# Electronic Supplementary Materials

For https://doi.org/10.1631/jzus.A2000121

# Unified characterization of hydro-mechanical properties of soil-bentonite mixtures exposed to pore-fluid salinity

Xin LIU, Wen-zhe ZHANG, Xiao WEI, Heng-xing LAN

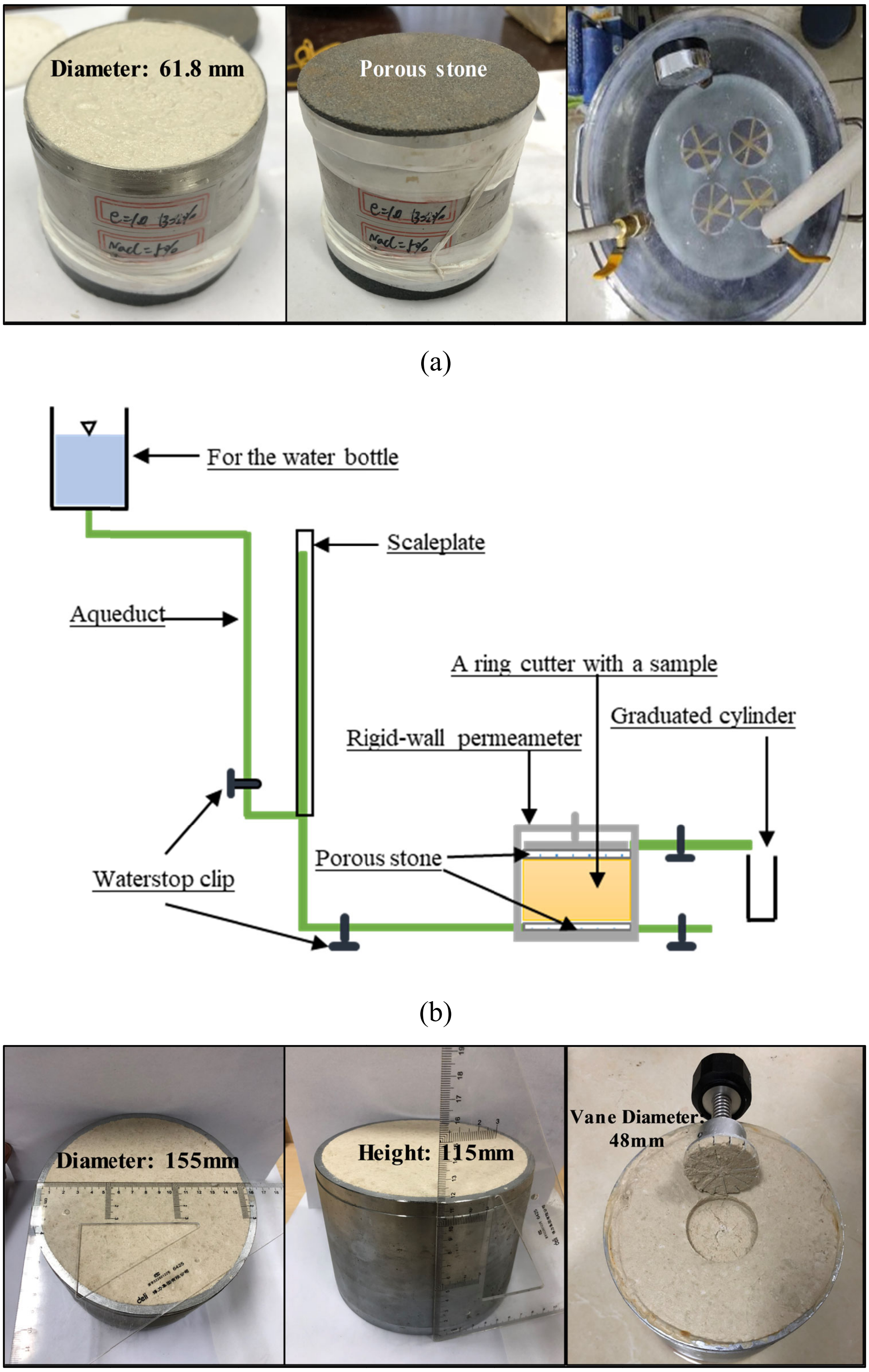
## Data S1 Unified characterization of hydro-mechanical properties of soil-bentonite mixtures exposed to pore-fluid salinity

**Below are the explanations on the test procedures:**

In the laboratory experiments, uniformly distributed crushed silica ($C_u$ = 1.4) was used as the base material and the bentonite was used as the addictive. The specific gravity of bentonite and the crushed silica are 2.70 and 2.65, respectively. To produce a sequence of soil–bentonite mixtures, the oven-dried materials were first screened through a 63-μm sieve, and the bentonite was then mixed with the crushed silica at varied mass quantities from 0 to 45%. By performing the X-ray diffraction tests, the clay fraction was found mainly composed of $Na^+$-montmorillonite, which is considered preferentially as a buffer or a sealing material in engineering practice.

In this study, remolded soil specimens were prepared using the moist tamping method with an initial moisture content of 20%, and the global void ratio (*e*) was used as a target parameter. To achieve a specified void ratio, predetermined amounts of mixtures were compacted into five successive layers of equal thickness. Note that under-compaction technique was adopted during compaction (i.e., use 1% of under-compaction ratio), which is similar in principle to several researchers in testing the silty sand, so that it can prevent soil segregations and enhancing uniformity. All specimens were confined in the cutting rings with porous stones locked tightly at both ends, and they were then submerged under the deionized water and the saline water respectively in a vacuum chamber for 24 hours (Fig. S1-1(a)). Upon the end of saturation stage, no air bubbles on the porous stones can be observed, indicating a continuous water phase inside of the specimen. Note that the degree of saturation ($S_r$) of specimens was readily calculated after the test, and it was found that the post-test $S_r$ is greater than 0.98 for all specimens.

The hydraulic conductivity of the soil-bentonite mixtures was measured using the falling-head method in a rigid-wall permeameter with inner diameter of 61.8 mm and height of 40 mm (Fig. S1-1(b)). To prevent side leakage along the wall during the test, the inside of ring was lubricated with silicon greases before the test. The permeameter and the cylinder for measuring outflows were both enclosed with an airtight plastic bag to reduce the evaporation. Permeation was continued until the cumulative flow of water as recorded from the volume change gauges is linearly increased with time, and the values of hydraulic conductivity become stable (BS 1337-6). On the other hand, the undrained shear strength of the saturated specimens was measured using a laboratory vane apparatus with an accuracy of 0.1 kPa, and the general procedure was implemented according to BS 1377-7. Note that the samples for the vane shear test were prepared in a cylinder cell that is much larger than the permeameter in the hydraulic conductivity test, so that the wall effect on the measured values is considered negligible (Fig. S1-1(c)).



(a)

(b)

(c)

Fig. S1-1. Illustrations of test procedures: (a) sample saturation; (b) rigid-wall permeameter; (c) vane shear test.