

**Point-of-use upflow sand filter for rural water treatment using natural local sand:
Understanding and predicting pressure drop**

ABSTRACT

A simple, small scale upflow sand filter was fabricated using a locally obtained sands at three different rivers in Sabah, Malaysia: Liwagu River (SL), Tamparuli River (ST), and Kaingaran River (SK). The grain size, porosity, bulk density, particle density and sphericity of the sands were characterized to associate with the corresponding pressure drop across the sand bed. The highest pressure drop per unit length for SK, PT, and SL are 15.85 kPa m⁻¹ at 0.747 m s⁻¹ vs, 10.18 kPa m⁻¹ at 0.352 m s⁻¹ vs, and 9.24 kPa m⁻¹ at 0.747 m s⁻¹ vs, respectively. The pressure drop per unit length at different filter bed depth were plotted, and compared against three theoretical models of Ergun, Kozeny-Carman, and Fair and Hatch. By analyzing the experimental-theoretical comparison using RMSE and Chi-Test, prediction of pressure drop in an upflow sand filter is able to be predicted using the Kozeny-Carman equation preceding filter bed fluidization and subsequently Fair and Hatch's equation after bed is fluidized.