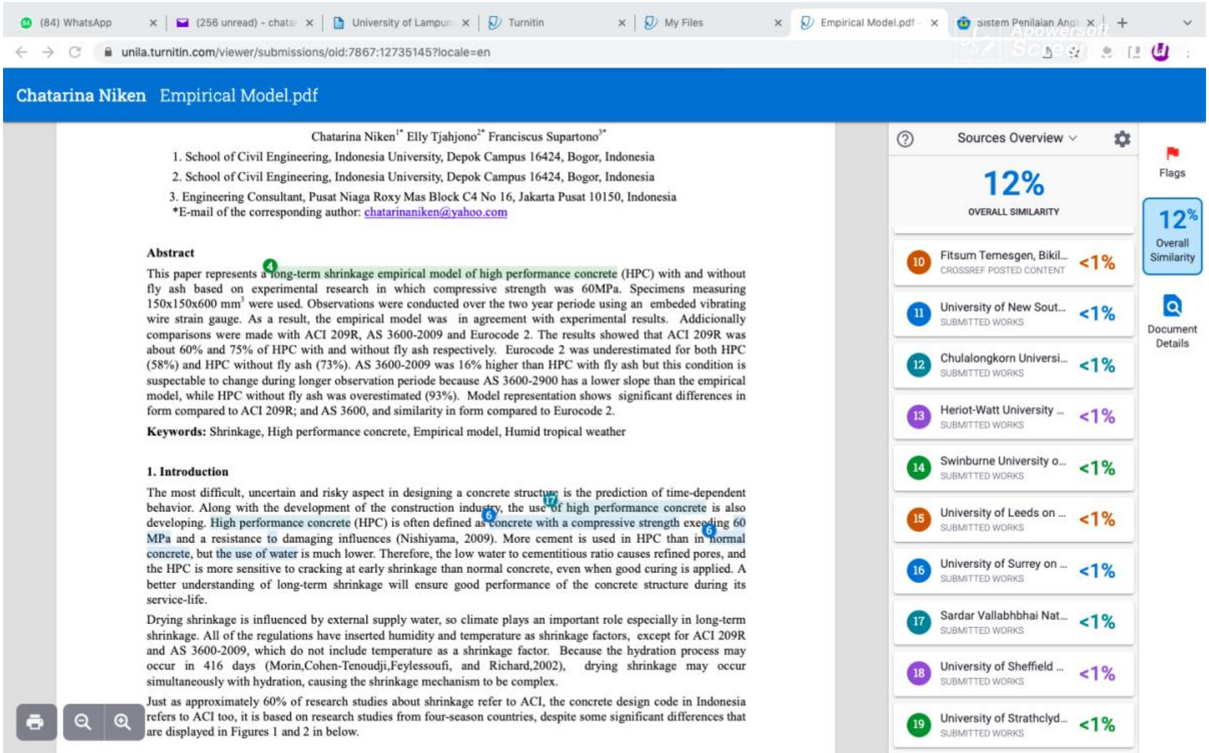

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Keywords: Shrinkage, High performance concrete, Empirical model, Humid tropical weather

1. Introduction

The most difficult, uncertain and risky aspect in designing a concrete structure is the prediction of time-dependent behavior. Along with the development of the construction industry, the use of high performance concrete is also developing. High performance concrete (HPC) is often defined as concrete with a compressive strength exceeding 60 MPa and a resistance to damaging influences (Nishiyama, 2009). More cement is used in HPC than in normal concrete, but the use of water is much lower. Therefore, the low water to cementitious ratio causes refined pores, and the HPC is more sensitive to cracking at early shrinkage than normal concrete, even when good curing is applied. A better understanding of long-term shrinkage will ensure good performance of the concrete structure during its service-life.

Drying shrinkage is influenced by external supply water, so climate plays an important role especially in long-term shrinkage. All of the regulations have inserted humidity and temperature as shrinkage factors, except for ACI 209R and AS 3600-2009, which do not include temperature as a shrinkage factor. Because the hydration process may occur in 416 days (Morin,Cohen-Tenoudji,Feylessoufi, and Richard,2002), drying shrinkage may occur simultaneously with hydration, causing the shrinkage mechanism to be complex.

Just as approximately 60% of research studies about shrinkage refer to ACI, the concrete design code in Indonesia refers to ACI too, it is based on research studies from four-season countries, despite some significant differences that are displayed in Figures 1 and 2 in below.