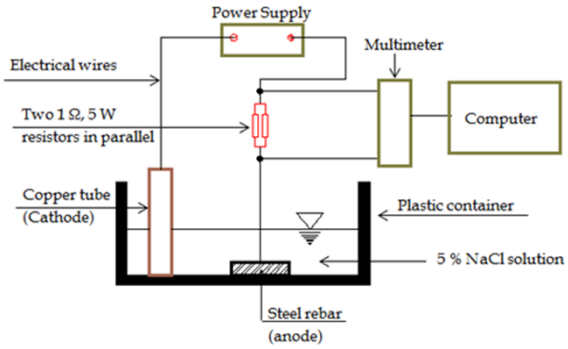
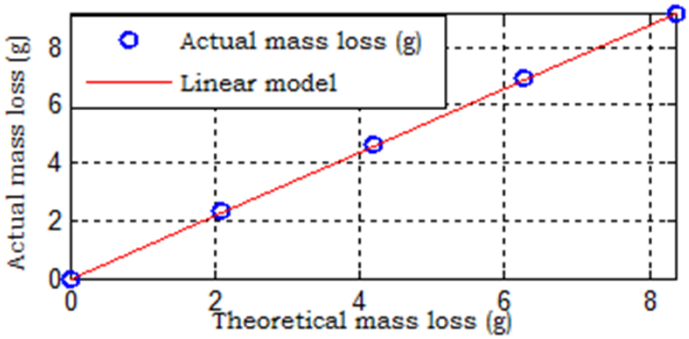
A Model for Predicting Mass Loss of Steel Reinforcement Undergoing Accelerated Corrosion

- **Abstract:** Corrosion of steel reinforcement (rebar) inside concrete is a major problem facing the world today. Natural corrosion of steel rebar is a slow process which requires acceleration in the laboratory to understand its mechanism. The success of accelerated corrosion test (ACT) depends on accurate prediction of the expected corrosion rate (mass loss per unit time). In this study, the corrosion rate of steel rebar inside a 5 % NaCl solution, impressed with a constant current of 500 mA for 16 hours, is investigated. Two ACT schemes, continuous and discontinuous ACT were utilized to measure the mass loss of the steel rebar. A linear relationship between measured and theoretical mass loss (estimated by Faraday's Law) was found and modeled using least square regression algorithm.

- **Accelerated corrosion setup:** A Steel rebar and a copper tube were used as the anode and cathode, respectively. The impressed current was supplied by a direct current power supply with maximum current of 3 A and monitored using a wireless multimeter.

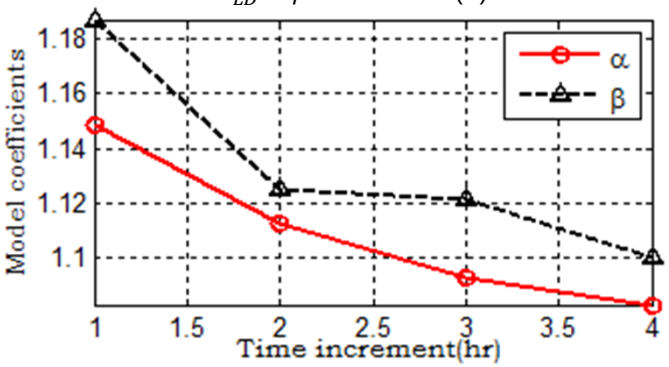


- **Result:** .



$M_{LC} = \alpha \Delta m$ ..... (1)

$M_{LD} = \beta \Delta m$ ..... (2)



where M_{LC} and M_{LD} are the mass loss (g) models for continuous and discontinuous ACT, respectively, α and β are the coefficients of the models, Δm is the mass loss (g) computed using Faraday's Law.

- **Conclusions:**

i) The mass loss measurements show that corrosion rate of the steel rebar decreases with time but Faraday's Law predicts a constant corrosion rate and therefore cannot be directly used to predict corrosion rate or mass loss of steel rebar undergoing ACT.

ii) Discontinuous ACT produces more mass loss than continuous ACT for the test conditions used in this study. This is because the corrosion products surrounding the steel rebar inhibit the corrosion rate.

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- **Ref:**

ASTM G 1-03. (2003). "Standard practice for preparing, cleaning and evaluating corrosion test specimens." West Conshohocken, PA

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